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# A Directory of Western Palearctic Wetlands





**Directory of  
Wetlands of International  
Importance  
in the  
Western Palearctic**

Compiled by Erik Carp

for the  
United Nations Environment Programme (UNEP),  
Nairobi, Kenya  
and the  
International Union for Conservation of Nature and  
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# WETLANDS DIRECTORY

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This One



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# FOREWORD

Wetlands are not wastelands. This is a truism for ecological *cognoscenti* but the concept is still far from being generally appreciated. Too many people still have a vague ancestral antipathy for marshes, feeling them to be uninteresting, unhealthy places fit only to be drained – or to serve as dumping places for garbage, and sites for smelly factories or noisy airfields. To such people a Directory of Wetlands might seem to be a catalogue of dullness.

On the contrary, the Directory is a vital, essential weapon in the struggle to save our remaining wetlands. And they need to be saved, since they are regulators of water regimes; habitats supporting a characteristic flora and fauna; a resource of great economic, cultural, scientific and recreational value. The words are taken from the preamble to the 'Convention on Wetlands of International Importance Especially as Waterfowl Habitat.' Twenty-seven countries have so far become Parties to that Convention and have between them listed for especial protection more than two hundred wetlands covering well over six million hectares. Yet the Directory serves to emphasise just how much more remains to be done before sufficient wetlands can be considered safeguarded for future generations. Meanwhile, by listing the more important wetlands and briefly describing the rich life dependent on them, the Directory leaves no excuse for thoughtless destruction on the grounds of ignorance.

Of all the multitudinous denizens of the wetlands, the most widely appreciated are the birds. Waterfowl are great migrants and their journeys clearly demonstrate that there must be international responsibility for their conservation, including the retention of an adequate network of the wetlands on which they depend at different seasons. International agreements are also needed to ensure that the kill of those which are traditional quarry species, with the accompanying disturbance, is kept within reasonable limits. The swift flight and massed ranks of waterfowl delight the specialist and the general public alike. They provide a great educational impact, bringing people to realise that places that support so many thrilling creatures are indeed worthy to be saved.

Because waterfowl are sizeable birds and congregate at times in wide open spaces, their numbers are fairly easy to measure. They can thus serve as indicators of the richness and health of the wetlands they frequent. And, because the birds are so attractive, thousands of highly competent amateur observers offer to count them regularly, year in and year out.

The coordination of this army of observers has been one of the tasks of the International Waterfowl Research Bureau, working through George Atkinson-Willes of the Wildfowl Trust at Slimbridge. The IWRB has thus all along been essential to the wetland conservation programme, providing the one really quantitative criterion of an area's worth, the holding of one per cent of a species' regional population. When the IWRB Headquarters moved to Slimbridge in 1969, Erik Carp came to us as Administrator. For more than four years his calm industry and command of five European languages were great assets. He helped see through the last stages of gestation, and the birth, of the Wetlands Convention. We are happy that he has remained in close association, as an IWRB Consultant, ever since, particularly during the preparation of the Directory.



It can rightly be objected that, important as they are, waterfowl figure too largely in the decisions made as to the relative value of the different wetland sites. It would certainly have been preferable if all the elements in the ecosystems – plants, invertebrates, fish, amphibians, reptiles and mammals – could have been assessed in detail. But although some qualitative information on these subjects has generally been provided, by the time that quantitative data comparable with that available for birds had been garnered by competent specialists, many of the wetlands concerned might well have been destroyed for want of designation.

This Directory would have been even more valuable if it had covered the whole world. However, North America already has highly detailed national inventories. It is in the southern parts of Asia and Africa and in South America that information is most lacking. Yet to have awaited compilation of data from those regions would have been to delay unreasonably this Western Palearctic publication. We must hope for supplementary volumes, and soon, for it is in these uncharted areas that the remaining great pristine wetlands lie; and they are threatened most pressingly with drainage and devastation. Surely we must do all in our power to help see that the mistakes made in the north are not repeated in the south. The programmes of education and management, as recently reviewed and reinforced by the 'World Conservation Strategy', are beginning to bite. Some of the world's statesmen are realising that drainage schemes, although appealing to the public, are not, in the long run, of great benefit to their countries.

It is my belief that the Directory will play no small part in saving the wetlands it describes.

G. V. T. Matthews

Slimbridge,  
Gloucester GL2 7BX  
23 July 1980

*Director of the International  
Waterfowl Research Bureau*

# DIRECTORY OF WETLANDS OF INTERNATIONAL IMPORTANCE IN THE WESTERN PALEARCTIC

## INTRODUCTION

### **1. Early history of efforts to conserve Western Palearctic wetlands, with special reference to those of international importance as waterfowl habitat.**

Although a small number of wetlands in several countries of Europe were given some measure of protection during the first decades of the present century (for instance, the Naardermeer, Netherlands, 1906, the Camargue, France, 1928, and the Cerné and Certovo lakes, Czechoslovakia, 1933), no attempt was made on an international scale to safeguard such sites from the then rapidly increasing threats of drainage, modification for industrial or technological purposes, and pollution, the triple threat which has remained paramount up to the present day. It was not until after the Second World War, that an initiative in organizing the international protection of waterfowl and their habitats, was taken by the International Council for Bird Preservation (ICBP), which had been founded in 1922. Recognizing the threat, to migrant waterfowl in particular, posed by uncontrolled hunting and the increasingly severe loss of habitat in many European countries, ICBP in 1947 set up the International Wildfowl Research Bureau (IWRB), later renamed the International Waterfowl Research Bureau, which has ever since played a leading part in the conservation of wetlands and waterfowl (the change to the latter name was dictated by the confusion often caused by the term 'wildfowl' both in English and in translation to other languages).

The Bureau, although an offspring of ICBP, is endowed with an entirely independent status. Its aims are to stimulate and coordinate research into and conservation of waterfowl and wetlands at an international level. It now has over thirty member countries, delegates or representatives of which attend the annual meeting of its Executive Board in order to discuss and organize research and conservation projects. In addition, at fairly regular intervals, the Bureau together with other international conservation bodies undertakes the organization of international conferences within its field of interest. The most important of these have been held at Les Saintes Maries de la Mer, France, 1962; St. Andrews, Scotland, 1963; Noordwijk, Netherlands, 1966; Leningrad, USSR, 1968; Ramsar, Iran, 1971; and Heiligenhafen, Federal Republic of Germany, 1974.

Meanwhile, in the limnological field, the wetland conservation initiative was taken at the XIV Congress of the Societas Internationalis Limnologiae (SIL), assembled at Salzburg, Austria, in 1959, when it was decided to prepare a list of lakes and rivers whose protection is particularly desirable and to ask for United Nations recognition of this list. In 1961, the Commission on Ecology of the International Union for Conservation of Nature (IUCN), meeting at Zürich, Switzerland, agreed to collaborate in the preparation of such a list, for which the title Project AQUA was later adopted. At the same time under the title of Project MAR and again on the advice of the Commission on Ecology, IUCN decided to

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compile a parallel list of temperate wetlands of international importance primarily as waterfowl habitat. The importance of these two projects and their eventual fruition nearly ten years later are reviewed in some detail in the next three sections.

### **2. Project MAR, the MAR Conference and the MAR List**

The aims of the MAR programme on conservation and management of temperate marshes, bogs and other wetlands were: 1) to prepare a broad statement on the value of such wetlands to mankind and give wide publicity to this statement (an aim achieved with noteworthy success in 1965 by the joint IUCN/IWRB publication and distribution of a well-illustrated brochure entitled 'Liquid Assets' or 'Resources méconnues', thanks to the financial assistance given by UNESCO, which also sponsored a new edition in 1979; 2) to assemble all important data on means of conserving wetlands, to keep or improve them as wildlife habitat by proper management, to restore those that have deteriorated and adapt man-made aquatic habitats to wildlife needs, and to make all the relevant information in this field known and available to all persons and organizations who are in the position to promote, assist or support wetland conservation; 3) to undertake an inventory and classification of European and north-west African wetlands of international importance; and 4) to offer technical assistance in the establishment of effective reserves on these sites.

The meeting known as the MAR Conference, called to decide on the implementation of these aims, was organized jointly by IUCN, ICBP and IWRB and held from 12 to 17 November 1962 at Les Saintes Maries in the Camargue. Of particular relevance in the present context was the unanimous decision to go ahead with the compilation of a list as recommended under aim (3) of the project. Generally referred to as the MAR List, this was completed and published by IUCN in 1965. Selection of sites for inclusion was mainly based on ornithological data, of which a considerable amount was available as compared with data on other aspects of wetlands, which tended to be scarce or fragmentary. Moreover, a rich and varied birdlife and the presence, maybe, of rare and specialized species, are signs that a site is of ecological value and likely to have features of unusual botanical, hydrological or geological interest. Similarly the presence seasonally of large numbers of migratory waterfowl obviously emphasizes the international value attached to a particular site.

For practical reasons the MAR List was limited to about 200 sites, since this was thought to be the maximum number on which the international bodies concerned would be able to promote effective conservation action, in the immediate future, under section (4) of the project. The listed wetlands for each country were also divided into two categories, those in the A category being considered to be of major importance for the conservation of European waterfowl populations; the B category still of vital importance, particularly for migratory species, and for that reason equally deserving of conservation, even if not usually harbouring waterfowl in such high concentrations or large variety.

### **3. The Convention of Wetlands of International Importance, especially as Waterfowl Habitat (Ramsar Convention).**

The MAR Conference of 1962 had called attention to the need for an international convention on wetland conservation and this need was again stressed by a specific recommendation of the European Meeting on Wildfowl Conservation held in the following year at St Andrews, Scotland. Acting on this recommendation, IWRB

sent out a memorandum to 35 countries, containing eight suggested points which a convention might cover. On the basis of the replies received and of further discussions at the next European Meeting on Wildfowl Conservation, held at Noordwijk, Netherlands, in 1966, the Dutch Ministry of Culture, Recreation and Social Welfare offered to prepare a first draft, which was ready in time for informal consideration by the IWRB Executive Board Meeting at IUCN headquarters in Morges in 1967. On this basis a formal Draft Convention was prepared and circulated prior to the International Regional Meeting on Conservation of Wildfowl Resources held in Leningrad in September 1968. There the USSR delegation expressed its views by submitting an alternative text and a resolution was passed urging that all possible steps be taken to accelerate "the adoption of a convention concerning wetlands".

Accordingly, both the available texts were meticulously compared at the next Annual Board Meeting of IWRB, held in Vienna in May 1969, and it was concluded that a compromise could be drafted without great difficulty. The Dutch Ministry once again undertook responsibility for this and its revised draft was considered at a technical meeting in March 1970, held at Espoo, Finland, and attended by representatives of IUCN, ICBP, IWRB, the Food and Agriculture Organization of the United Nations (FAO), the Conseil International de la Chasse (CIC), and ecologists from ten IWRB member states. It was the modified text emerging from this consideration that was finally presented to the plenipotentiary International Conference on the Conservation of Wetlands and Waterfowl, convened by the invitation of the Government of Iran at Ramsar from 30 January to 3 February 1971.

The final text of the 'Convention on Wetlands of International Importance, especially as Waterfowl Habitat', as adopted at Ramsar, was therefore the fruit of nine years of careful study and close comparison between a large number of international organizations, countries and individual representatives. In the course of the negotiations it became abundantly clear that States were not prepared to accept a Convention that infringed sovereign rights to deal with their own natural resources, so that any idea of 'blocking' alterations to the ecological status of wetlands, backed by sanctions, was out of the question. Instead, the Convention in effect calls on States to make *declarations of intent* to safeguard their wetlands and to do so in concert with other States. In addition, every Contracting Party to the Convention must designate one or more suitable wetlands within its territory for inclusion in a List of Wetlands of International Importance, the Convention List. Wetlands so designated are indicated in the present Directory, which has the wider aim of providing a comprehensive idea of the important wetlands in the western Palearctic whether or not the country concerned is yet a party to the Convention and whether or not a particular wetland has been included in the Convention List.

Under the provisions of the Convention the United Nations Educational, Cultural and Scientific Organization (UNESCO) was nominated as the Depository for instruments of ratification or accession and the date when the Convention would come into force was fixed at four months from the day when seven States became parties to it through such accession or ratification. This took place on 21 December 1975, four months after the accession of Greece. A chronological list of the parties to the Convention (up to the date of going to press) is as follows: Australia (1974), Finland (1974), Norway (1974), Sweden (1974), South Africa (1975), Iran (1975), Greece (1975), Bulgaria (1975), United Kingdom (1976), Switzerland (1976),

## INTRODUCTION

Federal Republic of Germany (1976), Pakistan (1976), New Zealand (1976), USSR (1976), Italy (1976), Jordan (1977), Yugoslavia (1977), Senegal (1977), Denmark (1977), Poland (1977), Iceland (1977), German Democratic Republic (1978), Hungary (1979), Netherlands (1980), Japan (1980), Morocco (1980) and Tunisia (1980). In two more countries which have signed the Convention, Belgium and Ireland, ratification waits parliamentary approval of the necessary legislation. Out of the grand total of 29 countries, the wetland situation in 24 is reviewed in the Directory.

As for the Ramsar Convention List, maintenance of which forms part of the bureau duties assigned to IUCN under the provisions of the Convention, the 214 sites so far listed by the 27 parties to the Convention cover a total of over 6.4 million hectares (including estimates of Greek and some more recently listed sites). A few countries, even when well endowed with wetlands of international importance, have entered only a single or no more than two wetlands in the List in order to qualify as a party to the Convention: it is to be hoped that they will in due course make some additions and one function of the Directory is to provide the necessary information for the best possible selection to be made.

### 4. Project AQUA and the AQUA List

Contemporarily with the final stages in the process from completion of the MAR List to adoption of the Ramsar Convention, the parallel work of Project AQUA, on listing of lakes and rivers of high limnological interest, attained its first objective early in 1969. This was the completion and distribution for comments, corrections and amplification of a provisional list and was done under the auspices of Section PF (Production, Freshwaters) of the International Biological Programme, the world-wide plan for a ten-year research effort on 'the biological basis of productivity and human welfare'. Soon after the Programme was launched in 1964, the PF Section had agreed to take over the SIL/IUCN Project AQUA initiative, the aim of which was confirmed as 'the international recognition of freshwater and brackish water areas which are of agreed international importance for research, education and training, and of which therefore countries should accept national responsibility for conservation'. The aim was thus complementary to that of Project MAR, with its criteria of 'international importance' related to scientific value as demonstrated by the volume and duration of research carried at a particular site (or, in some cases, by consensus on its research potential) in contrast to the ornithological evidence assembled by IWRB for the purposes of the MAR List.

It should, however, be noted that the criteria subsequently developed, as explained in Section 5 below and used in the present Directory, are in effect an amalgamation as well as a general broadening and strengthening of those on which the MAR and AQUA lists depended. It is also important to note that when, in 1971, the definitive version of the AQUA List was published, as IBP Handbook No. 21 and with financial assistance from UNESCO, it was specifically anticipated in the Foreword that the international convention which had recently reached the stage of agreement (viz. the Ramsar Convention) might provide an appropriate legal framework of protection for some of the sites in the AQUA List. Many of them do in fact coincide with or adjoin sites derived from the MAR List and attention is always drawn to such instances in the Directory. The Directory also lists separately the great majority of the other AQUA sites and, although less material is available for detailed descriptions, a representative sample has been included. Finally, reference must be made to an event of particular significance

for Project AQUA which took place in October 1970, between the publication of the provisional and definitive AQUA Lists, when the Intergovernmental and Interdisciplinary Programme on Man and the Biosphere (MAB) was launched by UNESCO. Consideration of aquatic ecosystems formed an important part of its plan, embracing both the conservation and the study of the structure and function of a wide range of water bodies. Hence the completion of the AQUA List was in fact carried out within the framework of the programme of IBP/UNESCO Joint Projects. There are now 33 States participating in the relevant 'MAB Project 5' and some 155 field research projects have been or are concerned with human impacts on freshwater and coastal aquatic ecosystems: reports on the subject by an MAB expert panel and international working group, respectively, were published in 1972 and 1974.

### **5. Criteria for the selection of wetlands of international importance**

In view of the need to establish clearcut criteria for the choice of the wetlands to be listed under the provisions of the Ramsar Convention, a special Committee on Criteria was set up at the International Conference on Conservation of Wetlands and Waterfowl held at Heiligenhafen in 1974. Its recommendations adopted and, as stated above, forming the basis for the selection of the sites included in the Directory, divided the criteria into four main groups:

1. criteria pertaining to the importance of wetlands for waterfowl populations and species;
2. criteria concerned with the representative character or uniqueness of wetlands;
3. criteria concerned with scientific research, educational or recreational values of wetlands; and
4. criteria concerned with practical aspects of the conservation and management of wetlands.

The detailed criteria within these four heads are set out in Annex I at the end of the Directory.

Certain qualifications and suggestions for refining and extending the criteria, though they have yet to be formally adopted, with or without further modifications, at the next IUCN/IWRB-sponsored international conference, were discussed at a technical meeting on the evaluation of wetlands from a conservation point of view, held at Bad Godesberg, Federal Republic of Germany, in October 1977. The meeting considered that in general the 'Heiligenhafen Criteria' met requirements for the selection of internationally important sites, with particular reference to those of value as waterfowl habitat, but expressed doubts about the criteria in group 4. It was recommended that the criteria used for evaluation should be restricted to those providing a scientific basis for the choice of sites and should not be concerned with the question whether conservation of a particular area is feasible. A further recommendation was that wherever possible, criteria concerned with diversity, rarity or the 'naturalness' of an area should be applied on a quantitative basis, and it was considered that the overriding priority at international level was to ensure that representative samples of all major biomes are conserved. For this purpose the size of individual areas was judged to be of less importance than their viability as hydrological units. It was felt, however, that the potential conservation value of a site (especially of one which appeared recently to have lost its importance) should always be taken into consideration and, finally, that although it was desir-

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able for agreed criteria to be formally linked with the Ramsar Convention and the selection of sites for the Convention List, some flexibility should be retained especially in the treatment of sites in countries where studies and surveys concerned with conservation values are still at an early stage.

Lastly, it should be noted that two other listings of sites of great international importance, the Biosphere Reserves of UNESCO's MAB Programme and the sites nominated under UNESCO's World Heritage Convention, include several outstanding wetlands, to which more will certainly be added in years to come. To date 17 Biosphere Reserves are in this category and 2 World Heritage sites. This is indicated in each case in the Conservation Status column of the checklist for each country and also in the text for any site of which there is a detailed description.

### 6. The Scope and Format of the Directory

Although as indicated in preceding sections, the Wetlands Directory has been planned as a successor to the now outdated MAR List, incorporating also the relevant data from the worldwide AQUA List, the area covered extends substantially beyond the limits adopted for the initial purposes of Project MAR. It now includes not only the whole of the Western Palearctic as generally defined, except for the extreme fringe of the largely desert areas to the south, but also countries immediately to the east for which sufficient data on the importance of their wetlands for migratory waterfowl mainly if not exclusively of west Siberian breeding origin, have become available. All European countries are thus represented (with the exception of a few very small States with unsuitable terrain in the present context, such as Andorra, Monaco and San Marino); Western Siberia as bounded on the east by the River Yenisey; the Kazakh, Uzbek and Turkmen Republics of Soviet Central Asia; Iran, Afghanistan and Pakistan; the Near East countries of Turkey in Asia, Cyprus, Iraq, Syria, Lebanon and Jordan; and the Maghreb countries of Egypt, Libya, Tunisia, Algeria and Morocco. Of the Atlantic islands, the Azores, Madeira, the Canaries and Cape Verde are omitted in the absence of relevant data. But some information on the Selvagens is included in the chapter on Portugal and, similarly, information on Svalbard (Spitzbergen) in the chapter on Norway.

When the Directory project was launched in 1973, the intention was to have a loose-leaf publication in the then current style of the IUCN Red Data Books, later applied also to the World Directory of National Parks and Other Protected Areas. This would have had the advantages that individual reports on wetland situations could readily be revised and replaced and that the coverage of the Directory could gradually be extended to all parts of the world without disrupting the systematic presentation of the information. However, the format has proved to have its drawbacks, notably in relation to the cost of production and servicing, marketing difficulties and the facilities now available for computerised data storage. In keeping with the policy which has now been generally adopted, the decision was therefore taken to publish the Directory in a bound form and, since there was no guarantee that funds could be made available for an indefinite period, to limit the present volume to Western Palearctic wetlands. Questionnaires were accordingly circulated through IUCN and IWRB contacts in most of the countries concerned and were devised to enable the incoming information to be assembled in a reasonably consistent way. The result represents a considerable departure from the original MAR and AQUA Lists, including the abandonment of the MAR 'A' and 'B' categories which tended to promote the idea that 'B' sites have much less urgent conservation needs.

## 7. Contents of the country reports

Basically, the section for each country is prefaced by a general review of its wetland situation, followed by a list of the wetlands deemed to be of international importance. The list gives the coordinates of each site, its size, the code of the Heiligenhafen Criteria on which its selection is based and an indication of the extent to which it is protected. A sketch-map shows the location of each site (those of mainly limnological interest distinguished by a triangular symbol) and should enable its relation to topography and routes of access to be readily determined by reference to larger scale maps of the country concerned. Whenever possible a detailed description is appended of one or more characteristic wetlands; in some cases, where there are many well studied sites and the relevant material has been supplied, the number of descriptions may amount to twenty or thirty.

Additional information in the detailed site-descriptions, over and above what is contained in the lists, includes distances and direction from the nearest large town, altitude above sea level, maximum and average depth of water, wetland type or types according to the Isakov/Eber classification (see below), general ecology, legal status in relation to protection, the tenure or ownership of the wetland, any management practices applied to it or threats to its existence or quality, an assessment of past or present research, and principal references.

The system of classification used in the Directory and set out in Annex II at the end of the Directory, is based on the main kinds of wetland distinguished by Isakov (1966), as subsequently tested and refined by Eber (1969), in the light of his experience of waterfowl habitat in the Federal Republic of Germany. The classification has been deliberately kept at this simple level and no attempt has been made to apply the distinctions between habitat types elaborated by Isakov at the next level or any vegetational criteria, since the precise data needed for that purpose are still too often lacking.

The Directory is in this respect and several others less complete and comprehensive than would have been desirable. But the fact is that information received or to be found in the literature tends to be very uneven in quantity and quality – an indication of how limited the knowledge of wetlands still is in many areas. Nevertheless it is much to be hoped, in conclusion, that the Directory will, in the first place, prove useful to the already considerable range of persons and organizations interested in wetlands, from governmental authorities responsible for environmental quality, through scientists, research workers and students in many different fields, to the travellers, visitors and holiday-makers who seek out and enjoy the equally diverse pleasures and values that wetlands have to offer; and that, in the second place and no less importantly, it will serve to stimulate an ever wider interest and the supply of sufficient new information to justify updating the Directory and its extension to other parts of the world.

## 8. Acknowledgements

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## INTRODUCTION

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<b>Israel</b>	<b>U. Paz</b>
<b>Iran</b>	<b>E. Firouz, D. A. Scott</b>
<b>Iraq</b>	<b>A. H. Y. Al Adhub, P. V. George Kainady, A. Niazi, D. A. Scott</b>
<b>Italy</b>	<b>S. Allavena, A. Chelini, L. Contoli, F. Corbetta, F. Garbari, R. Massoli Novelli, L. Poldini, A. Pozzi, F. Pratesi, P. Pupillo, L. Scalera-Liaci, F. Valsecchi</b>
<b>Lebanon</b>	<b>Z. Moubayed, J. Neuschwander, G. Tohme</b>
<b>Morocco</b>	<b>M. Thevenot</b>
<b>Netherlands</b>	<b>D. W. Maas, M. F. Mörzer Bruyns</b>
<b>Norway</b>	<b>H. C. Gjerlaug, M. Norderhaug, H. A. Støen</b>
<b>Poland</b>	<b>K. Dobrowolski</b>
<b>Portugal</b>	<b>M. Borges de Carvalho, F. O'Gorman</b>
<b>Spain</b>	<b>F. Bernis, M. Fernandez Cruz, J. L. Perez Chiscano</b>
<b>Sweden</b>	<b>L. E. Esping</b>
<b>Switzerland</b>	<b>U. Glutz von Blotzheim, H. Leuzinger, W. Thönen</b>
<b>Tunisia</b>	<b>Service de la Chasse &amp; des Parcs Nationaux, H. Baccar, M. Smart</b>
<b>Turkey</b>	<b>Z. Bayer, T. Gürpınar</b>
<b>USSR</b>	<b>N. Skokova</b>
<b>United Kingdom</b>	<b>G. L. Atkinson Willes, N. Morgan, T. Sexton, Nature Conservancy Council</b>

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E. Carp, Co-ordinator.

Tour du Valat, Camargue, August 1979.

**Note** To facilitate reference, Annexes I (Wetland Criteria) and II (Wetland Types) are placed at the end of the Directory.

# AFGHANISTAN

## SUMMARY OF WETLAND SITUATION

The mountainous country of Afghanistan constitutes a major watershed. The Amu Darya rises on the north side of the Hindu Kush and flows north-west into the USSR. The Hari Rud flows westwards ending in a closed salt basin along the Iranian border. Other streams flow east and south from the Hindu Kush to join the Indus. In south-west Afghanistan the Helmand River also ends in a closed saline basin, extending on both sides of the Afghan-Iranian border in the Sistan (Seistan) region. The Helmand basin is of special hydrological interest by virtue of a seasonally reversed flow in its lower reaches, caused by some peculiar features of its water regime. Salinity is therefore less pronounced than in other enclosed basins.

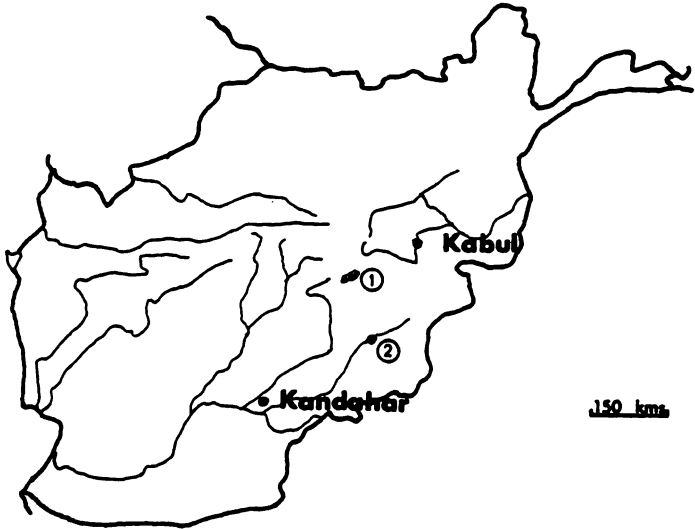
The combination of quite frequent severe droughts and diversion of water by irrigation schemes, for agricultural purposes, has affected most wetlands of importance for breeding and migrating waterfowl. The two best known wetlands, both somewhat saline in character, are the Dasht-i-Nawar (1) situated at an altitude of 3,200 m, and the Ab-i-Istada (2), at an altitude of 2,100 m. Both are breeding places for the Greater Flamingo *Phoenicopterus ruber*; in fact the Dasht-i-Nawar is probably the highest of all the known regular breeding sites of that species. It also provides a resting-place on migration for the White or Siberian Crane *Grus leucogeranus*, classified in the Red Data Book as 'endangered': 76 of these birds were recorded in March 1970. Ab-i-Istada was gazetted as a flamingo and waterfowl sanctuary in 1977, but there are no recent reports of its status and general effectiveness.

In addition to the two major wetlands, a number of smaller freshwater lakes which are situated along the Kabul River are visited by variable numbers of waterfowl, especially during the migration season. They include the Chaman, Kharga, Nagha, Sarobi and Duranta lakes. Due to their high altitude, most Afghan wetlands are covered with ice and snow during the winter months, from November to February or later. None of the wetlands in the country is as yet properly documented and for many reasons, including their importance as staging-posts for migratory birds, it would be highly desirable for additional information and descriptions to be included in future editions of the Directory.

## WETLANDS OF INTERNATIONAL IMPORTANCE

	Locality	Latitude	Longitude	Size	Wetland criteria/ Conservation status
1.	Dasht-i-Nawar	33°50'N	67°40'E	c. 240 sq. km	1c,d,e; 2a,b,c; 4a Protection planned
2.	Ab-i-Istada	32°40'N	67°55'E	c. 160 sq. km	1c,d,e;2a,b,c; 4a Protection planned

# AFGHANISTAN



# ALBANIA

## SUMMARY OF WETLAND SITUATION

Major alterations have been carried out since 1940 in practically all Albanian wetlands. Most natural marshes have been drained for economic use and in a massive drive against malaria. Many of the rivers have been regulated or canalized, especially in the broad and fairly flat coastal belt in the west. Former flood-pains have been transformed into agricultural land, irrigated through a series of reservoirs and channels. The irrigated areas are of considerable importance to waterfowl as providing resting-places during migration.

In the mountains inland and along the south-west coast, numerous small lakes are to be found and on the borders with Yugoslavia and Greece four large and very notable lakes: Liquen-i-Shkodres/Lake Shkodra or Scutari (1), 365 sq. km, of which 125 sq. km lies in Albania; Liquen-i-Ohrid/Lake Ohrid (2), 348 sq. km, of which 97 sq. km lies in Albania; Liquen-i-Prespa/Lake Prespa (3), 283 sq. km, of which 100 sq. km lies in Albania; and Liquen-i-Prespes/Lake Mikra Prespa (4), 52 sq. km, of which 8 sq. km lies in Albania. These lakes are of international importance as breeding and feeding areas for White and Dalmation Pelicans *Pelecanus onocrotalus* and *P. crispus*, the Pygmy Cormorant *Phalacrocorax pygmeus* and a number of other species of waterfowl. Being largely of karstic origin, the lakes also have great limnological interest, Ohrid in particular supporting a rich endemic and relict fauna of fish and other aquatic species.

The sea coast, over 400 km in length, is varied and includes both sandy and stony beaches, flat marshy shores and cliffs. It is rich in peninsulas, spits and bays. Unfortunately, water pollution is reported to be a problem to fisheries and is no doubt also causing damage to flora and fauna.

The only nature reserve which protects a wetland habitat and which is of international importance to waterfowl, is the Kune Reserve at the mouth of the Drini. This comprises the Kune lagoon, the rivermouth and neighbouring land areas extending over many square kilometres. Nesting species include grebes Podicipitidae, the cormorants *Phalacrocorax carbo* and *P. pygmeus*, Night Heron *Nycticorax nycticorax*, Squacco Heron *Ardeola ralloides*, Little Egret *Egretta garzetta*, Grey Heron *Ardea cinerea*, Spoonbill *Platalea leucorodia*, Glossy Ibis *Plegadis falcinellus* and many species of ducks, rails, waders and gulls.

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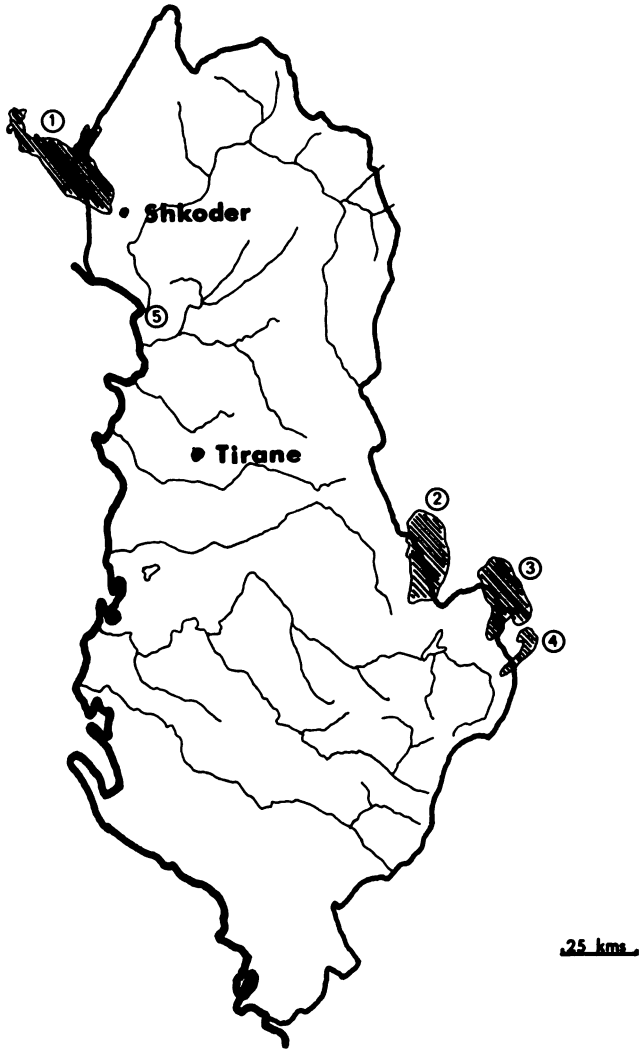
ALBANIA

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WETLANDS OF INTERNATIONAL IMPORTANCE

	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
1.	Liquen-i-Shkodres/Lake Shkodra	42°10'N	19°20'E	12,470 ha in Albania (total 34,970 ha)	1c,d,e; 2a
2.	Liquen-i-Ohrid/Lake Ohrid	41°00'N	20°45'E	9,700 ha in Albania (total 34,800 ha)	1c,d,e; 2a
3.	Liquen-i-Prespa/Lake Prespa	40°55'N	21°00'E	9,720 ha in Albania (total 28,300 ha)	1c,d,e; 2a
4.	Liquen-i-Prespes/Lake Mikra Prespa	40°45'N	21°06'E	800 ha in Albania (total 5,270 ha)	1a,c,d,e; 2a,b
5.	Drini river-mouth (Kune Reserve)	41°45'N	19°28'E	several hundred hectares	2a Protected

# ALBANIA



## DETAILS OF LISTED AREAS

### 1. LIQUEN-I-SHKODRES (Lake Shkodra or Scutari; Skadarsko Jezero)

**Criteria for inclusion** 1c, d, e; 2a.

**Geographical location** North-west Albania, on the border with the Montenegrin republic of Yugoslavia. 42°10'N 19°20'E.



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**Area** 34,970 ha (12,470 ha in Albania).

**Altitude** 6 m.

**Water depth** 7 m maximum; mean 4 m but a few deep holes go down to as much as 44 m.

**Wetland type** 19.

**Ecology** Oligotrophic karstic lake, generally shallow but having a few very deep areas where karstic collapse has occurred.

**Legal status** No information.

**Tenure** State ownership.

**Management practices** It is not known to what extent fishing and wildfowling as practised under some measure of control on the Yugoslav side of the border are replicated in the Albanian sector.

**Threats** No information.

**Scientific research** Studies may well have been undertaken by the University of Tirane, but information is lacking.

**Principal reference material.**

See references at end of Summary; no details are available of limnological papers except for Rakaj, N. 1971 quoted above.

**2. LIQUEN-I-OHRID (Lake Ohrid; Ohridsko Jezero)**

**Criteria for inclusion** 1c, d, e; 2a.

**Geographical location** 41°00'N 20°45'E, on the border between Albania and the Macedonian republic of Yugoslavia.

**Area** 34,800 ha (9,700 ha in Albania).

**Altitude** 695 m.

**Water depth** Maximum 286 m; mean 145 m.

**Wetland type** 19.

**Ecology** A lake of karstic origin consisting of a permanently submerged collapse feature or polje, developed over a tectonic base. Vegetation includes shoreline species such as pondweed *Potamogeton*, water milfoil *Myriophyllum* and hornwort *Ceratophyllum*; the bottom supports meadows of *Chara* spp. (stoneworts) between depths of 6 to 18 m. The endemic gasteropod fauna is regarded as a tertiary relict.

**Legal status** No information.

**Tenure** Presumably state ownership.

**Management practices** None reported.

**Threats** Some threat of pollution from effluent derived from settlements surrounding the Yugoslav sector.

**Scientific research** For the lake as a whole, intensive investigations have been undertaken over many years.

**Principal reference material**

Stanković, S. 1960. *The Balkan Lake Ohrid and its living world*. The Hague, W. Junk. (Includes many references to other published work).

# ALGERIA

## SUMMARY OF WETLAND SITUATION

The varied group of fresh or brackish lakes and marshes (1) situated in the extreme north-eastern corner of Algeria between 'Annaba and the Tunisian frontier, near the small coastal town of El Kala, can be regarded as among the most interesting wetland areas of the Maghreb. The lakes are of exceptional value because of their rich and diverse flora and fauna, including several rare and endangered species; they also provide valuable habitat for large numbers of migratory and wintering waterfowl. Their conservation is of altogether vital importance in maintaining the existence of characteristic North African wetland ecosystems, most of which have been obliterated by being drained for agriculture.

In western Algeria, the only wetland in the coastal region considered to be of international importance is the mainly brackish Marais de la Macta (3), south-west of Mostaganem. It was drained in the 1960s, but became flooded again by 1972 and should certainly be kept in that condition: it serves a most useful purpose both for soil and general environmental protection and also as a refuge for wintering and migrating waterfowl.

The vast hinterland includes several large wetland areas of an ephemeral and usually very saline character; all those listed are situated in the north-east between Constantine and Touggourt (5-7). They depend for existence on winter rainfall and may in favourable years offer excellent seasonal feeding grounds for flamingos and a great assortment of wintering and migrating waterfowl including waders or shore birds, herons and cranes.

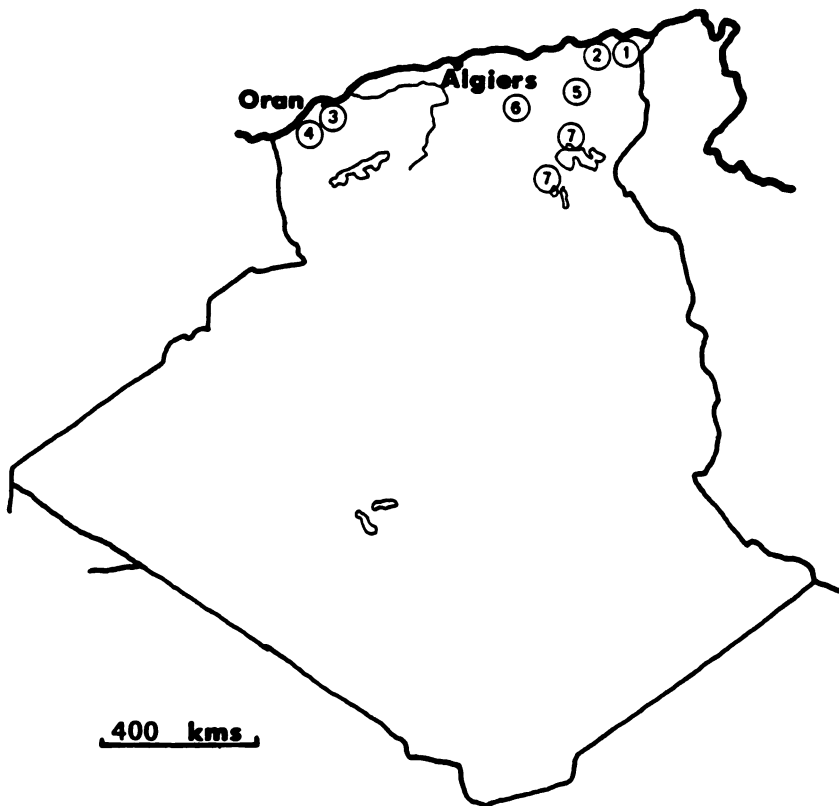
## WETLANDS OF INTERNATIONAL IMPORTANCE

	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
1.	Wetland complex of El Kala:				
1.1	Lac Tonga	36°53'N	8°31'E	c. 3,000 ha	1a,d,e; 2a; 3c; 4a Unprotected
1.2	Lac Oubeira	36°53'N	8°10'E	2,800 ha	1a,b; 2a; 3c; 4a Unprotected
1.3	Lac Mellah	36°53'N	8°10'E	837 ha	1a,b,d,e; 2a,b; 3c; 4a Unprotected
1.4	Garaet Mekhada	36°25'N	7°59'E	several thousand ha	1a,b,c,d,e; 2a,b; 3c; 4a Unprotected
1.5	Barrage de Cheffia (on the Oued Bouna-moussa)	36°08'N	8°05'E	c. 3,000 ha	1a,b; 4a Unprotected
2.	Guerbes Senadjas	36°52'N	7°15'E	c. 50,000 ha	1c,d,e; 2a; 3c; 4a,b Unprotected
3.	Marais de la Macta	35°45'N	0°05'W	several thousand ha	1a,b,e; 2a,b; 3c; 4a Partly protected?

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	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
4.	Grande Sebkhah d'Oran	35°35'N	1°00'W	Varies from c. 50,000 to 150,000 ha	1a,e; 2a; 4a Unprotected
5.	Wetland complex south of Constantine, including: Garaet et Tarf	35°42'N	7°10'E	c. 200,000–300,000 ha	1a,b; 2a; 4a,b Unprotected
	Sebkhah Hamiett and nine others	35°37'N	5°34'E		
6.	Chott el Hodna	35°25'N	4°30'E	c. 110,000–120,000 ha	1e; 2a; 4a Unprotected
7.	Chott Melrhir and Chott Merouane	34°15'N	6°20'E	c. 100,000 ha	1d,e; 2a; 4a Unprotected

ALGERIA



## DETAILS OF LISTED AREAS

## 1. Wetland complex in the vicinity of El Kala:

## 1.1 LAC TONGA

**Criteria for inclusion** 1a, d, e; 2a, 3c; 4a.

**Geographical location** 36°53'N 8°31'E, about 60 km east of 'Annaba and 5 km from the Tunisian border. Grouped with the next four sites, though they are spread along nearly 50 km of the coastal belt, since their ecology (*q.v.*) differs and together they form a convenient unit for conservation purposes.

**Area** About 3,000 ha.

**Altitude** Near sea level.

**Water depth** Maximum: 2.6–2.8 m; average: 0.5–1.0 m.

**Wetland types** 11, 18.

**Ecology** Freshwater marsh with abundant vegetation and hardly any open water, surrounded by wooded hills. An excellent example of a bio-community of Mediterranean coastal wetland, with some unusual features (presence of leeches and watersnails) but otherwise typical. The area is of great importance to wintering, migrating and breeding waterfowl, the latter almost certainly including scarcer species such as Marbled Teal *Anas angustirostris* and White-headed Duck *Oxyura leucocephala*. There is much movement of birds over an intervening ridge between this site and Lac Oubeira (1.2).

**Legal status** The wetland is not yet protected but a project to include it in a National Park is being considered.

**Tenure** State ownership.

**Management practices** No information.

**Threats** Shooting pressure is high. An attempt to drain the wetland was initiated in 1860–1865 and pumping continued until 1935, when it was abandoned as a failure; but the risk remains of calls for its revival.

**Scientific research** The area is discussed in Chapter 4 of Thomas (1975). IWRB waterfowl counts have been carried out each year since 1971.

**Principal reference material**

Thomas, J. P. 1975. *Ecologie et Dynamisme de la végétation des dunes littorales et des terrasses sableuses quaternaires de Jijel à El Kala, Est Algérie*. Unpublished thesis.

Thomas, J. P., Djender, M. & Bougazelli, N. 1976. *Projet de Parc National Marin, Lacustre, Terrestre, de El Kala (Annaba), Algérie*. Report prepared for the Consultative Meeting of Experts on Marine Parks and Wetland Reserves organized by UNEP in January, 1977. Mimeo.

## 1.2 LAC OUBEIRA

**Criteria for inclusion** 1a, b; 2a; 3c; 4a.

**Geographical location** 36°53'N 8°10'E, about 50 km east of 'Annaba and 10 km west of El Kala, very close to the coast. One of five sites which can be conveniently

grouped together though spread along nearly 50 km of the coastal belt.

**Area** 2,800 ha.

**Altitude** Near sea level.

**Water depth** 2–3 m.

**Wetland type** 18.

**Ecology** Eutrophic lake, much of it overgrown by pondweed *Potamogeton* sp. and surrounded by a thin belt of reeds. The lake is rich in fish and is important to migratory and wintering waterfowl, especially Little and Black-necked Grebes *Tachybaptus ruficollis* and *Podiceps nigricollis*, Wigeon *Anas penelope*, Pochard *Aythya ferina*, Little Egret *Egretta garzetta* and Coot *Fulica atra*. The Glossy Ibis *Plegadis falcinellus* is an occasional visitor. A few species were found nesting in small numbers in 1976.

**Legal status** Uprotected.

**Tenure** State ownership.

**Management practices** No information.

**Threats** Moderate to heavy fishing and hunting pressure.

**Scientific research** On behalf of IWRB, staff of the Station biologique de la Tour du Valat, Camargue, and others have carried out winter waterfowl censuses since 1972.

#### **Principal reference material**

Blondel, J. 1967 La situation des zones humides en Algérie. In Salverda, Z. (ed.) *Proc. 2nd Eur. Meeting on Wildfowl Conservation, Noordwijk aan Zee*, 1966. The Hague, Ministry of Cultural Affairs, Recreation and Welfare publ.

Johnson, A. R. & Hafner, H. 1972. Waterfowl census in autumn 1971 on some Tunisian and Algerian wetlands. *IWRB Bull.* 33: 51–62.

Hovette, C. and Kowalski, H. 1973. Waterfowl counts in north-west Africa – January/February 1972. *IWRB Bull.* 34: 42–58.

### **1.3 LAC MELLAH**

**Criteria for inclusion** 1a, b, d, e; 2a; 3c; 4a

**Geographical location** 36°53'N 8°10'E, virtually identical to that of Listed Area 1.2 (*q.v.*), which it adjoins, and one of the five sites which constitute the El Kala wetlands, scattered along a 50 km stretch of coastlands to the west of El Kala towards 'Annaba.

**Area** 837 ha.

**Altitude** Near sea level.

**Water depth** Maximum 6 m; average 3–4 m.

**Wetland type** 7.

**Ecology** A saltwater lagoon, connected with the sea, and with a submerged vegetation dominated by tassel pondweed *Ruppia spiralis*. The lagoon is rich in fish and of importance to migrating and wintering waterfowl, especially diving

## ALGERIA

ducks (such as Pochard *Aythya ferina*; also Tufted Duck *A. fuligula*, of which it is the only major station in North Africa) and Coot *Fulica atra*, sometimes in huge concentrations. Its importance for the nesting of these or other species is minimal because of lack of cover, but needs further investigation. A considerable variety of mammals, including Wild Boar *Sus scrofa*, is dependent on the wetland and to be found in the surrounding area.

**Legal status** Unprotected but fishing and the use of boats on the lagoon is restricted to personnel of the Fishery Institute of Algeria (OPA). This wetland would also be included in a National Park which is under consideration for establishment in the area.

**Tenure** State ownership, under lease to the Fishery Institute.

**Management practices** Some dredging has been undertaken. Fishing methods are largely confined to the use of traditional fish-traps.

**Threats** Some fishing and hunting pressure along the shoreline.

**Scientific research** Several wildfowl censuses since 1971, carried out by staff of the Station biologique de la Tour du Valat, Camargue, on behalf of IWRB.

### Principal reference material

All titles quoted under the previous component of this wetland zone, area 1.2, are relevant. A study entitled 'Le parc marin lacustre et terrestre de El Kala ('Annaba, Algérie) by Nadia Bougazelli and J. P. T. Maliza Djenda, published in stencilled form, is useful but no details of the date or whether and where it can still be obtained, are available.

## 1.4 GARAET MEKHADA

**Criteria for inclusion** la, b, c, d, e; 2a, b; 3c; 4a.

**Geographical location** 36°25'N 7°59'E, the furthest west of the El Kala wetland complex and only about 20 km from 'Annaba.

**Area** At least 10,000 hectares.

**Altitude** Near sea level.

**Water depth** Very shallow and largely depending on rainfall.

**Wetland types** 7, 8, 12 and 23.

**Ecology** Flood plain of two or three rivers, bounded by dunes, and including the small Lac des Oiseaux. A mixture of fresh or brackish shallow marshes, with some lagoons heavily overgrown with reeds and rushes *Scirpus*, *Phragmites* and *Typha*. The wetland is separated from the sea by dunes covered with *Halimium*, oak *Quercus* sp. and tree heath *Erica arborea*, and its main sources of water are the Oued Bounamoussa and Oued el Kebir. There are areas of grassland, interspersed with *Asphodelus* spp. and grazed by cattle, and a few patches of cultivation.

The mammals include Wild Cat *Felis silvestris* and possibly Pardel Lynx *Felis lynx pardellus* (*Lynx pardina*), Wild Boar *Sus scrofa* and Red Deer *Cervus elaphus*. Like the rest of the El Kala wetland complex, this section is important for migrating and wintering waterfowl, notably Greylag Goose *Anser anser*, Pintail *Anas acuta*, Shoveler *A. clypeata*, Teal *A. crecca* and Wigeon *A. penelope*; these species graze here but retire to the Bounamoussa or Cheffia dam (1.5) when disturbed by hunters. Possible breeding species include White-headed Duck *Oxyura leucoce-*

*phala* and Marbled Teal *Anas angustirostris*, while the Purple Gallinule *Porphyrio porphyrio* nests commonly. Birds of prey are unusually abundant and include Long-legged Buzzard *Buteo rufinus*, Marsh Harrier *Circus aeruginosus*, Bonelli's Eagle *Hieraetus fasciatus*, Egyptian Vulture *Neophron percnopterus* and Griffon Vulture *Gyps fulvus*, the latter probably nesting in nearby hills.

**Legal status** Unprotected.

**Tenure** State ownership.

**Management practices** None.

**Threats** Some hunting pressure near the mouth of the Oued Mafrag and its vicinity.

**Scientific research** Several winter censuses of wildfowl since 1971 carried out by staff of the Station biologique de la Tour du Valat, Camargue, on behalf of IWRB.

**Principal reference material**

As for other sections of the wetland, especially areas 1.1 and 1.2 (*q.v.*).

## 1.5 BARRAGE DE CHEFFIA (on the Oued Bounamoussa)

**Criteria for inclusion** 1a, b; 4a.

**Geographical location** 36°08'N 8°05'E, on the southern border of the wetland complex about half way between El Kala and 'Annaba.

**Area** About 3,000 ha.

**Altitude** 170 m.

**Water depth** Maximum about 20 m.

**Wetland type** 16.

**Ecology** A fairly large and deep impoundment in the hills bordering and overlooking the coastal plain. Its special importance is that it provides a refuge for waterfowl when shooting is in progress in the low-lying sections of the wetland. At such times very considerable numbers of duck have been observed, e.g. Wigeon *Anas penelope* (up to 95,000), Teal *A. crecca* (1500) and Pintail *A. acuta* (3500).

**Legal status** Unprotected.

**Tenure** State ownership.

**Management practices** The water body is managed solely as a storage reservoir.

**Threats** A certain amount of shooting takes place around the reservoir.

**Scientific research** The reservoir was added to the sections of the wetland complex covered by the IWRB midwinter waterfowl censuses in 1974 (M. Smart, February) and again in 1975 (A. R. Johnson, H. de Jong and J. van Dierman, January).

**Principal reference material**

None except for the IWRB Census reports.

## 2. GUERBES SENADJAS

**Criteria for inclusion** 1c, d, e; 2a; 3c; 4a, b.



ALGERIA

**Geographical location** 36°52'N 7°15'E, about 45 km west of 'Annaba, enclosed by the Djebel Edough on the east and the Filfila range to the west and extending to the Mediterranean in the north.

**Area** About 50,000 ha.

**Altitude** Sea level to 10 m.

**Water depth** Maximum in the marshland 2m; Lake Freitis 4m; over all average 0.4-0.6 m.

**Wetland types** 11, 12, 18, 23.

**Ecology** A triangular-shaped low-lying area hemmed in by mountains on east and west and drained by the Oued el Kebir, the waters of which are held back by an important dune formation bordering the coast. As a result there are numerous marshy areas, small lakes and fens, mostly covered over with *Juncus*, *Scirpus* and *Carex*. Some inundated stands of alder *Alnus glutinosa*, rich in ferns, and a sizeable lake (Freitis) with open water, along the Oued el Kebir, are other notable features. The dune vegetation of cork oak *Quercus suber* and *Halimium halimifolium* is subject to periodic destruction by fire. The flora of the wetlands has a European character with several boreal as well as tropical species and also a few endemics. At least three Felid species are found in the area and it is possible that a fourth, the Caracal Lynx *Felis caracal*, may survive in very small numbers. A subspecies of Banded Mongoose *Mungos mungo widringtonii* and the common Genet *Genetta genetta* also occur.

**Legal status** Unprotected.

**Tenure** State ownership.

**Management practices** Reafforestation has been attempted in the sand dune belt, but unfortunately with insufficient regard for ecological considerations.

**Threat** There is no tourism and no serious hunting pressure at present, but a survey of the springs which occur in the dunes, with a view to tapping them for development purposes in that zone, might in fact lead to desiccation unless adequate precautions are taken.

**Scientific research** Freitis lake and its environs have been visited by one or two zoologists and botanists, but only on a very few occasions.

**Principal reference material**

No publications have been listed but the ecological and other details given here are based on information kindly furnished by Dr. J. P. Thomas (Les Asphodèles, D 10131 El Biar, Alger).

### 3. MARAIS DE LA MACTA

**Criteria for inclusion** 1a, b, e; 2a, b; 3c; 4a.

**Geographical location** 35°45'N 0°05'W, about 25 km SSW of Mostaganem and straddling the road and railway to Oran, which is 75 km to the west.

**Area** Several thousands of hectares.

**Altitude** Near sea level.

**Water depth** Shallow and rainfall-dependent.

**Wetland types** 8, 11, 12 and 23, but this is somewhat uncertain and needs further checking.

**Ecology** Before it was drained in the early 1960s, this brackish coastal wetland varied in size between 3,000 and 15,000 ha. Since drainage operations were reduced or halted and the area became re-flooded an unspecified number of years later, but certainly by 1972, its extent does not seem to have been precisely determined. The marsh, separated from the sea by dunes, now supports a vegetation composed mainly of sharp sea rush *Juncus acutus*, tamarisk *Tamarix gallica*, *Salicornia* (= *Arthrocnemum*) *fruticosa* and several gramineous species, but there are still large areas of open water. The site is used for grazing cattle.

Waterfowl (particularly Teal *Anas crecca*, Wigeon *A. penelope*, Coot *Fulica atra* and Limicolae) winter or stop off in the area on migration in important numbers and it also provides a refuge for some threatened species (e.g. Glossy Ibis *Plegadis falcinellus* was observed in February 1972). Before 1960 many interesting species were recorded as nesting, including Little Grebe *Tachybaptus ruficollis*, Purple Heron *Ardea purpurea*, Squacco Heron *Ardeola ralloides*, Night Heron *Nycticorax nycticorax*, Mallard *Anas platyrhynchos*, Marbled Teal *A. angustirostris*, Avocet *Recurvirostra avosetta* and Black-winged Stilt *Himantopus himantopus*; Greater Flamingos *Phoenicopterus ruber* were seen regularly. Its status as a breeding site since re-flooding is uncertain and needs further investigation.

**Legal status** Unprotected but reported in 1977 to have nature reserve status.

**Tenure** State ownership.

**Management practices** No information is available, but the maintenance of a plentiful supply of freshwater in this area could be valuable for irrigation of surrounding arable lands and also ensure conservation of the marshland for controlled exploitation by cattle-grazing. Further attempts at drainage, on the other hand, would only lead to loss and impoverishment of the soil.

**Threats** The industrial zone of the town of Arzew, some 20 km along the coast to the west, is tending to spread towards La Macta. There is also a risk that the Oued, draining the large catchment to the south into the wetland, may become polluted.

**Scientific research** Midwinter waterfowl censuses have been carried out in 1972 and 1975, by personnel of the Station biologique de la Tour du Valat, Camargue, on behalf of IWRB (Hovette & Kowalski, Feb. 1972; Johnson, de Jong and van Dierman, January 1975).

**Principal reference material**

Blondel, J. 1967. La situation des zones humides en Algérie. In Salverda, Z. (ed.) *Proc. 2nd Euro. Meeting on Wildfowl Conservation, Noordwijk aan Zee, 1066*. The Hague, Ministry of Cultural Affairs, Recreation and Social Welfare publ.

#### 4. GRANDE SEBKHA D'ORAN

**Criteria for inclusion** 1a, e; 2a; 4a.

**Geographical location** 35°35'N 1°00'W, its extreme eastern point about 20 km almost due south of Oran, with the potential inundation area extending westwards for another 40 km.

**ALGERIA**

**Area** Normally 50,000 ha, but can increase to at least 150,000 ha after heavy rainfall.

**Altitude** 85 m.

**Water depth** Generally shallow but no figures available.

**Wetland type** 17.

**Ecology** A salt lake with a variable amount of water, depending on winter rainfall. The vegetation around its shores is composed mainly of reeds *Phragmites communis*, the glasswort *Arthrocnemum glaucum*, *Scirpus* sp., *Suaeda fruticosa* (= *vera*) and *Juncus* sp. Important concentrations of waterfowl have been observed in winter, including such species as Shelduck *Tadorna tadorna*, Marbled Teal *Anas angustirostris* (about 200 of this scarce duck in February 1972), Pintail *A. acuta*, Shoveler *A. clypeata* and Avocet *Recurvirostra avosetta*. An estimated 1,450 Greater Flamingos *Phoenicopterus ruber* were recorded in 1972, also in February.

**Legal status** Unprotected.

**Tenure** State ownership.

**Management practices** None.

**Threats** Hunting pressure is high.

**Scientific research** A midwinter census of the waterfowl initiated by IWRB was carried out in January 1975 by Johnson, de Jong and van Dierman.

**Principal reference material**

Apart from accounts of an ornithological survey in 1972 and the report of the 1975 census (*IWRB Bulletins*), no relevant publications have been identified.

**5. THE WETLAND COMPLEX SOUTH OF CONSTANTINE**

(Es Shikra, Garaet et Tarf, Garaet Guellit, Garaet Ank Djemel, Sebkheth Djendli, Les Lacs, Chott Gadaine, Chott el Beida, Chott el Frain, Sebkheth Hamieth, Sebkheth Guellal)

**Criteria for inclusion** 1a, b; 2a; 4a, b.

**Geographical location** The wetlands of this complex are scattered over a distance of 150 km from east (e.g. Garaet et Tarf 35°42'N 7°10'E) to west (e.g. Sebkheth Hamieth 35°37'N 5°34'E) in a shallow arc ranging from about 60 to nearly 100 km from Constantine to the south. The nearest to the town, almost due south, are known as 'Les Lacs' (35°48'N 6°30'E).

**Area** 200,000–300,000 ha.

**Altitude** 800–1000 m.

**Water depth** Mainly shallow, varying with and depending on winter rainfall.

**Wetland type** 17.

**Ecology** The water level of the eleven named sites varies seasonally so it is not surprising that none of them are known to support any emergent macrophytes, although halophile plants such as *Salicornia* are found around their shores. They are nevertheless of special importance to migrating and wintering waterfowl and favoured by ducks such as Shelduck *Tadorna tadorna*, Wigeon *Anas penelope* and

Pintail *A. acuta* and by limicoline species accustomed to saline conditions like Dotterel *Charadrius morinellus* and Avocet *Recurvirostra avosetta*. The largest of the pans, Garaet et Tarf, providing well over 2000 sq. km of feeding grounds when saturated, supports large numbers of Common Cranes *Grus grus* (950 counted in 1971) and Greater Flamingos *Phoenicopterus ruber* (5,000 in 1971), although nesting by the latter, which is quite likely, has never been proved.

**Legal status** Unprotected.

**Tenure** State ownership.

**Management practices** Include exploitation of salt left by evaporation. Despite the saline conditions, grazing of domestic stock and raising of cereal crops are possible in the near vicinity of the wetlands.

**Threats** Hunting pressure is severe.

**Scientific research** Midwinter wildfowl censuses have been carried out on behalf of IWRB by Johnson and Hafner in December 1971, and Johnson, de Jong and van Dierman in January 1975.

**Principal reference material**

None noted except for the results of census work published in the *IWRB Bulletin*.

## 6. CHOTT EL HODNA

**Criteria for inclusion** 1e; 2a; 4a.

**Geographical location** 35°25'N 4°30'E. The eastern end of the inundation zone is about 80 km north-west of Biskra on the Constantine to Touggourt road and railway, while the western end is little more than 50 km north-east of Bou Saada.

**Area** Normally varies between 110,000 and 120,000 ha, but after abundant rainfall can be as much as 400,000 ha, since the giant pan extends at least 90 km from east to west.

**Altitude** 400 m.

**Water depth** Shallow.

**Wetland type** 17.

**Ecology** The term 'chott' is usually applied, as in this case, to salt lakes which only hold water in winter. As the water retreats the muddy margins form a salt-crust 3 to 5 cm thick. The scanty vegetation round the chott is, therefore, naturally halophile but includes phanerogams, which are often quite abundant in the vicinity of springs. Due to the vast size of the area its importance for the Limicolae, Anatidae and other waterfowl has not yet been properly assessed and more investigation is needed: the chott has been suspected as a flamingo nesting area but this has yet to be proved.

**Legal status** Unprotected.

**Tenure** State ownership.

**Management practices** None, apart from efforts to improve and develop agriculture and animal husbandry in the zone surrounding the salt lake.

**Threats** Hunting pressure is light or non-existent except very locally.

ALGERIA

**Scientific research** No information.

**Principal reference material**

No information.

## 7. CHOTT MELRHIR and CHOTT MEROUANE

**Criteria for inclusion** 1d, e; 2a; 4a.

**Geographical location** 34°15'N 6°20'E and 34°00'N 6°00'E, respectively. These two salt lakes are at the western end of a vast depression and situated in the below sea level sector. The latter extends from a point 50 km south-east of Biskra well into Tunisia north of Nefta and Tozeur. The lakes are about 25 km apart, Chott Melrhir being considerably the larger.

**Area** About 100,000 ha.

**Altitude** 26 m below sea-level.

**Water depth** Shallow.

**Wetland type** 7.

**Ecology** The two salt lakes are surrounded by desert vegetation, such as *Arthrocnemum* and *Salicornia* species, grading from procumbent to about 30 cm in height and including some rare plants. This dwarf bush supports an interesting avifauna, notably Otidae, such as the Houbara Bustard *Chlamydotis undulata*, and sand-grouse Pteroclididae. More directly dependent on the wetlands for feeding or resting during migration are various species of duck Anatidae and the Greater Flamingo *Phoenicopterus ruber*.

**Legal status** Unprotected.

**Tenure** State ownership.

**Management practices** None.

**Threats** Hunting pressure is confined to the vicinity of a road which branches to the east off the main Touggourt highway. At the point where it runs between the two salt lakes en route for Souf el Oued, it is little more than 10 km from either of them and a mere 90 km from Biskra.

**Scientific research** None on record.

**Principal reference material**

No information.

# AUSTRIA

## SUMMARY OF WETLAND SITUATION

The greater part of the Federal Republic of Austria is mountainous: the Alps stretching from the Swiss border, gradually get lower in the eastern part of the country till they meet the Pannonian plains south of Vienna. It is in this area that one of the most interesting wetlands of Central Europe is located, comprising the Neusiedler See and the adjacent pond area of Seewinkel (1). The waters of both are alkaline and extremely rich in animal and plant species, due partly to the fact that this is the meeting place of several climatological systems. The wetlands form one of the most important breeding and moulting areas for waterfowl in Central Europe, while huge concentrations of ducks Anatidae and waders Limicolae can be encountered during the migration season. Because of its proximity to Vienna the possibilities of the area for study and education as well as tourism are excellent. Both the Neusiedler See and the Seewinkel lakes have been the subject of a considerable number of limnological studies.

The river March along the border with Czechoslovakia has large stretches of intact riverine forest and wet meadows. A large WWF reserve is situated near Marchegg (2), protecting the breeding colony of the eastern race of Cormorant *Phalacrocorax carbo sinensis* and Night Heron *Nycticorax nycticorax*. Conservation measures should maintain the original character of this unique area although they do not exclude limited hunting and fishing.

A small reserve, the Hagenauer Bucht (3) is situated in the valley of the Lower Inn, on the border with the Federal Republic of Germany. It forms an entity with the reservoirs protected by West German territory (see relevant section of Directory).

A fourth site of international importance is situated in the Rhine Delta near Bregenz, where the river enters the Bodensee (4). An area of 1,400 ha was set aside as a reserve as long ago as 1942. It will be given the status of a Nature Reserve in the near future and it is also hoped that it will be enlarged.

A number of mountain lakes figure in the AQUA List. Those that are clearly of more than national interest have been incorporated in the main checklist (6-7) but eleven other sites recognized by Project AQUA have been included in an addendum, since they are all of major limnological interest and in several cases provide excellent examples of successive stages of eutrophication.

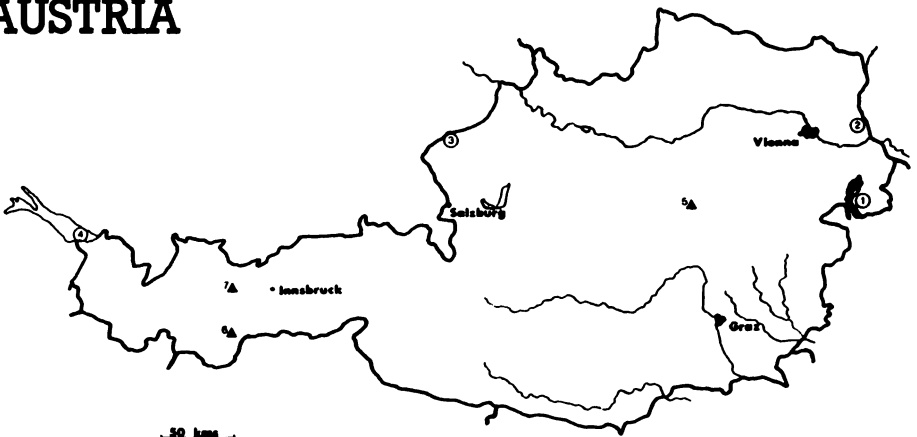
## WETLANDS OF INTERNATIONAL IMPORTANCE

	Locality	Latitude	Longitude	Size	Wetland criteria/ Conservation status
1.	Neusiedlersee and Seewinkel	47°48'N	16°50'E	27,000 ha in Austria (total 35,000 ha)	1a,b,c,d,e; 2a,b,c; 3a,b,c; 4a Landscape reserve 1,400 ha Nature Reserve

AUSTRIA

	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
2.	Marchauen, Marchegg	48°15'N	16°55'E	1,200 ha	1d,e; 2a,b; 3a,b,c; 4a,b 1,120 ha Nature Reserve
3.	Reservoirs on the Lower Inn	48°15'N	12°55'E	not specified	1a 166 ha protected cf. No. 35 in FGR list
4.	Rhine Delta, Bodensee	47°28'N	8°42'E	not specified	2a; 3c; 4a
<b>Wetlands of mainly limnological interest:</b>					
5.	Lunzerseen: Untersee, Mittersee and Obersee	47°52'N	15°03'E	68 ha	2a,c; 3b Protected
6.	Schwarzee ob Sölden	46°58'N	10°57'E	3.5 ha	1e; 2b; 3a Unprotected
7.1	Vorderer Finstertalersee	47°12'N	11°02'E	15.7 ha	3a Unprotected
7.2	Hintere Finstertalersee	47°12'N	11°02'E	7.4 ha	3a Unprotected
<b>Other sites of limnological interest:</b>					
	Attersee	47°53'N	13°33'E	467.2 ha	State owned          Protected
	Traunsee	47°52'N	13°48'E	255.5 ha	
	Mondsee	47°49'N	13°02'E	142.1 ha	
	Wolfgangsee	47°45'N	13°25'E	131.5 ha	
	Hallstättersee	47°35'N	13°39'E	85.8 ha	
	Irrsee	47°55'N	13°18'E	34.7 ha	
	Längsee	46°47'N	14°24'E	7.6 ha	
	Oberer Plenderlesee	47°12'N	11°35'E	2.1 ha	
	Gossenköllesee	47°13'N	11°01'E	1.6 ha	
	Hirschebensee (Unterster Plenderlesee)	47°12'N	11°03'E	c. 1.2 ha	
	Krottensee	47°49'N	13°23'E	0.9 ha	Privately owned

AUSTRIA



## DETAILS OF LISTED AREAS

### 1. NEUSIEDLERSEE and SEEWINKEL

**Criteria for inclusion** 1a, b, c, d, e; 2a, b, c; 3a, b, c; 4a.

**Geographical location** 47°48'N 16°49'E, about 50 km south-east of Vienna on the western edges of the Little Pannonian Plain. The southern end of the lake extends into Hungary. The Seewinkel area comprising about 50 shallow alkaline lakes is located immediately to the east of Lake Neusiedl.

**Area** About 35,000 ha of which c. 18,000 ha are open water and about 8,000 ha are Hungarian territory. The ponds in the Seewinkel area are small; the biggest being Lange Lacke of 226 ha.

**Altitude** Lake Neusiedl is situated at 114 m above sea level and Seewinkel c. 120 m above sea level.

**Water depth** Fluctuating throughout the year and from year to year. In 1977 the main lake averaged about 1.5 m and it has dried out completely in the past, for example in 1865 and 1872. Most of the Seewinkel lakes are about 1 m deep.

**Wetland type** 17, 18.

**Ecology** The Neusiedlersee is an alkaline, meso-eutrophic lake with low transparency. It is about 35 km long and 6 to 12 km wide and is the largest soda lake in Europe. It is fed by small streams, and probably also by springs in the lake itself. The lake margins have reedbeds in many places which sometimes extend about 4 km into the lake and much of the surrounding land is cultivated. The Seewinkel's mosaic of small alkaline ponds, on the other hand, are surrounded by a mixture of fields and the remnants of what was once a steppe landscape. Most of the ponds dry out in summer. The area as a whole has an extremely varied flora and fauna, situated as it is at the junction of Alpine, Pannonian and Central European climatological systems. Breeding birds of what is, therefore, a very exceptional region, include Great White Egret *Egretta alba* (c. 300 pairs) Purple Heron *Ardea purpurea* (c. 300 pairs), Grey Heron *A. cinerea* (c. 180 pairs) and Spoonbill *Platalea leucorodia* (200–250 pairs).

The Seewinkel area is an especially important breeding area for large numbers of Anatidae, Rallidae, Laridae and Limicolae, including Greylag Goose *Anser anser* (250 to 300 pairs), Mallard *Anas platyrhynchos*, Garganey *A. querquedula*, Gadwall *A. strepera*, Shoveler *A. clypeata*, Ferruginous Duck *Aythya nyroca*, Kentish Plover *Charadrius alexandrinus*, Black-tailed Godwit *Limosa limosa* (c. 8 pairs in 1975), Redshank *Tringa totanus* (c. 150 pairs) and Avocet *Recurvirostra avosetta* (c. 40 pairs in 1976). The Stone Curlew *Burhinus oedicephalus* probably no longer nests in this area although 10–15 pairs were still doing so between 1960 and 1970. The Common Tern *Sterna hirundo* breeds in fair numbers and the Black-headed Gull *Larus ridibundus* population has increased recently to about 800–1000 pairs. The area is a moulting ground for Pintail *Anas acuta* as well as Greylag, Gadwall and other aquatic species. Huge numbers of geese visit the area in autumn and winter, including c. 6,000 Greylags, c. 30,000 White-fronted Geese *A. albifrons*, and c. 10,000 Bean Geese *A. fabalis*. Important numbers of wintering Mallard, Gadwall, Shoveler and Pintail have also been recorded. A small population of Great Bustard *Otis tarda* survives in the Hansag area to the south-east, in which the typical mammals are the European Ground Squirrel *Citellus citellus* and its predator, a subspecies *eversmanni* of the Weasel *Mustela nivalis*.



## AUSTRIA

**Legal status** The area has been protected as a landscape reserve since 1952. The Seewinkel-Lange Lacke sector comprises an area of about 980 ha, of which 440 have been leased to the World Wildlife Fund for a period of 20 years, while the remainder is protected by the Federal Government of Burgenland. The WWF has control over the hunting rights in about 2,500 ha of the Seewinkel-Sandeck zone, which enables the waterfowl populations of the area as a whole to be given a fair measure of protection.

**Management practices** Fishing, reedcutting and tourism are among the economic activities which are allowed to be practised in the area and have an impact on its ecology.

**Threats** Occasional unauthorised agricultural activities and sporadic attempts to convert wetlands into fishponds. In general the various pressures on lakes and wet meadows, outside of protected areas, are heavy. Thus the Hansag peatlands in the south-east are already largely drained and used for agriculture with the exception of one small nature reserve.

**Scientific research** Ecological and systematic research has been carried out in both the Neusiedlersee and Seewinkel sectors, including studies of the macrophytes, plankton and bottom fauna.

### Principal reference material

Zimmerman, R. 1944. *Beiträge zur Kenntnis der Vogelwelt des Neusiedlergebietes*. Sonderdruck aus dem I. teil des Bd. 54 der Annalen der Naturhistorischen Museum in Wien, 1943, ausgegeben in August 1944, Selbstverlag der Wiss. Staatsmuseen.

Löffler, H. 1959. Zur Limnologie des Seewinkelgebietes. *Sitz. ber. Öster. Ak. Wiss. math. nat.* K1(1) 168: 315–362.

Guglia, O. & Festetics, A. 1969. *Pflanzen und Tiere des Burgenlandes*. Österreichischer Bundesverlag, Wien.

Festetics, A. & Leisler, B. 1970. Ökologische Probleme der Vögel des Neusiedlerseegebietes, besonders des World-Wildlife Fund Reservates Seewinkel (III Teil: Möwen und Watvogel, IV. Teil Sumpf- und Feldvogel).

Löffler, H. 1974. *Der Neusiedlersee, Naturgeschichte eines Steppensees*. Wien: Verlag Fritz Wolden. (Includes large bibliography).

# BELGIUM

## SUMMARY OF WETLAND SITUATION

In Belgium all the wetlands of international importance to waterfowl are situated in the flat low-lying coastlands, along the north-western borders of the country. Thousands of sea-duck also winter in off-shore territorial waters (for example, 8,500 Scoters *Melanitta nigra* were observed on the Vlaamse Banken in February 1972). The Zwin reserve (2), located in dunes just south of the Dutch border, includes a brackish lake complex that is an attractive habitat for many species of Anatidae, including Bewick's Swans *Cygnus bewickii* and Bean Goose *Anser fabalis*, as well as large numbers of Laridae and Limicolae. The reserve is of special educational value and has up to 400,000 visitors a year.

The Yzer (IJzer) Estuary (3) has been given 'classified landscape' status and is the site of various field courses organized annually by the University of Ghent. Traditional goose wintering grounds near Damme (4) harboured up to 8,750 White-fronted Geese *Anser albifrons* and a maximum of 1,500 Pink-footed *A. brachyrhynchus* in the winter of 1973/74. Buffer zones and secondary reserves in the polders north and west of Bruges (Moene in Meetkerke) seem essential for the effective protection of these wintering flocks.

Blankaart Lake and the Broeken grasslands are situated in a distinctive wetland area formed by the floodplain of the Yzer (5). Although, since the construction of a large reservoir in the area, the Broeken polder has been less often flooded in recent years, the total numbers of waterfowl have not declined, though there has been some loss of breeding habitat.

The polders on the left bank of the River Schelde (7), which include amongst others the Doel, Kallo and Varrebroek, form a wetland unit with the Verdrongen Land of Saeftinge beyond the Netherlands border downstream, many duck such as Teal *Anas crecca* and Wigeon *A. penelope* moving freely between the two sites. The area is also an important wintering ground for geese, maximum numbers of Bean Geese *Anser fabalis* and White-fronted *A. albifrons* being about 4,000 and 2,500, respectively.

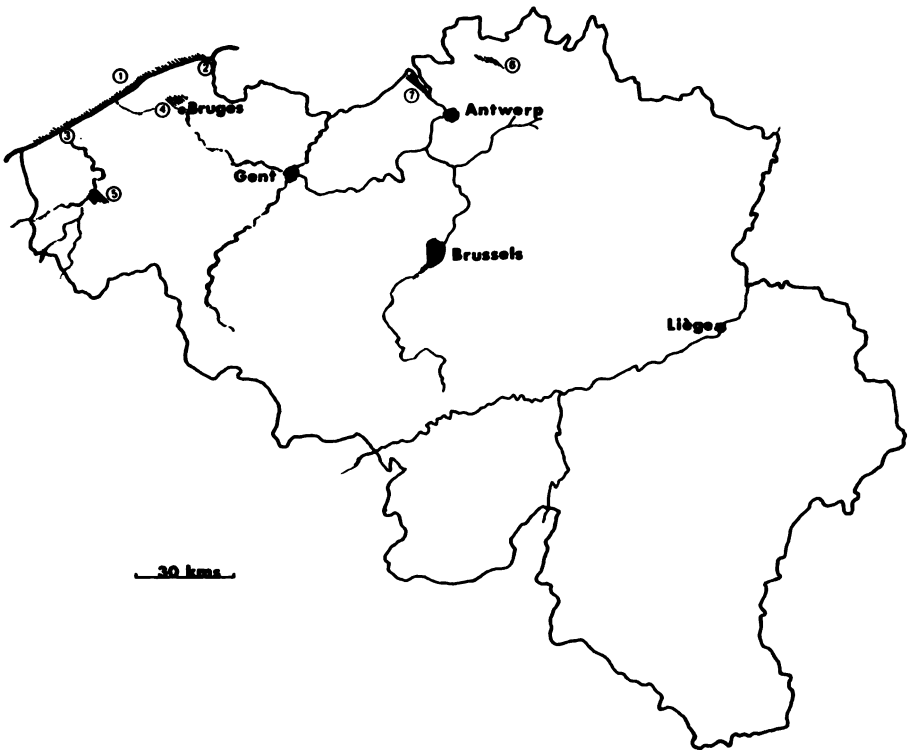
Kalmthout Heath and the associated heathland of Brecht and Wuustwezel, 30 km north-east of Antwerp (6), are a classified landscape part of which has been made into a reserve (850 ha). There are several oligotrophic fens of scientific interest in the area, such as Putse Moer and Stappens Ven, though they have to some extent been adversely affected by pumping for the local drinking water supplies. Up to 3,500 Whimbrel *Numenius phaeopus* have their winter roost in the area. Not far away near St. Lenaarts some abandoned claypits have recently become of considerable value for waterfowl, whilst 135 km to the south-east in the Hautes Fagnes area, with its extensive nature reserve, there are several interesting peatlands the precise international importance of which, according to the criteria used in this volume, still have to be assessed.

**BELGIUM**

**WETLANDS OF INTERNATIONAL IMPORTANCE**

	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
1.	Territorial waters along seacoast, especially the Vlaamse Banken	51°20'N	2°55'E	-	1a, b
2.	The Zwin	51°21'N	3°22'E	125 ha (+ 25 ha in the Netherlands)	1d, e; 2a, b; 3a, b, c; 4a, b Protected
3.	Estuary of the Yzer (Ijzer)	51°09'N	2°42'E	44 ha	1a, e; 2a; 3a; 4a Protected
4.	Wintering grounds for geese around Damme, including buffer zones N. & N.W. of Bruges	51°15'N	3°17'E	several thousand ha	1a, e; 3a, b, c; 4a 400 ha protected
5.1	The Blankaart Lake	50°59'N	2°51'E	400 ha	1d; 2a; 4a 70 ha prot., rest no shooting
5.2	Flood plain of the Yzer "The Broeken"			c. 4,200 ha	1a, b, e; 2a, b 400 ha protected
6.1	Kalmthout Heath (including 'Putse Moer & Stappens Ven)	51°23'N	4°28'E	1,873 ha	1b, d; 2a; 3c; 4a, b Landscape reserve, incl. 850 ha State Nature Reserve
6.2	Heathlands of Brecht and Wuustwezel	51°21'N	4°38'E	-	1b
7.	Left bank polders along River Schelde	51°19'N	4°15'E	-	1a; 3c; 4c

# BELGIUM



## DETAILS OF LISTED AREAS

### 2. ZWIN

**Criteria for inclusion** 1d, e; 2a, b; 3a, b, c; 4a, b.

**Geographical location** 51°21'N 3°22'E, near Knokke-Heist, on the Netherlands border, 18 km north-east of Bruges.

**Altitude** Sea level to 5 m.

**Area** 125 ha (plus 25 ha in the Netherlands) surrounded by a 1,500 ha buffer zone.

**Water depth** Variable.

**Ecology** An old salt marsh which was formerly part of the Schelde-Meuse-Rhine delta. It is enclosed by a 1.5 km long line of dunes to the north and by dykes to the south and west, but with a shallow creek linking it to the sea at its eastern end. This creek feeds a system of four brackish lagoons, the whole area often flooding during winter and at spring tides. The halophile vegetation includes glasswort *Salicornia* sp., seablite *Suaeda* sp. and sea lavender *Limonium vulgare*. The buffer zone includes coastal grasslands on a former airfield.

## BELGIUM

Breeding birds include Shelduck *Tadorna tadorna*, Mallard *Anas platyrhynchos*, Garganey *A. querquedula*, Oystercatcher *Haematopus ostralegus*, Kentish Plover *Charadrius alexandrinus* and, rarely, Ringed Plover *C. hiaticula* and Mediterranean Gull *Larus melanocephalus*. Migrant and wintering birds include Little Grebes *Tachybaptus ruficollis*, large numbers of ducks, waders and gulls (Great Black-back *Larus marinus*, Herring *L. argentatus* and Lesser Black-back *L. fuscus*), the latter using the area for roosting.

**Legal status** Reserve of 125 ha in Belgium plus 25 in Netherlands with 1,500 ha buffer zone.

**Tenure** Private reserve managed by the 'Reserves Naturelles et Ornithologiques de Belgique'.

**Management practices** Feeding and ringing of birds. The water level can be regulated. The influx of over 300,000 visitors a year is properly controlled.

**Threats** None reported: there is some grazing and shooting in the buffer zone.

**Scientific research** Experimental reintroduction of geese *Anser anser* and White Stork *Ciconia ciconia*. The Zwin is important for ornithological and botanical studies and is well-established as an educational centre.

### Principal reference material

Kuyken, E. 1972. Belgian wetlands of international importance. In *Proc. Internat. Conf. on Conservation of Wetlands and Waterfowl*, Ramsar, Iran, 1971. Slimbridge: IWRB publ. pp. 179–188.

## 5.1 BLANKAART LAKE

**Criteria for inclusion** 1d; 2a; 4a.

**Geographical location** 50°59'N 2°51'E. Municipality of Woumen (Dixmude), on the right bank of the River IJzer (Yzer).

**Altitude** About 5 m.

**Area** 40 ha.

**Water depth** 0.5–2.0 m.

**Ecology** A shallow freshwater lake occupying an area of about 70 ha and originating from earlier exploitation of peat in the valley of the Yzer river. The lake has gradually been silting up, resulting in wide expanses of reedbeds *Phragmites* and alder *Alnus*. Other typical plants include marsh vetches *Lathyrus* spp., sea milkwort *Glaux maritima* and marsh marigold *Caltha palustris*. Surrounding areas include hayfields. The lake is an important breeding site for Little and Great Crested Grebes *Tachybaptus ruficollis* and *Podiceps cristatus*, reintroduced Grey Heron *Ardea cinerea*, Bittern *Botaurus stellaris*, Little Bittern *Ixobrychus minutus*, Mallard *Anas platyrhynchos*, Shoveler *A. clypeata*, Pintail *A. acuta* and Garganey *A. querquedula*. It is also of great importance for the overwintering of some 20,000 Anatidae, 20–30,000 Limcolae and an increasing number of swans.

**Legal status** 70 ha are protected as a reserve.

**Tenure** The reserve is owned by the 'Réserves Naturelles et Ornithologiques de Belgique'.

**Management practices** Shooting is now prohibited on the lake and some 400 ha surrounding it and access is restricted. A number of new nesting-places have been created and efforts are being made to reintroduce the Cormorant *Phalacrocorax carbo*.

**Threats** None reported.

**Scientific research** Several thousands of birds are ringed annually. In general the scientific and educational importance of the site is well recognized.

**Principal reference material**

Kuyken, E. 1972. Belgian wetlands of international importance. In *Proc. Internat. Conf. on Conservation of Wetlands and Waterfowl*, Ramsar, Iran, 1971. Slimbridge: IWRB publ. Pp. 179–188.

### 6.1 KALMTHOUT HEATH (including Putse Moer and Stappens Ven)

**Criteria for inclusion** 1b, d; 2a; 3a; 4a, b.

**Geographical location** 51°23'N 4°28'E. North-east of Antwerp; municipalities of Kalmthout and Essen.

**Altitude** 20–25 m.

**Area** 1873 ha.

**Water depth** The depth of water in the two tarns, Putse Moer and Stappens Ven, has not been reported.

**Ecology** An area of marsh, heath, old dunes and woodlands, partly bordering the delta of the river Schelde. Vegetation includes dune grasslands of marram *Ammophila arenaria*, dry heath dominated by ling *Calluna vulgaris*, and wet heath with bog heather *Erica tetralix* and willows *Salix* sp. The oligotrophic marshes are of great interest being the southernmost examples of the type and the only examples in Belgium. The scattered tree cover includes stands of oak *Quercus*, birch *Betula* and fir *Abies* species.

The Kalmthout wetlands are important for breeding and wintering waterfowl including Black-necked Grebe *Podiceps nigricollis*, Pintail *Anas acuta*, Shoveler *A. clypeata*, Tufted Duck *Aythya fuligula*, Pochard *A. ferina*, Spotted Crake *Porzana porzana* and Curlew *Numenius arquata*. It is also an important roosting area for large numbers of other waders like Whimbrel *Numenius phaeopus* and Black-tailed Godwit *Limosa limosa*.

**Legal status** 850 ha of the wetlands have been declared a State Nature Reserve but the area as a whole has the status of a Landscape Reserve.

**Tenure** 80 ha are State owned and 732 ha municipal territory.

**Management practices** Private properties within the area are fenced and closed and the Nature Reserve is generally inaccessible to the public. Authorised visitors are encouraged to keep strictly to the paths. Prohibitions on human activities include habitation, cultivation, hunting, fishing, pasturing and woodcutting (except for limited forestry permitted on private holdings). Rabbits are controlled.

**Threats** None reported.

**Scientific research** There is a well established centre for research and education.

**BELGIUM**

**Principal reference material**

Kuyken, E. 1972. Belgian wetlands of international importance. In *Proc. Internat. Conf. on Conservation of Wetlands and Waterfowl*, Ramsar, Iran 1971. Slimbridge: IWRB publ. Pp. 179–188.

# BULGARIA

## SUMMARY OF WETLAND SITUATION

Many Bulgarian coastal lakes and marshlands have been drained or modified since 1944, to an extent that the area has become notably less attractive as habitat for breeding and migratory waterfowl. Recently there have been reports of a number of measures being taken to conserve what remains of a once very rich waterfowl habitat. Bulgaria signed and ratified the Ramsar Convention on 24 September 1975 and entered two wetland areas on the Convention List, namely Lake Srebarna (2), near Silistra on the Danube and close to the Romanian border, and Lake Arkoutino (5), in the Ropotamo National Park on the Black Sea coast to the south-east of Burgas.

Certainly, Lake Srebarna is one of the most important inland lakes in the country and notable, amongst other things, as a traditional breeding site of the Dalmation Pelican *Pelecanus crispus*, a species which has declined seriously in recent years and now rates as 'vulnerable' in the Red Data Book. A number of changes affecting the fauna and flora of Srebarna have followed the separation of the lake from the Danube by the construction of a dam. The pelicans now do most of their feeding in the nearby Romanian marshes: Other species which nest in the lake area include the Mute Swan *Cygnus olor*, Greylag Goose *Anser anser*, Pochard *Netta rufina*, Squacco Heron *Ardeola ralloides*, Little Egret *Egretta garzetta*, Great White Egret *Egretta alba*, Spoonbill *Platalea leucorodia* and Glossy Ibis *Plegadis falcinellus*.

At the Annual Board Meeting of the IWRB, held at Alushta, Crimea, in the USSR, in 1976, Dr Boev reported that four new reserves had been established which may encourage the White Pelican *Pelecanus onocrotalus* to breed again in Bulgaria, where it still occurs in summer: its former nesting place in the marshes of Lake Mandra near Burgas (4) has become so altered as to make it unsuitable. Precise information is lacking about what are probably still important wetland sites in the Black Sea coastlands near Shabla and Varna, as well as in the Burgas-Pomorie complex (4). The same applies to a number of other Bulgarian wetlands, including Lake Zrebevo (1) near Stara Zagora, the Danube islands of Wardim and Belene (3), where breeding colonies of herons Ardeidae and cormorants Phalacrocoracidae have been recorded, the Balabana swamp forest near Elcheve, and the mouths of the rivers Kamchiya and Batova, south of Varna.

## WETLANDS OF INTERNATIONAL IMPORTANCE

\*Nominated for inclusion in the Ramsar Convention list

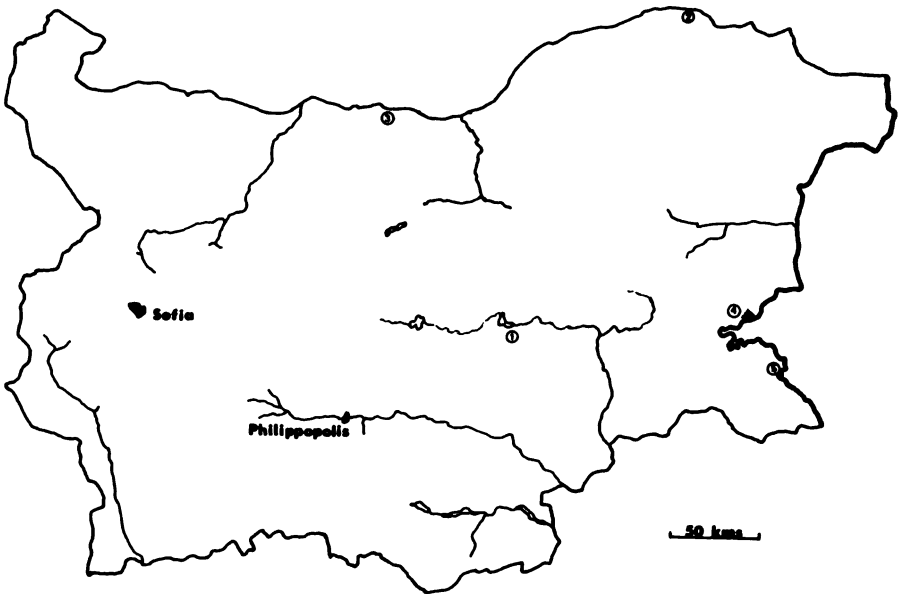
	Locality	Latitude	Longitude	Size	Wetland criteria/ Conservation status
1.	Lake Zrebevo	42°30'N	26°00'E	No information	1a
*2.	Lake Srebarna	44°08'N	27°06'E	5,000 ha	1d,e; 2a,b; 3b; 4a,b Protected (Ramsar site confined to 500 ha reserve)



**BULGARIA**

	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criterial Conservation status</i>
3.	Belene Island and ponds	43°39'N	25°10'E	Acc. to MAR list c.4,500 ha	1c,d,e; 2a
4.	Burgas/Pomorie lake and marshland complex	42°30'N	27°30'E	Acc. to MAR list c.4,300 ha	1a,b,c,d,e; 3b
*5.	Lake Arkoutino	42°18'N	27°45'E	700 ha	2a; 4a Protected

**BULGARIA**



# CYPRUS

## SUMMARY OF WETLAND SITUATION

There are only two major wetlands on the island, Limassol Salt Lake (1), often referred to as Akrotiri Salt Lake, and the Larnaca Salt Lake complex (2). Both of them have considerable importance for waterfowl especially during migration periods. A fairly detailed description of each of these areas is appended below.

The third wetland listed, the Athalassa Reservoir (3), is a small lake of only 23 ha in extent. It does not attract the larger species of waterfowl, but is visited by some of the smaller species, such as Coot *Fulica atra*, Moorhen *Gallinula chloropus* and various Limicolae. The reservoir is surrounded by a state Forest and the site, which is situated in the vicinity of Nicosia, is deemed to be worth listing because of its potential as a small park or reserve of considerable educational and touristic value. One particular asset possessed by the reservoir is that its water is managed in such a way that it should never completely dry out during the summer months; it is in fact intended that a minimum depth of 1.5 m should be maintained.

## WETLANDS OF INTERNATIONAL IMPORTANCE

	Locality	Latitude	Longitude	Size	Wetland criteria/ Conservation status
1.	Limassol Salt Lake	34°30'N	32°57'E	9,400 ha	1a,c,e; 2a; 3a,b,c; 4a Partly protected
2.	Larnaca Salt Lakes	34°52'N	33°36'E	678 ha	1e; 3b,c Partly protected
3.	Athalassa Reservoir	35°09'N	33°21'E	23 ha	3c; 4a

## CYPRUS



## DETAILS OF LISTED AREAS

## 1. LIMASSOL SALT LAKE

**Criteria for inclusion** 1a, c, e; 3a, b, c; 4a.

**Geographical location** 34°30'N 32°57'E. The salt lake is situated on the peninsula which extends to the south-west of Limassol for a distance of approximately 14 km.

**Area** The maximum surface area covered by water in winter is 9.4 sq. km, representing about 7.85 million cubic metres of water.

**Altitude** Approximately 1.7 m below sea level.

**Water depth** About 1 m.

**Wetland type** 17.

**Ecology** The lake is a natural depression and contains water from about the beginning of December until the end of July, drying out almost completely during the rest of the summer. The lake bottom is composed of recent sand and clay between about 1.5 and 6.0 m thick. The salt lake was in fact originally a gulf of the sea but as a consequence of an along-shore drift and a slight change in sea level, a pair of spits gradually advanced seawards from the mouths of the Kouris and Garyllis Rivers towards Akrotiri Island. On eventually reaching the island, the spits formed a tombolo with an isolated patch of seawater between them which is now the lake. The coarse pebbles and sand of the tombolo probably allow light seepage of seawater into the lake, but not enough to keep the area flooded in summer. The lake is however sometimes replenished when the sea sweeps over two low sections of the enclosing bank during storms, and also by fresh water spilling over from the nearby marshy area on the north and north-west.

There are four distinct vegetation zones. First a belt of forest composed of *Eucalyptus* and *Casuarina* spp. and blue-leaved wattle *Acacia cyanophylla*, with a ground flora of aromatic inula *Inula viscosa*, the bramble *Rubus ulmifolius*, the grasses *Cynodon dactylon* and *Erianthus ravennae*, sedge *Cyperus* spp., cat's-tail *Typha latifolia*, and rushes and reeds *Scirpus holoschoenus*, *Juncus maritimus* and *Phragmites* spp., and the climber *Smilax aspera*, Liliaceae. Secondly, in the south of the area, a belt of scrub forest, consisting mainly of *Juniperus phoenicia*, *Pinus brutia* and the mastic *Pistacia lentiscus*. Thirdly, in the north and north-west, a boggy zone dotted with some tamarisk *Tamarix* sp. and ground cover of rushes, couch-grass, reeds, bramble, *Inula* and *Juncus*. Fourthly, around the actual margins of the lake, rushes *Juncus* sp., shrubby glasswort *Arthrocnemum fruticosum*, shrubby seablite *Suaeda vera* and *Tamarix*. The lake itself is devoid of any vegetation due to the high salinity of the water which ranges from 25% to the hypersaline conditions of summer when the water dries out and the salt is deposited.

The lake is of great importance to migrating and wintering waterfowl. The most numerous duck are Pintail *Anas acuta* (2,000 to 4,000, January 1972), Wigeon *A. penelope*, Mallard *A. platyrhynchos*, Teal *A. crecca* (3,000, February 1972) and Shelduck *Tadorna tadorna* (1000 February 1972). Greater Flamingo *Phoenicopterus ruber* have been recorded in numbers up to 7,500 (February 1972). White Pelicans *Pelecanus onocrotalus* are more occasional but 45 were present in November 1972. Birds of prey are a characteristic feature of the avifauna, among the most notable being Eleonora's Falcon *Falco eleonora*, which nests on the Akrotiri

cliffs, and the Mediterranean race of the Peregrine Falcon *Falco peregrinus brookei*.

**Legal status and Tenure** State ownership but the area is within the Sovereign Base area over which the U.K. retains jurisdiction. Part of it has been established as a Permanent Game Reserve.

**Management practices** Only the forest areas are under management, exercised by the Department of Forests of the Ministry of Agriculture and Natural Resources. A great number of visitors, both local and from abroad, visit the area, especially during the wet period when waterfowl abound, the flamingos attracting most of the attention. The western side of the lake has been made easily accessible by the asphalted road to Akrotiri and the military airfield. Access to the rest of the lake shore is by dirt tracks. There is some grazing of livestock in marshy areas and along the shores.

**Threats** Reclamation projects for agriculture seem unjustifiably expensive and offer little chance of success. Excessive pumping of water from the aquifer to the north of the lake for the irrigation of orchards, which at one time threatened the wetland, has now been replaced by a major irrigation project bringing water from the Yermasoyia reservoir some 20 km away. Other projects in the area include a salt-industry, for which a small area on the eastern side of the lake would be utilized, and a sewage disposal and purification plant for Limassol town. But although the installations involved might impair the scenic values of the site, they could perhaps have beneficial effects on the water regime.

**Scientific research** Work on environmental quality and on the microfauna of the wetland is being undertaken by the Department of Fisheries, but otherwise the only organized scientific research revolves round ornithological observations.

#### **Principal reference material**

Apart from references in the reports of Ornithological Societies, there are no publications on the wetland and its ecological importance. Most of the material for this description of the area derives from a Report on Wetlands and Marine Parks in Cyprus prepared for a Consultative Meeting of Experts on Mediterranean Marine Parks and Wetlands, convened by UNEP in Tunisia in 1977, which was presented by Mr Leontios I. Leontiades, Conservator of Forests.

## **2. LARNACA SALT LAKES**

**Criteria for inclusion** 1e; 3b, c.

**Geographical location** 34°52'N 33°36'N, extending from about 2 to about 7 km south of the south-eastern coastal town of Larnaca.

**Area** The wetland complex consists of four interconnected lakes of 449, 39, 166 and 24 ha in size.

**Altitude** About sea level.

**Water depth** The main lake is rarely more than a metre deep, at its deepest during the winter months; the other three are considerably shallower. All four lakes dry out in the summer, when the watertable sinks to a few cm below the surface.

**Wetland type** 17.

**Ecology** The banks of the lake are formed by outcrops of sandy and shelly limestones and siltstones of recent to Pleistocene age and, at most, about 12 m thick. Below them are calcareous and marly deposits dating back to the Pliocene. The lake bottom is covered by extensive limnic deposits of loose silt, sand and clay, in thin alternating layers of a total thickness of about 6 m. The origin of the lake has not been studied in detail, but it seems probable that in recent times it was in fact a lagoon connected to the sea and later cut off by changes in the sea level. It is generally accepted that seawater still reaches the lake through an underground flow. Fresh water is added to it by surface run-off during the rainy season, but part of this inflow has been diverted in recent years and now runs directly into the sea, by-passing the main lake.

The wetland is devoid of characteristic vegetation. Apart from small patches of recently planted forest on the north-east and south-west, it is separated from the surrounding agricultural land by a belt of ground only a few metres wide. The predominant species in the forest plantations are stone or umbrella pine *Pinus pinea*, cypress *Cupressus sempervirens*, *Casuarina* spp., *Eucalyptus* spp. and blue-leaved wattle *Acacia cyanophylla*.

The lake is an important feeding and roosting area for waterfowl in winter and during the migration periods. Although the species are very much the same as those recorded as the Limassol Salt Lake, they generally occur in rather smaller numbers. The Larnaca Salt Lakes, apart from their proximity to the town of Larnaca, are only about 50 km from the capital Nicosia and have therefore tended to get many more visitors than the Limassol Lake, especially as the mosque of Hala Sultan Tekke, commemorating the Prophet's foster-mother, is situated nearby. The main attraction of the lakes themselves is the presence of Greater Flamingos *Phoenicopterus ruber*.

**Legal status and Tenure** Government owned. The lake is a Permanent Game Reserve.

**Management practices** The collection, towards the end of each summer, of the salt deposited by the evaporating waters is under State control.

**Threats** Nothing likely to endanger the future well-being and integrity of the wetlands has been reported.

**Scientific research** Confined at present to ornithological observations, including occasional counts of waterfowl numbers.

**Principal reference material**

No specific account of this wetland and its ecological importance has been published, but reports of Ornithological Societies have for some years maintained a fairly detailed record of the birdlife. The foregoing description of the site is largely drawn from a Report on Wetlands and Marine Parks in Cyprus presented by the Conservator of Forests, Mr Leontios I. Leontiades, to a Consultative Meeting of Experts on Mediterranean Marine Parks and Wetlands, convened by UNEP in Tunisia in 1977.

# CZECHOSLOVAKIA

## SUMMARY OF WETLAND SITUATION

Situated as it is on the main European watershed, Czechoslovakia has no major natural water bodies. The larger swamps, at one time quite numerous in the flood plains on the South Bohemian plateau and of South Moravia, were being drained and transformed into agricultural fields and fish-pond complexes as early as the 13th and 14th centuries. Regulation of rivers and further drainage activities are still continuing in a number of areas. However, there are still several peatbogs of considerable interest in Bohemia and Moravia, while sites of particular value for breeding and migrating waterfowl are to be found in the fishpond complexes, what remains of the floodplains, and along the valleys of the Danube and its tributaries. The most important of these are the Doksy fishponds in Central Bohemia (5), the Třeboň basin (8) and Řežabinec fishponds (10) in southern Bohemia, and the Lednice fishponds (13) and nearby Krive Jezero state nature reserve in the remnants of the River Dyje floodplain.

In the alluvial plain of the Danube there are a number of important marshes, swamps and oxbows of limnological, botanical and ornithological interest (15). The Parizské Močiare state reserve in the valley of the river Pariz, a tributary of the Danube, has a very distinctive vegetation and avifauna comparable to that of Kis Balaton in Hungary. Another south Slovak reserve worth noting is Dedinský Ostrov, an area of 120 ha at the southern end of Zitny Ostrov island in the Danube valley.

Five or six wetlands have been under study for the purposes of possible inclusion in the Ramsar Convention schedule, if and when Czechoslovakia becomes a party to the Convention. They comprised the Velký a Malý Tisý state nature reserve in the Třeboň basin, established in 1957 and including two lakes and their surroundings, an area of 706 ha; the Lednické Rybníky state nature reserve (13), including oxbow lakes of the river Dyje and some 552 ha of fishponds and 300 ha of meadow woodland, which was created in 1953; Krive Jezero state nature reserve to which reference has already been made, also situated in the Dyje valley, covering 104 ha of the former course of the river and surrounded by meadow woodland of willow, oak and ash, which was established in 1973; the 140 ha Parizské Močiare protected area in southern Slovakia, established in 1966, also previously mentioned; and the Dedinský Ostrov protected area, established in 1963, referred to in the previous paragraph.

Plans for the creation of an international reserve which would also include a protected area along the Hungarian bank of the Danube, are also under study. The aim would be to protect the entire Danube valley in an extensive landscape park and safeguard the last remnants of meadow woodland, a feature of which are the colonies of Cormorant *Phalacrocorax carbo* and Grey Heron *Ardea cinerea* and the rare and threatened species of birds of prey, such as the White-tailed Eagle *Haliaeetus albicilla*, which still nest there.

Mention may be made of the wetlands along the river Morava (March) which marks the border with Austria over a length of about 50 km. On the Austrian side, an important protected area, the Marchauen or Marchegg Nature reserve

CZECHOSLOVAKIA

(No. 2 in the Austrian wetland list) has already been established under World Wildlife Fund auspices.

Finally, Czechoslovak waters of mainly limnological importance, the natural, true lakes, are for the most part confined to the mountains of western Bohemia and the Tatra mountains along the northern border of Slovakia. In both areas they are of glacial origin, being situated on the southern fringe of the last great glaciation. The Tatra lakes (22), in particular, have been the subject of hydrobiological studies ever since the emergence of hydrobiology as a specific discipline. They form, of course, a unit with the high mountain lakes on the Polish side of the border. From a limnological viewpoint, the special interest of other Czechoslovak wetlands centres on the large complexes of fishponds, which have often been several hundred years under human management, thus giving local biologists unusual opportunities to investigate the gradual changes that have occurred, especially in recent decades, and to lead the way in the assessment of hydrological productivity.

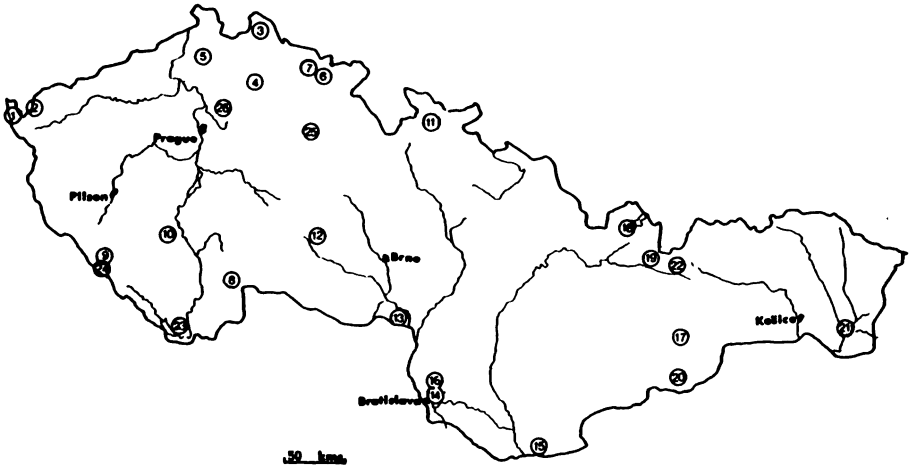
**WETLANDS OF INTERNATIONAL IMPORTANCE**

	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
<b>Western Bohemia</b>					
1.	Soos	50°05'N	12°20'E	221 ha	1d; 2a; 3a,c; 4a,b Protected
2.	Božidarská rašeliniště peatbogs	50°20'N	12°15'E	200 ha	1d,e; 2a; 3a,b,c; 4a Protected
<b>North Bohemia</b>					
3.	Velká Jizerská Louka peatbog	50°50'N	15°05'E	365 ha	1c,d,e; 2a,c; 3a; 4a,b,c Protected
<b>Central Bohemia</b>					
4.	Hrabanovská černava	50°10'N	15°05'E	35 ha	1d; 2a;3b; 4a Partly protected
5.	Doksy fishpond complex	50°40'N	14°30'E	1000 ha	1c,d,e; 2a; 3a,b,c; 4a Protected
<b>East Bohemia</b>					
6.	Upska rašelina peatbog	50°35'N	16°00'E	10 ha	1c,d; 2a; 3b,c; 4a,b,c Protected
7.	Pancička rašelina peatbog	50°40'N	15°30'E	31 ha	1a,d;2a,b; 3a; 4a,b Protected
<b>South Bohemia</b>					
8.	Třeboň basin	49°00'N	14°45'E	60,000 ha	1d,e; 2a;3a,b,c; 4a Protection planned
9.	Jezerní slat peatbog	49°15'N	13°20'E	120 ha	1d;2a,c; 3c; 4a,b Protected
10.	Rezabinec fishpond	49°20'N	14°10'E	120 ha	1a,d,e; 2a;3a,b,c; 4a Protected
<b>North Moravia</b>					
11.	Rejvízská rašeliniště bogs	50°15'N	17°10'E	220 ha	1d; 2a,b; 3c; 4a,b Protected

					CZECHOSLOVAKIA
	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
<b>South Moravia</b>					
12.	Darko peatbogs and fishponds	49°35'N	15°55'E	452 ha	1d; 2a; 3b; 4a Protected
13.	Lednické rybníky (fishponds)	48°47'N	16°45'E	613 ha	1a,c,d,e; 2a,b; 3a,b,c; 4a Protected
<b>West Slovakia</b>					
14.	Jurský Šuň	48°10'N	17°10'E	350 ha	1d; 2a; 3b,c; 4a Protected
15.	Oxbow lakes of Dunaj (Danube river)	47°45'N	18°05'E	558 ha	1d,e; 2a; 3b; 4a Protected
16.	Záhorská nížina wetlands	48°15'N	17°10'E	364 ha	1d,e; 2a,b; 3a,b,c; 4a Protected
<b>Central Slovakia</b>					
17.	Trstie peatbog	48°42'N	19°55'E	10 ha	1d; 2a,b,c; 3b; 4a Unprotected
18.	Upper Orava basin wetland complex	49°20'N	19°30'E	3,500 ha	1c,d; 2a,b; 3b,c; 4a Only 11 ha protected
19.	Jelšie and Machy wetlands	49°05'N	19°35'N	52 ha	1d; 2a; 4a Protected
20.	Dubno wetlands	48°17'N	19°50'E	15 ha	2a; 3b; 4a Protection planned
<b>East Slovakia</b>					
21.	Oxbow lakes along the lower courses of Latorica, Uz, Laborec and Bodrog rivers	48°45'N	21°55'E	49 ha	1d,e; 2a,b,c; 3a,b; 4a Partly protected
22.	Lakes of the High Tatra mountains	49°00'N	20°10'E	3 sq. km	1c,d,e; 2a,c; 3b,c; 4a,b Protected
23.	Upper course of the Vltava river	48°45'N	14°20'E	550 ha	1d,e; 2a; 3b,c;4a Partly protected
<b>(Additional sites of limnological interest)</b>					
<b>West Bohemia</b>					
24.	Černé and Čertovo Jezero	49°10'N	13°11'E	152 ha	1c,d; 2a; 3b; 4a,b The 2 lakes (18 ha and 10 ha) are included in a 152 ha Nature Reserve
<b>East Bohemia</b>					
24.	Bohdanecský rybník	50°05'N	15°40'E	176 ha	1e; 3b; 4a Partly protected
<b>Central Bohemia</b>					
26.	Oxbow lakes and backwaters of the river Lába (Elbe)	50°10'N	14°30'E	A few hectares	1e; 2a; 3a,b; 4a Status uncertain



# CZECHOSLOVAKIA



## DETAILS OF LISTED AREAS

### 1. SOOS

**Criteria for inclusion** 1d; 2a; 3a, c; 4a, b.

**Geographical location** 50°05'N 12°20'E, West Bohemia in the Cheb district, near the village of Nový Drahov and close to the Bavarian frontier.

**Area** 221 ha.

**Altitude** 430 m.

**Water depth** Maximum: 1m; average nearer to 0.50 m.

**Wetland types** 17, 21, 22.

**Ecology** The wetland is the result of a complex of natural phenomena originating from volcanic activities at the foot of the Krušné hory Mountains. Sites which have been subjected to flushes of mineralized water now support a variety of fen-like and halophytic plants as do the saline overflows with their different concentrations of sulphates and chlorides. The diatomaceous soils of the area are another noteworthy geological feature. Typical of the more halophytic vegetation are such species as strawberry clover *Trifolium fragiferum*, sea milkwort *Glaux maritima*, lesser sea spurrey *Spergularia salina* (= *marina*), mud rush *Juncus gerardi*, the dandelion *Taraxacum bessarabicum*, the viper-grass *Scorzonera parviflora* and the bulrush *Schoenoplectus* (= *Scirpus*) *tabernaemontani*. Unusual and rare species of the fens include the orchid *Orchis* (= *Dactylorhiza*) *traunsteineri* and a *Sphagnum* sp.

**Legal status** State Nature Reserve.

**Tenure** State-ownership.

**Management practices** The reserve is managed by the State Institute for the Protection of Monuments and Nature. Conducted tours are arranged for the many visitors to the area.

**Threats** None reported.

**Scientific research** No information.

**Principal reference material**

Keilhack, R. & Rudolph, K. 1929. *Die Soos bei Franzensbad in naturwissenschaftlicher und balneologischer Beziehung*. Berlin: Veröffent. Zentralstelle Balneologie. Pp. 39–76.

Brabez, R. 1941. *Zur Kenntnis der Algenflora des Franzensbader und Sooser Thermalbereiches*. B. B. Centralblatt 41/A.

Lhotská-Medlinová, M. 1952. *Vegetační poměry Soosu u Františkových Lázní*. Dissertation, Charles Univ., Praha. Unpublished ms.

## 2. BOŽIDARSKÁ RAŠELINIŠTĚ PEAT BOGS

**Criteria for inclusion** 1d, e; 2a; 3a, b, c. 4a.

**Geographical location** 50°20'N 12°15'E, West Bohemia, Karlovy Vary district; situated in the Krušné hory Mountains along the border with the G.D.R., near the village of Boží Dar.

**Area** About 200 ha.

**Altitude** 970–1035 m.

**Water depth** Maximum 5.90 m; average between 2 and 4 m.

**Wetland types** 21, 22.

**Ecology** About 90 percent of the wetland is natural, although there was a certain amount of peat digging in the 19th century but none of it in the central area. The peatbog complex consists of six independent sections, several of which have been separated artificially. The land between these bog areas consists partly of wet meadows and partly of pine-wood mires. The bogs themselves are covered with the pine *Pinus rotundata*, cotton grass *Eriophorum vaginatum*, crowberry *Empetrum nigrum*, blueberry *Vaccinium* sp. and cranberry *Oxycoccus* (= *Vaccinium*) *quadripetalus*. The surface of the raised bogs still has remnants of hummock communities (species of *Sphagnum* moss), the communities of the drainage lines being dominated by mud sedge *Carex limosa* interspersed with marsh arrow-grass *Scheuchzeria* (= *Triglochin*) *palustris*. Areas which have been exploited for peat are densely covered with birch *Betula nana*. Rarer species include *Ledum palustre*, the birch *Betula tortuosa*, the sedge *Carex brunnescens* and the mosses *Sphagnum balticum*, *Cephaloziella elachista* and *Paludella squarrosa* (for which this is the only known locality in the Krušné hory Mountains).

**Legal status** State Nature Reserve,

**Tenure** State-ownership.

**Management practices** None.

**Threats** None reported.

CZECHOSLOVAKIA

**Scientific research** No systematic research or teamwork has yet been undertaken on this site.

**Principal reference material**

Kästner M. & Flössner, W. 1933. *Die Pflanzengesellschaften der erzgebirgischen Moore*. Dresden.

Váňa, J. 1967. Mechorosty rašeliništ v oblasti Boží dar -Horní Blatná – Pernink v Krušných horách (Bryophyten der Moore im Gebiet von Boží Dar – Horní Blatná-Pernink/Erzgebirg) *Preslia*, Praha, 39: 97–105.

**3. VELKÁ JIZERSKÁ LOUKA PEAT BOG**

**Criteria for inclusion** 1c, d, e; 2a, c; 3a; 4a, b, c.

**Geographical location** 50°50'N 15°05'E, North Bohemia, Jablonec nad Nisou district, central plateau of the Jizerské hory Mountains on the Czechoslovak/Polish border, 12 km north of Tanwald.

**Area** The total area of the wetland, which extends both sides of the border, is about 550 ha, of which two-thirds is on Czechoslovak territory and is in an entirely natural state with about 117 ha of registered peatbog. The Polish sector was deforested a century ago.

**Altitude** 820–835 m.

**Water depth** Maximum: between 2.5 and 3 m.

**Wetland types** 21, 22.

**Ecology** A complex of at least 6 large peatbogs with fragments of parkland taiga still present even where the substrate is highly mineralized. The area is surrounded by waterlogged spruce forests interspersed with small peatbogs. The main plant communities fall into three classes, Oxycocco-Sphagnetum, Scheuchzerio-Caricetum fuscae and Vaccinio-Piceetum (Sphagno-Pinetum) but there are also patches of pondweed *Potamogeton alpinus*, preserved meadows of mat-grass *Nardus* sp. and the woodrush *Luzula sudetica*, fragments of a cloudberry *Rubus chamaemorus* and mountain pine *Pinus mugo* association, and subarctic relicts such as dwarf birch *Betula nana*, the sedge *Carex chordorrhiza*, Siberian juniper *Juniperus sibirica* (the largest continuous stand in Czechoslovakia) and *Betula pubescens* aff. subsp. *tortuosa*.

**Legal status** State Nature Reserve.

**Tenure** State ownership.

**Management practices** None.

**Threats** None reported.

**Scientific research** The flora of the Jizerské hory Mountains has been studied by a team of botanists.

**Principal reference material**

Brieger, F. 1923. Beiträge zur Flora des Isergebirges. *Oest. bot. Zschft.* 77: 354–356.

Brieger, F. 1923. Die Vegetation des Isergebirges. *Oest. bot. Zschft.* 77: 394–420.

Puchmajerova, M. 1936. Rašeliny Jizerských hor. *Arch. přír. Výzk Čech.*, Praha, 19(3): 1–44.

#### 4. HRABANOVSKÁ ČERNAVA

**Criteria for inclusion** 1d; 2a; 3b; 4a.

**Geographical location** 50°10'N 15°05'E, Central Bohemia, Nymburk district, about 40 km east of Praha.

**Area** 35 ha.

**Altitude** 185 m.

**Water depth** Maximum: 2m; average between 0.2 and 0.5 m.

**Wetland type** 21.

**Ecology** About 70% of the wetland is natural. Its vegetation is typical of a limestone substratum, the principal plant communities being Schoenetum nigricantis bohemicum, dominated by bog-rush *Schoenus nigricans* and *S. ferrugineus*; Juncetum subnoduosi with stands of cut-sedge *Cladium mariscus*, the smallreed *Calamagrostis neglecta*, tufted sedge *Carex elata*, purple moor-grass *Molinia caerulea* and recently increasing areas of reed *Phragmites communis*. The area is also of interest because of its many species of terrestrial orchids and, not least, from the entomological point of view.

**Legal status** A State Nature Reserve gives total protection except for 7 ha.

**Tenure** State ownership.

**Management practices** The management aim is the preservation of the exceptionally interesting ecosystems and species of the reserve, which is not open to the public. Access is strictly limited to the wardens and research workers. Regular mowing was practised until 1950, and its resumption has been recommended.

**Threats** The wetland is chiefly threatened by excessive fertilization of surrounding fields, and by drainage.

**Scientific research** The biology of the area has been studied by a number of institutes of the Czechoslovak Academy of Sciences and Charles University as well as the State Nature Conservancy. An investigation into the peculiar fluctuations of the water-table has been proposed.

#### **Principal reference material**

Husáková, J., Kneifl, V., Pecina, P., Pivničková, M. & Šebek, S. 1973. Poznámky ke společenstvem historii a ochraně státní přírodní rezervace 'Hrabanovská černava' u Lysé nad Labem. *Ochr. Přír.*, Praha, 6: 126–132.

#### 5. DOKSY FISHPOND COMPLEX 'Novozámecký rybník, Jestřebské blato, Břehynský rybník, Pustý rybník, Velký Dokesský rybník).

**Criteria for inclusion** 1c, d, e; 2a; 3a, b, c; 4a.

**Geographical location** 50°40'N 14°30'E, Central Bohemia, Ceska Lipa District, about 60 km almost due north of Praha.

**Area** 1000 ha.

**CZECHOSLOVAKIA****Altitude** 252–280 m.**Water depth** Maximum c. 6 m; the average is about 1.6 m.**Wetland types** 21, 22, 24.

**Ecology** About 60 percent of the wetland is in its natural state. Rare plant communities in some danger of becoming extinct, include: Myriophyllo-Nupharetum (including the Bohemian white water lily *Nymphaea candida*); Eleocharitetum acicularis; Caricetum paniculatae (including bogbean *Menyanthes trifoliata*, water violet *Hottonia palustris*, frog-bit *Hydrocharis morsus-ranae* and marsh cinquefoil *Comarum* (= *Potentilla*) *palustris*; Valeriano dioicae-Caricetum davailliana, Sphago-Caricetum lasiocarpae; Rhynchosporietum albae (including both the white and brown species of beak-sedge *Rhynchospora alba* and *fusca*); Caricetum limosae; Carici elongatae-Alnetum; Ledo-Sphagnetum; Vaccinio uliginosi-Pinetum; Juncetum filiformis (on sandy soils and including grey hair-grass *Corynephorus canescens*, sand-loving fescue *Festuca psammophila*, thrift *Armeria vulgaris*, shepherd's cress *Teesdalia nudicaulis*, and the everlasting *Helichysum arenarium*. One of the units of the wetland, Velký dokesský rybník, is a *locus classicus* of 22 species of algae. The area is also an excellent breeding site for marshland birds including the Marsh and Montagu's Harriers, *Circus aeruginosus* and *pygargus*, the Bearded Tit *Panurus biarmicus*, Red-necked Grebe *Podiceps grisegena* and the Spotted and Little Crakes *Porzana porzana* and *parva*. Altogether about 100 species of birds have been recorded as nesting.

**Legal status** A State Nature Reserve includes the Břehyňský rybník, the Novozámecký rybník and the Velký Dokesský rybník.

**Tenure** State ownership.

**Management practices** None, except in the area surrounding the Velký dokesský rybník (Máchovo jezero), which is a recreation area.

**Threats** Reeds are harvested by the local population and bogbean *Menyanthes* is picked along the margins of the Novozámecký rybník and offered for sale, but the impact of these activities has not been assessed. Eutrophication and consequent excessive growth of macrophytes are also a problem.

**Scientific research** Systematic hydrobiological investigation have been carried out in the protected research area of the 'Swamp' (Velký dokesský rybník).

**Principal reference material**

Kropáčová, A. & Holubičková, B. 1959. Studie o vegetaci luk u Jestřebí. In Studie über die Wiesenvegetation bei Jestřebí. *Věd. Pr. výzk. Úst. Meliorací ČSAV*, Praha, 1959: 165;186.

Fott, B. 1960. Zur Kenntnis der Gattung Saturnella (Chloroceales). *Nova Hedwigia* 2: 273–278.

Kropáčová, A. 1960. Studie o vegetaci luk u Jestřebí II. In Studie über die Vegetation der Wiesen bei Jestřebí II). *Věd. Pr. výzk. Úst. zeměd.-lesn. Meliorací ČSAV*, Praha, 1960: 7–35.

Marsaková-Němejcová, M. 1963. Novozámecký rybník – rezervace, o které se mluví. *Ochr. Př.*, Praha, 18: 4–6.

Neuhäusl, R. & Neuhäuslová-Novotná, Z. 1965. Rostlinná společenstva státní přír. rezervace Břehyňský rybník u Doks. In Die Pflanzengesellschaften des Na-

turschutzgebietes Brehýskyrvbník bei Doksy (Hirschberg). *Preslia*, Praha, 37: 170–199.

Popovský, J. 1968. A contribution to the knowledge of Dinoflagellates from Bohemia. *Preslia*, Praha, 40: 251–263.

Nováková, M. & Popovský, J. 1972. *Dicranochaete bohémica* sp. nova found in Czechoslovakia. *Arch. Protistenkunde*. 114: 37–45.

## 6. UPSKA RASELINA PEATBOG

**Criteria for inclusion** 1c, d; 2a; 3b, c; 4a, b, c.

**Geographical location** 5°35'N 16°00'E, East Bohemia, Trutnov district, at the eastern end of the Krkonoše Mountains, 5 km SSW of Pec pod Sněžkou. On the north the wetland is bounded by the upper slopes of Studničná hora (mountain), on the west by the valley of the Bílé Labe, on the east by the sharp edge of the Obri-dul cirque; only some 10 ha of the bog are within Czechoslovak territory, the rest in Poland.

**Area** 10 ha.

**Altitude** 1,430 m.

**Water depth** Maximum 5 m; average 1 m.

**Wetland types** 21,22.

**Ecology** A typical subalpine peatbog on a plateau above the timber line. The vegetation is dominated by three associations – the cranberry-crowberry *Oxycocco-Empetrium hermaphroditum*, a fringe of sedgey *Caricion canescentis fuscae* and a Leuco-Scheuchzerion suballiance. Among the more interesting species involved are mountain pine *Pinus mugo* subsp. *pumilio*, the bilberries *Vaccinium uliginosum*, *V. myrtillus* and *V. vitis-idaea*, cranberry *Oxycoccus microcarpus*, mud sedge *Carex limosa*, marsh andromeda *Andromeda polifolia*, deer grass *Trichoforum* (= *Scirpus*) *austriacum*, and mosses *Sphagnum dusenii*, *S. balticum*, *S. rubellum* and *S. compactum*, and the relict *Carex magellanica* and cloudberry *Rubus chamaemorus* (the presence of the latter has not recently been confirmed).

**Legal status** A Nature Reserve within the Krkonoše National Park.

**Tenure** State ownership.

**Management practices** None.

**Threats** None reported.

**Scientific research** None at present in train.

### Principal reference material

Rudolph, K., Firbas, F. & Sigmund, H. 1928. Das Koppenplanmoor im Riesengebirge. *Lotos*, Prag. 76: 173–222.

Hadač, E. & Váňa, J. 1968. Příspěvek k poznání rašelinných společenstev vysočiných Krkonoš. (A contribution to the knowledge of plant communities of peat bogs in the eastern Giant Mountains). *Opera Corc., Vrchlabí-Praha*, 5: 157–173.

## 7. PANCÍČKA RAŠELINA PEAT BOG

**Criteria for inclusion** 1a, d; 2a, b; 3a; 4a, b.

**Geographical location** 50°40'N 15°30'E, East Bohemia, Semily district, about 75 km NE of Praha. At the western end of the Krkonoše Mountains, 6 km from Harrachov, spanning the watershed or sources of the Malá Mulava and Pančava streams which give rise to the Labe River.

**area** 31 h.

**Altitude** About 1,350 m.

**Water depth** Maximum: 2.8 m; average between 0,5 and 1 m.

**Wetland types** 21, 22.

**Ecology** A typical subalpine peatbog on a plateau above the timber line. The vegetation comprises the following well-protected associations: Oxycocco-Empetrion hermaphroditum, with a Caricion canescentis fuscae fringe and a suballiance of Drepanocladion exannulati; and Rhynchosporion albae with a suballiance of Leuko-Scheuchzerion. Two relict species, the cloudberry *Rubus chamaemorus* and a moss *Sphagnum lindbergii*, are present and others of interest include mountain pine *Pinus mugo*, bilberries *Vaccinium* spp., cranberry *Oxycoccus microcarpus* and deer-grass *Trichophorum* (= *Scirpus*) *austriacum*. Among the many mosses are *Sphagnum dusenii*, *S. balticum*, *S. rubellum* and *S. compactum*.

**Legal status** A State Nature Reserve within the Krkonosě National Park.

**Tenure** State ownership.

**Management practices** None.

**Threats** None reported.

**Scientific research** None at present in train.

### Principal reference material

Hadač, E. & Váňa, J. 1967. Plant communities of mires in the western part of the Krkonoše Mountains, Czechoslovakia. *Folia geobot. phytotax.*, Praha, 2: 213–254.

## 8. TŘEBOŇ BASIN

**Criteria for inclusion** 1d, e; 2a; 3a, b, c; 4a.

**Geographical location** 49°00'N 14°45'E, South Bohemia, Jindřichův Hradec district, in the vicinity of the town of Třeboň.

**Area** 60,000 ha.

**Altitude** 400–480 m.

**Water depth** Maximum: 10 m; average: 1m (fishponds).

**Wetland types** 12, 21, 22, 24, 25.

**Ecology** Five centuries ago the natural swampland and peatbogs were transformed by a sophisticated drainage system and the creation of numerous artificial fishponds. Since then the wetland has attained its secondary biological stability

and become exceptionally rich in aquatic, swamp, peatbog and psammophilous flora and fauna. The latter include both endemic species and also species of biogeographically sparse distribution. The area is an important breeding and resting place for migratory birds of which in one area alone, referred to in the next section, at least 95 species have been found breeding, including a high proportion of waterfowl.

**Legal status** Ten Nature Reserves are expected to be created in the near future (some of them are already in being) and the entire Třeboň basin will come under landscape protection. An ornithological and floristic Nature Reserve was established in 1957 at Velký a Malý Tisý, one of the areas to the north of Třeboň.

**Management practices** Large-scale management for fish-culture, agriculture and silviculture. Most of the management practices are vital for maintaining the biotopes, practically all of which are man-made.

**Threats** Excessive drainage aimed at adding to the extent of arable land, excessive use of fertilizers in pisciculture and agriculture, over exploitation of peat, timber and sand, disturbance due to poorly planned or managed recreational facilities on the banks of the fishponds.

**Scientific research** Important hydrobiological investigations have been carried out in the Velký a Malý Tisý reserve, also some plankton sampling though limnological research has not yet been very extensive. Entomology, ornithology and botany have received considerable attention under the auspices of the National Museum, Praha, and various Institutes of the Academy of Sciences.

#### **Principal reference material**

Anon. 1973. *Ecosystem Study on a Wetland Biome in Czechoslovakia*. Třeboň: Czechoslovak IBP/PT & PP Report No. 3.

Numerous papers on the plankton fauna, Coleoptera, Heteroptera and other invertebrates and on the birdlife have been published in such journals as *Ochrana Přírody* and Institute Bulletins.

## **9. JEZERNÍ SLAT PEAT BOG**

**Criteria for inclusion** 1d; 2a, c; 3c; 4a, b.

**Geographical location** 49°15'N 13°20'E, South Bohemia, Prahatice district, just to the north of Kvilda and 15 km south of Kašperské Hory.

**Area** 120 ha.

**Altitude** 1055–1,07 m.

**Water depth** Maximum 7.6 m; average 2.5 m.

**Wetland types** 21, 22.

**Ecology** A typical high mountained raised peatbog, minimally disturbed by drainage and peat digging, and located on a watershed. The wetland is fringed by peatbog communities of the sedges *Carex nigra*, *C. stellulata*, *C. canescens*, *C. limosa* and *C. rostrata* and *Sphagnum recurvum* moss. On drier sites dwarf birch *Betula nana* is abundant. The central part of the bog is covered by a solid stand of mountain pine *Pinus mugo* subsp. *pumilio*, with undergrowth of wortleberries *Vaccinium uliginosum*, *V. myrtillus* and *V. vitis-idaea*, crowberry *Empetrum ni-*



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grum, ling *Calluna vulgaris*, etc. *Pinus m. pumilio* does not grow in moister sections of the bog, where the cover is composed of cotton-grass *Eriophorum vaginatum*, the sedge *Carex pauciflora*, cranberry *Oxycoccus quadripetalus*, bog rosemary *Andromeda polifolia*, deer-grass *Trichoforum* (= *Scirpus*) *caespitosum* subsp. *austriacum*, and various mosses *Sphagnum* spp. The adjoining pastures are notable for the presence of the brown or Hungarian gentian *Gentiana pannonica*.

**Legal status** A State Nature Reserve.

**Tenure** State ownership.

**Management practices** None.

**Threats** None reported.

**Scientific research** None in progress.

### Principal reference material

Klastersky, I. 1954. Vrchoviště. 'Jeserní slat' u Kvildy na Šumavě. *Ochr. Přír.*, Praha, 9: 14–15.

Dohnal, Z. et al. 1965. *Československá rašliniště a slatiniště*. Praha.

## 10. ŘEŽABINEC FISHPOND

**Criteria for inclusion** 1a, d, e; 2a; 3a, b, c; 4a.

**Geographical location** 49°20'N 14°10'E, South Bohemia, Písek district and to the north of that town.

**Area** 120 ha.

**Altitude** 30 m.

**Water depth** Maximum: 2 m.

**Wetland types** 18, 21, 22.

**Ecology** The area consists of several biotopes. The fishpond itself is managed. Conditions of the open water (pH 7.2 – 8.2, beta-mesosaprobic) and those of the reed-belt (*Phragmites* and *Typha*, up to 100 m in width) are essentially those of other South Bohemian fishponds, with the additional asset that the birdlife is formally protected. The protected area also includes a mildly acid littoral (pH 6.0 to 7.0) bordered by wide belts of *Magnocaricetum* and *Parvocaricetum*, particularly on the east and south. Further to the east, there is an old sand pit containing small pools of varying age, size and substrate development. The algal flora of these sections of the wetland is extremely rich.

In the SW corner of the area there is a small, transitional mire, persisting from the early Holocene. Its plant cover is mainly composed of a *Molinion coeruleae* association with a more recent, open stand of reed *Phragmites communis*. Several of the higher plant species are of interest, e.g. alpine deer-grass *Trichophorum alpinum*, white beak-sedge *Rhynchospora alba*, sundew *Drosera rotundifolia*, marsh helleborine *Epipactis palustris* and the bladderwort *Utricularia bremmi*.

**Legal status** A State Nature Reserve since 1949.

**Tenure** State ownership.

**Management practices** None, other than the land use techniques which have given rise to the situation outlined in the next section.

**Threats** Excessive fertilization with lime (since 1958) combined with a higher water level, have caused increased alkalinity affecting even the peripheral zones of the wetland. The process of eutrophication is also partly due to a breeding explosion of *Laridae* (gulls), the population of which was estimated to have reached 100,000 by 1973. One indication of this is the continuous cover of *Phragmites* reeds over large areas. Fires ignited by sparks from railway locomotives represent another serious threat. There was a particularly big fire in 1973, leading to the suppression or disappearance of several scientifically important, acidophilic higher plants and algae.

**Scientific research** The main work on higher plants was carried out between 1940 and 1948, on bryophytes between 1952 and 1954, on algae between 1941 and 1958, on the avifauna between 1972 and 1973 and on entomological aspects from 1974 onwards.

#### Principal reference material

- Hejný, S. & Moravec, J. 1948. Rybník Řežabinec u Ražic-naleziště vzácných rašelinných druhů. *Cs. bot. Listy*, Praha, 1: 25–27.
- Ježek, V. 1955. Bryophyta státní přírodní rezervace 'Řežabinec'. *Ochr. Přír.*, Praha, 10: 65–69.
- Bílý, J. 1964. Rasy státní přírodní rezervace Řežabinec u Ražic. Rozsivky (Bacillariophyceae). *Sborn. jihočes. Muz. C. Budějovice, přír. Vědy*, 4: 77–105.
- Růžička, J. 1973. Die Zieralgen des Naturschutzgebietes 'Řežabinec' (Südböhmen). *Preslia*, Praha 45: 193–241.
- Komárek, J. 1975. Blaualgen aus dem Naturschutzgebiet 'Řežabinec' bei Ražice. *Nova Hedwigia* 23(2).

## 11. REJVÍZSKÁ RAŠELINIŠTĚ BOGS

**Criteria for inclusion** 1d; 2a, b; 3c; 4a, b.

**Geographical location** 50°15'N 17°10'E, Northern Moravia, Bruntal district. The wetland is situated at the foot of the northern slopes of the Jeseníky Mountains, 6 km east of the town of Jeseník, near the village of Rejvíz and close to the border with Poland.

**Area** c. 220 ha.

**Altitude** 730–795 m.

**Water depth** Maximum 6.5 m; average between 2 and 4 m.

**Ecology** This mire complex near Rejvíz consists of two practically independent raised bogs in between which there is a belt of shallow peat with vegetation typical of transitional or meadow mires. The greater part of the raised bogs supports subcontinental pine-bog-forest dominated by *Pinus rotundata* and *silvestris*, *Ledum palustre*, the wortleberries *Vaccinium uliginosum*, *V. vitis-idaea* and *V. myrtillus*, ling *Calluna vulgaris*, cotton-grass *Eriophorum vaginatum* and bog rosemary *Andromeda polifolia*. The moss cover is composed of *Sphagnum recurvum* agg., *S. magellanicum* and other species.

Two dystrophic lakes have been preserved in the central part of the bogs. The smaller lake in the eastern bog is full of mosses *Sphagnum cuspidatum* and *recurvum* agg. and arrow-grass *Scheuchzeria* (= *Triglochin*) *palustris*; the water surface

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of the larger lake in the western bog is clear of vegetation. The raised bogs are surrounded by lags or marshy meadows where birch *Betula pubescens*, Norway spruce *Picea excelsa* (= *abies*), the sedge *Carex lasiocarpa* and moss *Sphagnum platyphyllum* are the dominant species. Transitional zones are marked by stands of the sedges *Carex fusca*, *C. rostrata* and *C. appropinquata* and mat-grass *Nardus stricta*.

The entire area of the Rejvíz mire complex is a very important breeding ground for the Black Grouse, *Lyrurus tetrix*.

**Legal status** A State Nature Reserve.

**Tenure** State ownership.

**Management practices** None, except for planting spruce along the western margin of the wetland.

**Threats** None reported.

**Scientific research** None in progress.

### Principal reference material

Fah, R. 1926. Beiträge zur Kenntnis des Moosebruches. Dissert., Breslau.

Smarda, J. 1948. Rašeliniště u Rejvízu (The peat bogs near Rejvíz). *Ochr. Přír.*, Praha, 3(1): 1–6.

## 12. DARKO PEAT BOGS AND FISHPONDS (Padrtiny, Borky, Velké Dárko, Malé Dárko)

**Criteria for inclusion** 1d; 2a; 3b; 4a.

**Geographical location** 49°35'N 15°55'E, South Moravia, the district of Zdar-nad-Sazavou and 8 km NNW of that town.

**Area** Padrtiny peat bog 145 ha; Borky peat bog 107 ha; and Velké Dárko and Malé Dárko fishponds 200 ha.

**Altitude** 610–630 m.

**Water depth** Maximum 8.6; average between 2 and 3 m.

**Wetland types** 21, 22, 24.

**Ecology** This wetland is about 50 percent natural. The vegetation is typical of the peatbogs in this region – e.g. the pine *Pinus rotundata*, cotton-grass *Eriophorum vaginatum*, the sedge *Carex pauciflora*, the cranberry *Oxycoccus quadripetalus*, bog rosemary *Andromeda polifolia*, and bog mosses *Sphagnum magellanicum*, *S. papillosum* and *S. recurvum*. That of the transitional zones includes three other sedges *Carex chordorrhiza*, *C. lasiocarpa* and *C. rostrata*, the deer-grass *Trichophorum* (= *Scirpus*) *alpinum*, and creeping willow *Salix repens* and glacial relict mosses such as *Scorpidium scorpioides*, *Meesia triquetra* and *Paludella squarrosa*.

The fishponds and drainage canals of the wetland are being colonized and infilled by oligo-mesotrophic and dystrophic communities of such species as horsetail *Equisetum fluviatile*, sedges *Carex rostrata*, *C. vesicaria*, *C. gracilis* and *C. lasiocarpa* and the moss *Sphagnum cuspidatum*. Ancient plant associations persisting in large parts of the peatbogs include *Sphagnetum magellanicum*, *Pino rotundata-Sphagnetum*, *Vaccinio uliginosi-Pinetum*, *Betuletum pubescentis* and *Caricetum fuscae-caricetosum rostratae*. Padrtiny peatbog, in particular, is a per-

fect surviving example of the natural zonation and the geomorphology of a sub-continental raised peatbog. The two fishponds provide excellent habitat for waterfowl.

**Legal status** State Nature Reserve.

**Tenure** About 85 percent of the area belongs to the State, the remaining 15 percent to an Agricultural Co-operative.

**Management practices** Grass mowing and local drainage of the meadow on the periphery of the reserve; forest exploitation outside the reserve.

**Threats** No apparently adverse trends have been reported.

**Scientific research** Research work in the past has covered the phytocoenology, mycology, ecology, palynology, geology, hydrology, hydrobiology and climatology of the area. No systematic scientific investigations are currently in progress.

**Principal reference material**

Weiser, J. 1942. *Holopedium gibberum* auf der Böhmischem-Mährischen anhöhe. *Archiv fur Hydrobiologie* 39: 334–352.

Klika, J. & Šarda, J. 1944. Rostlinně-sociologický příspěvek k poznání rašeliništ a luk na Žďársku a Novoměstsku. *Věst. Král. Čes. Společ. Nauk, Cl. Math.-Natur.*, Praha, 7: 1–60.

Neuhaüsl, R. 1972, Vegetationsverhältnisse des hydrographischen Gebietes der Moore am Teich Velké Dárko (Böhmischem-Mährische Höhe). *Folia Geobot. Phyto-tax.*, Praha, 7: 105–165.

**13. LEDNICKÉ RYBNÍKY** (fishponds Nesyt, Hlohovecký, Prostřední, Mlýnský, Zámecký and Podzámecký).

**Criteria for inclusion** 1a, c, d, e; 2a,b; 3a, b, c; 4a.

**Geographical location** 48°47'N 16°45'E, south Moravia, Břeslav district. The fishponds are situated both north and south of the little town of Lednice 10 km to the north-west of Břeslav.

**Area** Nesyt 322 ha; Hlohovecký 104 ha; Prostřední 49 ha; Mlýnský 107 ha; Zámecký 30 ha and Podzámecký 1.5 ha; total 613.5 ha.

**Altitude** 160–185 m.

**Water depth** Maximum 5 m; average between 1.5 and 2 m.

**Wetland type** 24.

**Ecology** This wetland is to a large extent man-made. The fishpond system was started at the end of the 14th century and completed at the beginning of the 15th century. Nesyt, Hlohovecký, Prostřední and Mlýnský are fed by the Mikolovský potok (stream) and its small tributaries, Zámecký and Podzámecký by an arm of the river Dyje. The ponds are fringed by reedbelts, which vary in their composition according to water level and distance from open water or dry land. The plant associations thus fall into three main groups: emergent pond bottom flora, thermophile wetland flora and relict halophile flora. The associations represented in the three groups include: duckweed *Lemnion minoris*, frog-bit *Hydrocharition morsus-ranae* and pondweed *Potamion eurosibericum*; reed *Phragmition communis* and bur-marigold *Bidention tripartiti*; and cyperus-spurrey *Cypero-Sper-*

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gularion salinae, glasswort *Thero-Salicornion*, seablite *Thero-Suaedion*, saltmarsh grass *Pucinellion limosae* and mud-rush *Juncion gerardii*.

Plankton organisms of the fishponds comprise about 240 species of green and blue-green algae, partly lacustrine and partly halophytic species, dominated by *Enteromorpha intestinalis*, and about 190 species of zooplankton.

The most important mammals of the area are the Musk Rat *Ondatra zibethica*, Ground Vole *Arvicola terrestris*, Bank Vole *Clethrionomys glareolus* and various other representatives of the Insectivores, Lagomorphs, Rodents and Carnivores. The area provides an important breeding habitat for water-dependent birds, of which some of the more notable are Black-necked Grebe *Podiceps nigricollis*, Bittern *Botaurus stellaris*, Night Heron *Nycticorax nycticorax*, Grey and Purple Herons *Ardea cinerea* and *purpurea*, Greylag Goose *Anser, anser*, Ferruginous Duck *Aythya nyroca*, Red-crested Pochard *Netta rufina*, Marsh Harrier *Circus aeruginosus*, Little Crake *Porzana parva*, Avocet *Recurvirostra avosetta*, Savi's Warbler *Locustella luscinioides* and Bearded Tit *Panurus biarmicus*; it is a moulting ground for *Anser anser* and *Aythya ferina* and an important roosting area for migrating Anatidae and Limicolae.

**Legal status** The great part of the wetland has been a State Nature Reserve since 1953.

**Tenure** State ownership.

**Management practices** Intensive fishfarming of carp *Cyprinus carpio*, tench *Tinca vulgaris*, perch *Lucioperca lucioperca* and pike *Esox lucius*, which requires periodic drainage of ponds for fish harvesting.

**Threats** Excessive use of fertilizers. Some disturbance is also caused by the various facilities for recreation. A more serious threat in the long term could be the proposal to replace water drawn from the fishponds for irrigation purposes by chemically different water pumped from the river Dyje.

**Scientific research** The biology of the ponds has been under continual investigation for many years. The Nesyt fishpond, in particular, was chosen for intensive study of primary productivity and hydrobiology under the auspices of the International Biological Programme, 1965–1973.

### Principal reference material

- Smarda, J. 1966. Lednické rybník. Brno: Státní přírodní rezervace. (In Czech).
- Hachler, E. M. 1970. Bibliography of the avifauna of the Lednice fishponds. *Čs. Ochr. Přírod.*, Bratislava, 12: 227–242.
- Květ, J. (ed.) 1973. Littoral of the Nesyt Fishpond: Ecological studies *Studie ČSAV*, Praha, 15: 1–172. (Includes a list of 179 references).

## 14. JURSKÝ ŠUR

**Criteria for inclusion** 1d; 2a; 3b, c; 4a.

**Geographical location** 48°10'N 17°10', West Slovakia, Bratislava district, and about 10 km to the north-west of the city.

**Area** 350 ha.

**Altitude** 130 m.

**Water depth** Periodically flooded to a depth of 1–2 m.

**Wetland type** 21, 22.

**Ecology** about 7 percent of the wetland is natural. One of its features is a forest mainly composed of a superb closed stand of alder *Alnus glutinosa*. Noteworthy plant species are *Chrysanthemum serotinum*, a subspecies of the nettle *Urtica dioica kioviensis*, great pond sedge *Carex riparia*, grass-leaved iris *Iris pseudacorus* and marsh bedstraw *Galium palustre*, and there are also many hygrophilous species typical of herbaceous undergrowth. The vetchling *Lathyrus pannonicus* and the blue eryngo *Eryngium planum* are features of the surrounding meadowland.

The fauna of the area includes rare fresh water Foraminifera (*Entziella barbori*), Coleoptera (*Dyschirus tristis*, *Haliplus apicalis*, *Pterostichus taxonii*, *Berosus affinis*, *Dryops gryseus*) and numerous Diptera (e.g. *Rhaphiochaeta breviseta*, *Winthemia variegata*, *Lydella stabulana*, *Acemyia acuticornia*, *Anthorea pacifica*, *Leucostoma vimmeri*, *Phoranta subcoleoptera*, *Ligeriella aristata*). Amphibian species abound. Among the birds of note are the White Stork *Ciconia ciconia*, Saker Falcon *Falco cherrug*, Penduline Tit *Remiz pendulinus* and Roller *Coracias garulus*. Approximately 70 species of birds nest in the area and another 70 species occur during migration. The Harvest Mouse *Micromys minutus* and Nathusius's Pipistrelle *Pipistrellus nathusii* are two of the mammals recorded.

**Legal status** A State Nature Reserve.

**Tenure** State ownership.

**Management practices** The future of the nature reserve depends on the success of an irrigation programme which is in progress. Underground fires in drained and dried-out peat are adversely affecting the area. Exploitation of the peat has been impeded by the fact that there is a residue of gravel after burning.

**Threats** Apart from the threats implicit in the points mentioned in the previous section, increased disturbance by tourists and campers and danger from excessive fertilization of the surrounding fields also deserve mention.

**Scientific research** Numerous studies have been made of the phytocenology and zoology. A good series of dendrometric measurements have been taken and the results are available.

#### **Principal reference material**

Berta, J. 1957. Vegetačné pomery Svatojanskeho súru. MSc. Dissert, Bratislava.

Podhradský, V. & Borovský, S. 1962. Rezervácia Sur pri Bratislave. *Ochrana Pŕír. a Pamiat.*, Bratislava, 2/append. ad. us. 2.

Petrlík, F. 1968. *Jurský Sur*. Bratislava: Ed. Vydav SAV. 114 pp.

### **15. OXBOW LAKES OF DUNAJ (Danube) RIVER (Dedinský ostrov, Istrahov, Čičov, Malý Ostrov, Velký Lel, Apali)**

**Criteria for inclusion** 1d, e; 2a; 3b; 4a.

**Geographical location** 47°45'N 18°05'E, West Slovakia, Dunajská Streda and Komárno districts. The lakes fall within the territories of six communes: Gabčíkovo, Čičov, Klúčovec, Kameničná, Zlatná na Ostrove and Komárno.

**Area** Dedinský Ostrov 120 ha; Istrahov 14.06 ha; Čičov 78.87 ha; Malý Ostrov 166.58 ha; Velký Lel 12.12 ha; Apali no information; total: over 558.21 ha.

**Altitude** Between 109 and 117 m.

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**Water depth** No information.

**Wetland types** 12, 25.

**Ecology** Most of the wetland is natural. The wide and fairly deep oxbow lakes of the Danube River are fringed by forest which draws on river water with a high CaCO<sub>3</sub> content and is enriched with silt by periodic flooding. The water is normally stagnant or slow-flowing, but all the wetlands are within the reach of fluctuations in the water level of the Danube itself.

Plant species of open waters include the water lilies *Nymphaea alba*, *Nymphoides peltata* and *Nuphar lutea*, water chestnut *Trapa natans*, the water crowfoots *Batrachium* (= *Ranunculus*) *aquatile* and *fluitans*, and *Salvinia natans*. The communities of the wetland margins consist mainly of reeds *Phragmites communis*, cat's-tail *Typha latifolia*, pondweed *Potamogeton* species, and the sedges *Carex elongata*, *C. riparia* and *C. appropinquata*. The fringing forest is largely composed of white willow *Salix alba*, white poplar *Populus alba*, a subspecies of narrow-leaved ash *Fraxinus angustifolia pannonica*, black poplar *Populus nigra*, fluttering elm *Ulmus effusa* (= *laevis*), pedunculate oak *Quercus robur*, bird-cherry *Prunus padus* and wild vine *Vitis vinifera silvestris*.

The area is generally rich in a wide variety of game animals. It is an important nesting place for aquatic birds including Cormorant *Phalacrocorax carbo*, Purple Heron *Ardea purpurea*, Great White Egret *Egretta alba*, Pochard *Aythya nyroca* and Bearded Tit *Panurus biarmicus*. There are still some Great Bustard *Otis tarda* in the vicinity. Reptiles include the Grass Snake *Natrix natrix* and Sand Lizard *Lacerta gilii*.

**Legal status** A State Nature Reserve.

**Tenure** State ownership.

**Management practices** The forest communities are among the most productive in Czechoslovakia. *Phragmites communis* is harvested in several sites. Sport fishing and hunting are strictly controlled.

**Threats** An area frequented by tourists, mainly for water sports and recreation, is situated in the vicinity. The wetlands are also subject to the effects of chemically polluted water extracted from the Danube for irrigation purposes. Pollution which may be aggravated by the planned enlargement of the chemical industry, is expected in the near future to make the river water unsuitable even for agricultural crops.

**Scientific research** Numerous papers have been published on the comprehensive studies which have been undertaken in this area. Hydrobiological productivity has been investigated in detail; permanent experimental plots have been established for studying forest communities, and there is a wealth of articles and monographs on the fauna and its protection, with special reference to birds.

**Principal reference material**

Jurk, A. 1958. *Pődneekologické pomery a lesné spoločenstvá Podunajskej nížiny*. Bratislava.

Štolmann, A. 1962. Čičovské mrtve rameno Dunaja. *Sborn. Pr. a Ochr. Přír. v. západoslov. Kr.*, Bratislava, 698, 730, 744, 794, 814, 890, 916.

Šuchová, H. 1974. Pří, H. 1974. Príspevok k vegetácii čii čičovského mrtvého ramena (jazero Lyon). *Bot. Práce*, Bratislava.

**16. ZÁHORSKA NÍŽINA WETLANDS** (Abród, Zelienska, Cervený rybník, Starý rybník, Bezedné).

**Criteria for inclusion** 1d, e; 2a, b; 3a, b, c; 4a.

**Geographical location** 48°15'N 17°10'E, West Slovakia, Senica district, about 60 km NNE of Bratislava.

**Area** Abród 92.37 ha; Zelienska 85.52 ha; Cervený rybník 118.91 ha; Starý rybník 3.46 ha; and Bezedné 33.46 ha; total 363.72 ha.

**Altitude** 150–230 m.

**Water depth** Maximum 4 m; average between 1 and 2 m.

**Wetland types** 21, 24, 25.

**Ecology** About 90 percent of this wetland which lies in an extension of the Vienna Basin, is natural. The surface vegetation of its cool waters which are fed by underground springs, consists mainly of water chestnut *Trapa natans* and pondweed *Potamogeton* and starwort *Callitriche* species. They are bordered by stands of sedges such as *Carex elongata*, a striking swamp woodland of alder *Alnus glutinosa* and birches *Betula pendula* and *pubescens* and the fern *Dryopteris thelypteris*. The fen meadows support several interesting species, such as purple moor-grass *Molinia coerulea*, the sedges *Carex appropinquata* and *pseudocyperus*, *Iris sibirica*, milk parsley *Peucedanum palustre* and bogbean *Menyanthes trifolia*. The vegetation of the Bezedné site includes the horsetail *Equisetum maximum*, bog violet *Viola palustris*, sundew *Drosera rotundifolia*, sweet flag *Acorus calamus*, the birch *Betula erecta*, chaffweed *Centunculus* (= *Anagallis*) *minimus*, all-seed *Radiola linoides*, marsh clubmoss *Lycopodium inundatum*, and the postglacial relicts bistort *Polygonum bistorta*, alpine deer-grass *Trichophorum* (= *Scirpus*) *alpinum* and bog arum *Calla palustris*. Other plants of this locality are pennywort *Hydrocotyle vulgaris*, yellow-wort *Blackstonia perfoliata* ssp. *acuminata*, marsh gladiolus *Gladiolus palustris*, marsh cinquefoil *Comarum* (= *Potentilla*) *palustris* and white beak-sedge *Rhynchospora alba*.

The avifauna consists of various wetland species such as Little Bittern *Ixobrychus minutus*, Greylag Goose *Anser anser*, Garganey *Anas querquedula*, Marsh Harrier *Circus aeruginosus*, Water Rail *Rallus aquaticus*, Common Snipe *Gallinago gallinago*, Savi's Warbler *Locustella luscinioides* and Reed Bunting *Emberiza schoeniclus*.

**Legal status** A botanical and zoological State Nature Reserve.

**Tenure** State ownership.

**Management practices** Some forestry activities, mowing and sport fishing.

**Threats** The Abród area is in danger of being drained. The wetland as a whole is threatened by increased recreation activities (tourists, campers, building of week-end bungalows, swimming pools, etc.).

**Scientific research** Detailed information is available on the fauna, flora, phytocenology and ecology. The vegetation (forests, meadows and synanthropic vegetation) has been mapped. Comprehensive conservation plans have been published.

**Principal reference material**

Klika, J. 1958. K fytoocenologii rašelinných a slatinných společenstev na Zahorské



Krippel, E. 1959. Kvetena a rastlinné spoločenstvá Bezedného pri Plaveckom Štvrtku. *Biol. Práce SAV* 5(12): 37–66.

## 17. TRSTIE PEAT BOG

**Criteria for inclusion** 1d; 2a, b, c; 3b; 4a.

**Geographical location** 48°42'N 19°55'E, Central Slovakia, Rimavská Sobota district, south-east of the town of Tisovec beneath the summit of Trstie Mountain in the Slovenské rudohorie range.

**Area** 10 ha.

**Altitude** 1,100–1,113 m.

**Water depth** Unknown.

**Wetland types** 21, 22.

**Ecology** One of the highest peatbogs of the western Carpathian Mountains, with an extremely varied flora. The tree cover consists of spruce *Picea abies*, Scots pine *Pinus silvestris*, birch *Betula pendula* and the willows *Salix cinerea*, *S. silesiaca* and *S. caprea*. There is an abundance of plant species including ling *Calluna vulgaris*, wortleberries *Vaccinium vitis-idaea* and *V. myrtillus*, sundew *Drosera rotundifolia*, wood rush *Luzula albida*, bog violet *Viola palustris*, cotton grass *Eriophorum vaginatum*, the grounsel *Senecio rivularis*, various mosses *Sphagnum* spp., bistort *Polygonum bistorta*, bog orchid *Orchis palustris*, water forget-me-not *Myosotis palustris* (= *Scorpioides*) and chickweed wintergreen *Trientalis europea*.

**Legal status** Protection of the area has been recommended.

**Tenure** State ownership.

**Management practices** Some spraying of forested areas.

**Threats** The chemicals used in spraying are a potential hazard. The bog is situated close to a chalet frequented by hikers, but disturbance has hitherto been slight, apart from berry-picking both by visitors and the local population.

**Scientific research** A comprehensive account of the flora has been published. An appreciable herbarium collection has been made by V. Vraný. Faunistic investigations are planned.

### Principal reference material

The review of the Trstie peatbog flora was published in the Proceedings of the meeting of the Slovak Botanical Society held in Bratislava in 1970.

## 18. UPPER ORAVA BASIN WETLAND COMPLEX (including Benadovský mlyn, Jedlova, V Oraviciach, Klin and Vydrovka bogs and fens, and Orava reservoir).

**Criteria for inclusion** 1c, d; 2a, b; 3b, c; 4a.

**Geographical location** 49°20'N 19°30'E, Central Slovakia, Dolný Kubín district, close to the Polish border. This wetland complex comprises the upper basins of the rivers Orava and Oravica, upstream of the town of Tvrdosín. It includes a

mixture of fens, transitional mires, raised bogs, montane and submontane rivers and streams, and the Orava Reservoir. The eight constituent parts and their location are as follows:

- a) Fens and transitional mires, c. 1 km NE of Lokca village.
- b) Fen and transitional mire at Beňadovský mlyn, c. 1 km SW of Beňadovo in the Mutňanka valley.
- c) Transitional mires and fens at Jedlová, c. 5 km NE of Trstená, on the left bank of Zimník stream.
- d) V Oraviciach fen and transitional mire, c. 1 km SW of the mountain hotel and village of Little Oravica.
- e) Klin raised bog, 3 km SE of Námestovo.
- f) Vydrovka raised bog, 3 km NW of the upper end of Oravská Polhora village.
- g) Rivers and streams of the upper Orava basin.
- h) Orava reservoir.

**Area** (a) 4.5 ha; (b) 8 ha; (c) 3 ha; (d) 2.5 ha; (e) 11 ha; (f) 5 ha; (g) no estimate available; (h) 3,500 ha; total: over 3,534 ha.

**Altitude** (a) c. 620 m; (b) 720 m; (c) 670 m; (d) 825 m; (e) 625 m; (f) 740 m; (h) 600 m.

**Water depth** (a) max. not more than 2 m; min. no information; (b) max. 4 m; min. 2–2.5 m; (c) max. 2 m; min. 0.6–1 m; (d) no information; (e) max. 4.6 m; min. 2 m; (f) no information; (h) max. 15 m.

**Wetland types** 13, 21, 22, 24.

**Ecology** The vegetation of fens and transitional mires (a) – (d) is typically West Carpathian, with many relicts or phytogeographically interesting species and as yet little disturbance from human activities. Characteristic plant associations are of Sphagno-Tomenthypnion and Caricion davallianae fuscae. Species of note include the sedges *Carex chodorhiza*, *C. lasiocarpa*, *C. limosa* and *C. appropinquata*, cotton grass *Eriophorum gracile*, great spearwort *Ranunculus lingua*, marsh helleborine *Epipactis palustris*, horsetail *Equisetum variegatum* and, among the mosses *Cinclidium stygium* (only Czechoslovak locality), *Meesia triquetra*, *Paludella squarrosa*, *Helodium blandowii*, *Calliergon trifarium* and *Scorpidium scorpioides*.

The raised bogs (e) and (f) in the Orava area linked up with the Polish peatbog complex of Dolina Nowotarska. The dominant plants are cotton grass *Eriophorum vaginatum* and moss *Sphagnum apiculatum*; other noteworthy species include the wortleberries *Vaccinium uliginosum*, *V. myrtilus* and *V. vitis-idaea*, cranberry *Oxycoccus pratensis*, ling *Calluna vulgaris*, bog rosemary *Andromeda polifolia*, *Ledum palustre* and two more moss species (depending on the level of the water table) *Sphagnum magellanicum* and *S. nemoreum*. The raised bog at Vydrovka supports a considerable stand of *Pinus rotundata* and all the raised bogs feature species of oceanic and suboceanic distribution such as heath rush *Juncus squarrosus* and *Sphagnum papillosum* and *S. imbricatum* mosses.

It is worth mentioning here that Rudné bog, near Suchá hora, where peat exploitation took place in the 1960s, used to be the most important bog of the Orava area and probably in Czechoslovakia, and was noted for such species as white beak-sedge *Rynchospora alba*, marsh arrow grass *Scheuchzeria* (= *Triglochin*) *palustris*, great sundew *Drosera anglica* and *Sphagnum dusenii*. It therefore seems highly desirable that the still untouched section of the bog, which is on Polish territory and is now threatened by private peat-cutting for fuel, should be properly protected.

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The section (g) of the wetland, comprising clear catharobic trout waters still in fact extends throughout the Orava basin and is one of the few localities in Czechoslovakia with large, natural running-water ecotopes; but unless the whole basin of the Čierna and Biela Orava and Oravica rivers can be effectively safeguarded, pollution may be unavoidable. The Orava reservoir (b), one of the largest fresh water bodies in Central Europe, at the moment has a minimum of contamination. In general, its water is oligotrophic and the aquatic and swamp vegetation has not yet become fully stabilized since the reservoir filled in 1953. Pondweed *Potamogeton* dominated plant associations can be expected to colonize the shallower water and improve the habitat for the many resting or wintering birds which already use it. The reservoir has also recently become a breeding site for the White-tailed Eagle *Haliaeetus albicilla*.

**Legal status** The wetland has no legal protection, except for section (e), the Klin raised bog, which has been made into a State Nature Reserve.

**Tenure** Sections (e), (f), (g) and (h) are State-owned; sections (a), (b), (c) and (d) are privately owned.

**Management practices** Sections (a) – (d) periodical hay cutting; section (e) not managed; section (f) occasional timber cutting; and sections (f) – (h) set aside for recreational use, including sport-fishing and watersports.

**Threats** Sections (a)– (f) are threatened by drainage and peat-cutting, section (h) by contamination of the water by motor-boats and noise. It has been recommended that the north-eastern end of the reservoir should be closed to the public.

**Scientific research** Studies of the vegetation and phytogeography are in progress. No comprehensive research projects have yet been completed, but a few specific studies have been undertaken and the results published.

### Principal reference material

Jurko, A. & Peciar, J. 1959. Zpráva o vyskume rašeliniska pri Suchej Hore na Orave. (Bericht über die Erforschung des Torfmoores bei Suchá Hora in Orava). – *Acta Fac. Rer. Natur. niv. Comen., Bratislava – Botanica* 3(10–12): 469–508.

Rybniček, K. & Rybničková, E. 1965. Přechnodové rašelinistiě u Beňadova na Oravě. *Biologia*, Bratislava, 20: 373–375.

## 19. JELŠIE AND MACHY WETLANDS (Liptovska kotlina basin)

**Criteria for inclusion** 1d; 2a; 4a.

**Geographical location** 49°05'N 19°35'E, Central Slovakia, Liptovský Mikuláš district. The Jelšie site falls within the territory of the village of Demänova-Bodice and the Machy site that of the Liptovská Kokava commune.

**Area** Jelšie 25.59. ha; Machy 26.61 ha; total: 52.2 ha.

**Altitude** Jelšie: 690 m; Machy: 890–984 m.

**Water depth** No information.

**Wetland types** 21, 22.

**Ecology** About 90 percent of the two wetlands are natural. Jelšie lies on a substratum of alluvium from the Demänovka River and comprises a continuous, closed alder *Alnus glutinosa* swamp on a peat base, with islets of grass-covered fen. The herbaceous vegetation is composed of such species as the marsh marigold

*Caltha laeta*, meadow-sweet *Filipendula ulmari*, a hairy chervil *Chaerophyllum hirsutum*, tufted hair-grass *Deschampsia cespitosa*, the ferns *Dryopteris spinulosa*, *D. thelypteris* and *D. polypodioides*, marsh helleborine *Epipactis palustris*, bog bean *Menyanthes trifoliata*, dwarf viper-grass *Scorzonera humilis* and marsh gentian *Gentiana pneumonanthe*.

Machy has a sparse natural forest growing on its peat, mainly composed of spruce *Picea abies* and Scots pine *Pinus silvestris*. The ground cover includes bog wortleberry *Vaccinium uliginosum*, bilberry *V. myrtillus* and cowberry *V. vitis-idaea*, the crowberry *Oxycoccus quadripetalus*, cotton-grass *Eriophorum vaginatum* and several mosses of the genus *Sphagnum*.

**Legal status** A State Nature Reserve.

**Tenure** State ownership.

**Management practices** None reported.

**Threats** Cattle grazing.

**Scientific research** Some basic study has been made of the flora and phytocenology. Detailed ecological studies are now in progress.

**Principal reference material**

None quoted.

## 20. DUBNO WETLANDS (Dubninske močiare)

**Criteria for inclusion** 2a; 3b; 4a.

**Geographical location** 48°17'N 19°50'E, Central Slovakia, Rimavská Sobota district. The wetland is near the village of Dubno, in the Filakovo highlands, and not far from the Hungarian border.

**Area** About 15 ha.

**Altitude** 285–310 m.

**Water depth** The depth of the ground water varies between 1 and 4 m.

**Wetland type** 21.

**Ecology** Most of the area is natural. The vegetation of the wettest part is composed of reeds *Phragmites communis*, cat's-tail *Typha latifolia* and horsetail *Equisetum maximum*. This is bordered by stands of tall sedges with *Carex gracilis* dominant, grassland with *Festuca pratensis* dominant and small patches of carr formed by groups of the willows *Salix cinerea* and *S. fragilis*. The swamp is a nesting ground for various species of bitterns Botaurinae, rails Rallidae and warblers Sylviinae.

**Legal status** Proposals have been submitted for protection of the area and for the establishment of a nature reserve.

**Tenure** State ownership.

**Management practices** Harvesting of *Phragmites communis* and *Typha latifolia*.

**Threats** The future of the site could be adversely affected by the close vicinity of the village of Dubno, excessive fertilization of the surrounding fields and pollution of water flowing into the swamp.

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**Scientific research** Results of a preliminary survey, preceding the declaration of the nature reserve, are available. A complex biocoenological investigation of the entire area is being planned.

**Principal reference material**

None quoted.

**21. OXBOW LAKES ALONG THE LOWER COURSES OF LATORICA, UZ, LABOREC & BODROG RIVERS**

**Criteria for inclusion** 1d, e; 2a, b, c; 3a, b; 4a.

**Geographical location** 48°45'N 21°55'E, East Slovakia, Trebišov and Michalovce districts. In the extreme east of the country at the foot of the Carpathian mountain range.

**Area** Divided into five distinct sections: (a) remnants of the Tica oxbow – 15 ha; (b) Zelené jazero 5 ha; (c) Ortov Oxbow near Pavlovice 3.5 ha; (d) Starý Laborec 5 ha; and (e) Mrtvy Bodrog 20 ha; total 48.5 ha.

**Altitude** Between 96 and 101 m.

**Water depth** a) Maximum 1.5 m, average 0.7 m; (b) max. 1 m, av. 0.6 m; (c) max. 2.5 m, av. 1.5 m; (d) max. 1.2 m, av. 0.8 m; and (e) max. 2 m, av. 1.3 m.

**Wetland type** 12.

**Ecology** The numerous water bodies of this wetland, all at an advanced stage of silting, plant growth and progress towards dry land, are the remnants of a once vast system of oxbows, meanders and old river beds. Open water is usually found only in a small part of the area, depending on the ground water level. High water or flooding occurs in early spring. The main plant associations of the open water areas are Myriophyllo-Nupharetum, Trapetum natantis, Hydrochari-Stratiotetum and Spirodelo-Salvinietum. The surrounding reed and sedge associations tend to be Scirpo-Phragmitetum and Caricetum elatae, floating stands of which are the first step towards land formation. In the older oxbows, the reed and sedge belt is succeeded by communities of Salicetum pentandro-cinereae, in which several scarce species are to be found, such as bogbean *Menyanthes trifoliata*, marsh cinquefoil *Comarum* (= *Potentilla*) *palustre*, the moss *Sphagnum recurvum*, sundew *Drosera rotundifolia* and fen orchid *Liparis loeselii*, in addition to commoner wetland plants like milk parsley *Thysselinum* (= *Peucedanum*) *palustre*, floating sweet-grass *Glyceria aquatica*, marsh fern *Thelypteris palustris*, marsh thistle *Cirsium palustre*, purple loosestrife *Lythrum salicaria* and purple smallreed *Calamagrostis canescens*.

The variety of bird species breeding in the area is considerable and includes Bittern *Botaurus stellaris*, Purple Heron *Ardea purpurea*, Marsh Harrier *Circus aeruginosus* and Black-headed Gull *Larus ridibundus*. Among reptiles should be mentioned the Pond Tortoise *Emys orbicularis*, which is found occasionally.

**Legal status** Several sites in the area have been included in a State Nature Reserve.

**Tenure** State ownership

**Management practices** Burning, which is practised for the purpose of clearing and also to assist in the rearing of domestic waterfowl, needs to be more restricted.

**Threats** More serious than the burning is a proposal to drain some or all of the area, which should certainly be resisted. It is in fact an area that has not been affected by tourism; sport fishing is relatively unimportant and has almost ceased in recent years.

**Scientific research** Comprehensive information is available on the flora and fauna of this area. Numerous studies have been undertaken on wetland plant associations, hygrophilous meadows, inundated forests, etc. Important papers have also been published on the chemical composition of flowing waters and on the degree of pollution. Zoological research has dealt mainly with the avifauna, fishes, amphibians and mosquitoes.

**Principal reference material**

Hejny, S. 1960. *Ökologische Charakteristik der Wasser- und Sumpf-pflanzen in den slowakischen Tiefebene*n (Donau und Theissgebiet). Bratislava: Ed. Vydav-sav. 487 pp.

Berta, J. 1970. *Waldgesellschaften and Bodenverhältnisse in der Theisstiefebene. Vegetacia CSSR*, Br. Bratislava.

## 22. LAKES OF THE HIGH TATRA MOUNTAINS

**Criteria for inclusion** 1c, d; 2a; 3b; 4a, b.

**Geographical location** 49°00'N 20°10'E, East Slovakia, Poprad district, along the frontier with Poland.

**Area** Altogether the lakes cover an area of about 3 sq. km; the total volume of water is estimated at approximately 10 to 11 million cubic metres.

**Altitude**

2200–2100 m :	4 lakes
2100–2000 m :	34 lakes
2000–1900 m :	23 lakes
1900–1800 m :	15 lakes
1800–1700 m :	14 lakes
1700–1600 m :	39 lakes
1600–1500 m :	8 lakes
1500–1400 m :	2 lakes
1400–1300 m :	11 lakes
1300–1200 m :	1 lake
1200–1100 m :	3 lakes
1100–1000 m :	none
1000– 900 m :	3 lakes

**Water depth** The largest and deepest lake in the Slovakian part of the High Tatra Mountains is the Hincovo pleso (18.19 ha) which has a depth of 53.2 m.

**Wetland types** 15, 19, 20, 22.

**Ecology** The shores of the lakes are variously covered with peatbog, mountain pine *Pinus mugo* or herbaceous plants growing on rocky moraines; at higher altitudes the vegetation is either alpine or (where snow is persistent) of a tundra type. Important species of the peatbogs (apart from *Sphagnum* spp. and other mosses) include cranberry *Oxycoccus quadripetalus*, bog wortleberry *Vaccinium uliginosum*, cotton-grass *Eriophorum vaginatum*, the sedges *Carex pauciflora* and *limosa*, bog rosemary *Andromeda polifolia*, *Ledum palustre*, the willow *Salix*

*myrtilloides*, arrow grass *Scheuchzeria* (= *Triglochin*) *palustris*, moor-king *Pedicularis sseptum-carolinum*, red-rattle *P. palustris*, the rush *Juncus conglomeratus* (= *subuliflorus*), bog violet *Viola palustris*, marsh helleborine *Epipactis palustris*, sundew *Drosera rotundifolia*, marsh cinquefoil *Comarum* (= *Potentilla*) *palustre*, bogbean *Menyanthes trifoliata*, common butterwort *Pinguicula vulgaris*, bird's-eye primrose *Primula farinosa*, and a subspecies of marsh marigold *Caltha palustris laeta*. In really cold conditions one finds coral-worts *Cardamine opizii* and *C. amara*, *Heliosperma quadridentatum* (Caryophyllaceae) and scurvy-grass *Cochlearia tatrae*.

An abundance of cold-blooded animals are found in the cool, clean water, such as the Huchen *Hucho hucho*, the Brown Trout *Salmo trutta fario*, Grayling *Thymallus thymallus*, Charr *Salvelinus alpinus* and in shallow waters the Schneider *Alburnoides bipunctatus*. Other fish species include Barbel *Barbus barbus*, Goby *Gobio gobio*, Minnow *Phoxinus phoxinus*, Dace *Leuciscus leuciscus*, Chub *Leuciscus cephalus*, Ide *Leuciscus idus*, Nase *Chondrostoma nasus*, Burbot *Lota lota*, Pike *Esox lucius*, Perch *Perca fluviatilis* and Bullhead *Cottus gobio*.

A noteworthy animal of the Tatra lakes is *Brachinecta paludosa*, an arctic relict. Smaller invertebrate animals include an abundance of protozoans, particularly Rhizopoda and Helioidida, Rotifera ascarids (on the lake bottoms), 20 species of flatworms Rhabdocoela (*Opisthotum tundrae* and *Dalyellia lutheri* being of special interest), Oligochaeta (*Tubifex montanus*, *Tatriella slovenica*, *Trichodrillus tatrensis*), leeches (*Herpobdella octoculla*, the horse leech *Haemopsis sanguisuga*, *Glossiphonia complanata*) and numerous copepods and crustaceans such as *Diaptomus bacillifer*, *D. denticornis* and *D. tatricus* in dystrophic waters. The water fleas Cladocera are represented by 20 species and water mites (*Hydracahna* spp.) are abundant. *Niphargus tatrensis* is another noteworthy lake species. The Water Shrew *Neomys fodiens* and the Dipper *Cinclus cinclus* and Kingfisher *Alcedo atthis* are the most typical mammal and bird species of the lake shores. In addition to those already mentioned, the endemic species of the area include *Deltomerus tatricus*, *Tetrasoma carpaticum* and *Nebria tatrica*.

**Legal status** The area has its own legal status as a National Park (TANAP).

**Tenure** State ownership.

**Management practices** The lakes are used as reservoirs for the storage of surplus water which can be released into the rivers during droughts.

**Threats** Several lakes are used for recreational purposes (notably Strbske Pleso and Popradske Pleso), to the detriment of the lakeshore flora.

**Scientific research** Numerous papers have been published on the organic and inorganic natural resources of the High Tatra. The original studies of the flora and hydrobiology of the region were launched on the Polish side of the border as long ago as 1882.

**Principal reference material**

The National Park organization (TANAP) periodically publishes descriptive scientific papers. The Project AQUA volume, IBP Handbook No. 21 of 1971, (compilers H. Luther and J. Rzóška), lists a dozen of the more important papers on the limnology of the area.

### 23. UPPER COURSE OF THE VLTAVA RIVER (including Mrtvy luh and Velka niva)

**Criteria for inclusion** 1d, e; 2a; 3b, c; 4a.

**Geographical location** 48°45'N 14°20'E, South Bohemia, Prachatice and Cesky Krumlov district. The section of the river and its adjoining protected areas are just to the south of the latter town.

**Area** Composed of two main sites, Mrtvy luh: 400 ha; and Velka niva; 150 ha; plus about 30 km of the course of the Vltava river.

**Altitude** Mrtvy luh: 732–741 m; Velka niva 750 m.

**Water depth** Maximum 7.2 m; average 2.5 m.

**Wetland types** 13, 21, 22.

**Ecology** The vegetation of the peatbog section of the wetland consists mainly of *Pinus rotundata* (in shrub and tree form) and such typical raised bog species as cotton-grass *Eriophorum vaginatum*, bog wortleberry *Vaccinium uliginosum*, cranberry *Oxycoccus quadripetalus*, bog rosemary *Andromeda polifolia*, sundew *Drosera rotundifolia*, at least four species of *Sphagnum* moss – *S. magellanicum*, *S. recurvum*, *S. fuscum* and *S. cuspidatum*-, and the hair-moss *Polytrichum strictum*. The plant communities of flowing water are represented by water-milfoil *Myriophyllum alterniflorum*, the starwort *Callitriche hamulata*, water crowfoot *Batrachium* (= *Ranunculus*) *aquatile* s.l., the bur-reed *Sparganium simplex* (= *emersum*) and willow-moss *Fontinalis squamosa*. The bank communities include the sedge *Carex buikii*, grey alder *Alnus incana*, the monkshood *Aconitum calybotrion*, Jacob's ladder *Polemonium caeruleum* and willow-spiraea *Spiraea salicifolia*. The peatbog also has a fringe of natural, waterlogged spruce *Picea abies*.

**Legal status** A State Nature Reserve (Mrtvý luh); and the protected area of the Šumava.

**Tenure** State ownership.

**Management practices** None.

**Threats** None reported.

**Scientific research** None in progress but see next section.

#### Principal reference material

Holubickova, B. 1960. Studie o vegetaci blat (Mrtvý luh). *Sborn. vys. Sk. zemed.* 1960: 129–149.

Moravec, J. 1973. Příspěvek k rozšíření stolítku střídavokvětého *Myriophyllum alterniflorum* DC. – v. jižních Čechách. – *Zpr. cs. bot. Spleč.*, Praha, 8: 16–19.

### 24. CERNÉ AND CERTOVO JEZERO

**Criteria for inclusion** 1c, d; 2a; 3b; 4a, b.

**Geographical location** 49°10'N 13°11'E, West Bohemia, Klatovy district.

**Area** Cerné lake: 18 ha; Certovo lake: 10 ha.

**Altitude** Cerné: 1008 m; Certovo: 1030 m.

**Water depth** Cerné, maximum 40.5 m; mean 16.5 m. Certovo, maximum 37 m.



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**Wetland types** 15, 19, 20, 22.

**Ecology** Extremely oligotrophic lakes (i.e. very low in nutrients) of glacial origin, within a protected area of virgin forest. Its characteristic fauna includes a soft-water crustacean, the water-flea *Holopedium gibberum*, and an introduced salmonid fish of the charr genus *Salvelinus*.

**Legal status** Included in a 152 ha Nature Reserve since 1933.

**Tenure** State ownership.

**Management practices** None.

**Threats** None noted.

**Scientific research** Hydrobiological investigations in Czechoslovakia were initiated at this site and have continued since 1897, providing a unique record of changes.

### Principal reference material

Many papers have been published on the hydrobiological investigations of these lakes, most in Czech only, and twelve titles are listed in Luther, H. & Ržóska, J. 1971. *Project Aqua*, a source book of inland waters proposed for conservation. IBP Handbook No. 21 and IUCN occasional paper No. 2. Blackwell Scientific Publications, Oxford and Edinburgh.

## 25. BOHDANECKÝ RYBNÍK

**Criteria for inclusion** 1e; 3b; 4a.

**Geographical location** 50°05'N 15°40'E, East Bohemia, Pardubice district.

**Area** 176 ha.

**Altitude** 215 m.

**Water depth** Not quoted but known to be shallow.

**Wetland type** 5.

**Ecology** A man-made fishpond about 100 years old. The water conditions in the pond are eutrophic.

**Legal status** Included in a 250 ha Nature Reserve established in 1951.

**Tenure** State ownership.

**Management practices** Use for fisheries implies fertilization of waters and periodic draining for fish harvesting.

**Threats** Increasing eutrophication.

**Scientific research** A Biological and Fishery Station, founded in 1941, undertakes investigations of the lake.

### Principal reference material

Sramek-Husek, R. 1942. Survey of the activity of the Biological and Fishery Station at Bohdanec, near Pardubice. *Věda Přírodní* 21: 159–160 (in Czech).

## 26. OXBOW LAKES AND BACKWATERS OF THE RIVER LABA (Elbe)

**Criteria for inclusion** 1e; 2a; 3a, b; 4a.

**Geographical location** 50°10'N 14°49'E, between Celacovice and Přerov, 30 km NE of Prague, on the River Laba (Elbe).

**Area** A number of different water bodies of varying sizes from 0.2 ha to smaller.

**Altitude** Between 100 and 200 m.

**Water depth** Varies from 0.5 to 5.4 m.

**Wetland type** 12.

**Ecology** An area with a number of oxbow lakes and other water bodies now cut off from the Laba River and subject to periodic flooding. These present a great variety of wetland habitats, each having different ecological conditions.

**Legal status** No information.

**Tenure** No information.

**Management practices** Apparently none.

**Scientific research** One of the most intensively studied wetland areas in Czechoslovakia. Subjects covered extend from the characteristic fauna of temporary pools to productivity studies, the latter often rating as of international significance.

**Principal reference material**

Blazka, P. 1958. The anaerobic metabolism of fish. *Physiol. Zool.* 21: 117–128.

Hrbaček, J. 1962. Species composition and the amount of zooplankton in relation to fish stock. *Rozpravy CSA, MPV* 72: 1–116.

Straškraba, M., Kořinková, J. & Postolníková, M. 1967. Productivity of littoral region. *Rozpravy CSA, MPV*, 77: 3–80.

# DENMARK

## SUMMARY OF WETLAND SITUATION

Thanks to a long and mostly flat coastline, with its numerous fjordlike inlets and archipelagos, Denmark has a large number of wetlands of international importance. In the south-west of the country it shares the biggest and one of the most important wetlands in Europe, the Waddensea (Vadehavet), with two other countries, the Federal Republic of Germany and the Netherlands. Sites with excellent habitat for breeding waterfowl are situated along the coast and in the interior of North Jutland, particularly the Limfjord area which extends right across Northern Jutland from the North Sea to the Kattegat. These sites are also of exceptional importance for wintering and migrating ducks and geese (Anatidae). Vast concentrations of diving ducks and sea-ducks are found in the shallow waters of the Kattegat, the Lillebaelt, the South Fünen Archipelago, the Storebaelt, Oresund, South Sealand, Lolland, Falster and Mön.

The wintering waterfowl populations together with the relative importance of individual wetlands, have been studied by the Viltbiologisk Station at Kalø (8410 Rønde). Detailed information on waterfowl concentrations in the various wetlands can be found in the Danish Review of Game Biology Vol. 9 no. 1 (Waterfowl Populations in Denmark 1965–1973, a survey of the non-breeding populations of Duck, Swans, and Coot and their shooting utilization by A. H. Joensen).

Conservation of the freshwater wetlands has improved since the 1969 Conservation Act was modified in 1972. It is no longer possible to reclaim fresh or saltwater wetlands without the permission of the Conservation Planning Committee nor can changes be made affecting the flow of watercourses (unless they are wholly privately owned). The Ministry of the Environment, created in 1973, deals with conservation measures, physical planning and pollution control.

A list of 41 wetlands was drawn up for the List of Wetlands of Nordic Importance, published in 1973 and covering also the lists for Iceland, Norway, Sweden and Finland. Denmark signed and ratified the Ramsar Convention on Wetlands of International Importance in 1977 and entered 26 wetlands on the Convention list as indicated by an asterisk in the checklist which follows.

The Nature Protection Council and the Natural History Museum in Aarhus have been very active in promoting public awareness of wetlands. A number of management projects for their improvement as breeding sites for waterfowl have been carried out by the Viltbiologisk Station at Kalø.

## WETLANDS OF INTERNATIONAL IMPORTANCE

### \*Nominated for inclusion in the Ramsar Convention list

	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
1.	Vadehavet	55°20'N	8°30'E	100,000 ha	1a,b,d,e; 2a; 3a,b,c; 4a Partly protected (c.13,000 ha)

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	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
*2.	Fjilsø	55°42'N	8°15'E	3,000 ha	1a,b,c; 4a Partly protected (c.600 ha)
*3.	Ringköbing Fjord	56°00'N	8°15'E	25,000 ha	1a,b,c,d,e; 2a,b; 3a,b,c; 4a Partly protected
*4.	Vest-Stadil Fjord	56°11'N	8°09'E	3,000 ha	1a,b,c Habitat protected (900 ha)
*5.	Nissum Bredning with Harbroøre and Agger peninsulas	56°38'N	8°15'E	18,000 ha	1a,b,c,d; 2a,b; 4a Partly protected: special habitat protection given to Geller Odde (900 ha)
*6.	Nissum Fjord	56°21'N	8°14'E	7,500 ha	1a,c; 2a; 4a Partly protected
7.	Limfjorden with Agger and Jegindø	56°42'N	8°25'E	18,000 ha	1b No information on stae of prot.
8.	Ove Sø	56°52'N	8°25'E	450 ha	1a No information on state of prot.
9.	Hansted	57°07'N	8°37'E	4,500 ha	1a,d; 2a; 3a,b,c; 4a,b Protected
*10.	Vejlerne and Løgstør Bredning	57°01'N	9°00'E	40,000 ha	1a,b,c,d,e; 2a; 3a,b,c; 4a,b Partly protected (6,000 ha)
*11.	Ulvedybet, Nibe and Halkaer Bredninger	57°02'N	9°35'E	11,000 ha	1a,b; 2a; 4a Partly protected (880 ha)
*12.	Hirsholmene and surrounding sea	57°29'N	10°38'E	5,000 ha	2a; 3a,b; 4a Ramsar Convention site 600 ha
*13.	Nordre Rønner and surrounding sea	57°22'N	10°56'E	3,000 ha	1c; 4a Partly protected Ramsar site
*14.	Open sea south of Laesø incl. Hornfiskerøen	57°12'N	11°01'E	25,000 ha	1a,b,c,d; 2a; 4a,b Partly protected (350 ha)
*15.	The west of Alborg bay incl. outer parts of Randers and Mariager Fjords & Lille Vildmose	56°59'N	10°10'E	45,000 ha	1a,b,d; 2a,b; 3b; 4a,b Ramsar Convention site covers 20,000 ha
16.	Tjele Langsø	56°32'N	9°40'E	450 ha	1a; 2a No information on state of prot.
17.	Hjarbaek Fjord	56°33'N	9°20'E	2,800 ha	1a,b; 2b; 4a,b Protected

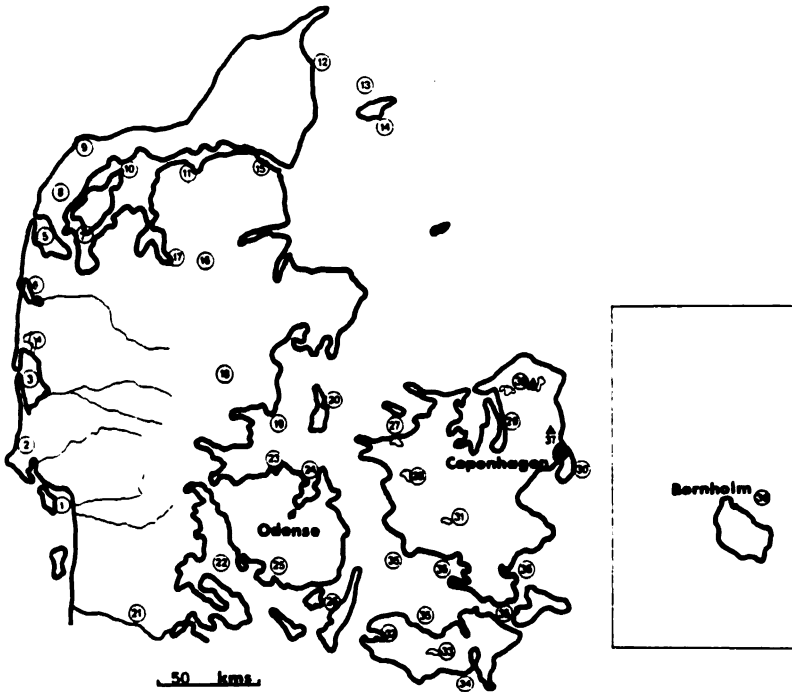
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	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
18.	Mossø	56°02'N	9°48'E	1,700 ha	1d; 2a No information on state of prot.
*19.	Outer parts of Horsens Fjord, Hou Røn, Svanegrunden & Endelave	55°51'N	10°10'E	20,000 ha	1a,b;2a,b; 3a; 4a Partly protected
*20.	Stavns Fjord	55°54'N	10°40'E	10,000 ha	1b; 2a; 4a Partly protected
21.	Freslev Mose, Tinglev Mose & Kongens Mose	54°50'N 54°56'N 55°01'N	9°15'E 9°15'E 8°56'E	150 ha 200 ha 60 ha	2a; 4a Habitat protected
*22.	Southern part of Lillebaelt	55°21'N	9°43'E	30,000 ha	1a,b,d; 2a,b; 4a Two reserves of 260 and 120 ha: Ramsar Convention site 15,000 ha
*23.	Nordfyn (Naeraa coast & Aebelø area)	55°36'N	10°13'E	22,000 ha	1a,d,e; 2a; 3a,b; 4a,b Partly protected
24.	Odense Fjord	55°30'N	10°34'E	8,000 ha	1a; 2a No information on state of prot.
25.	Arreskov sø	55°10'N	10°19'E	350 ha	2a No information on state of prot.
*26.	South Funen Archipelago	54°56'N	10°30'E	30,000 ha	1a,b,d,e; 2a; 3a; 4a Small parts of the area are prot.
*27.	Sejerø Bugt	55°47'N	11°18'E	23,000 ha	1a; 2a Parts are protected (± 650 ha)
28.	Tissø	55°35'N	11°18'E	1,300 ha	1a,c; 2a; Partly protected
29.	Southern part of Roskilde Fjord	55°56'N	12°00'E	6,500 ha	1a,b; 2a,b; 4a Partly protected
30.	Saltholm and the coast of Amager	55°36'N	12°41'E	9,600 ha	1b; 3d Habitat protection (2,500 ha)
31.	Tystrup-Bavelse sø	55°22'N	11°35'E	800 ha	1a,b; 2a; 3b,c Protected
*32.	Nakskov Fjord	54°50'N	11°02'E	5,000 ha	1b; 2a; 3b Partly protected
*33.	Maribo Søerne	54°46'N	11°31'E	1,200 ha	1a,b; 2a; 4a Protected
*34.	The waters between Lolland & Falster, incl. Rødsand & Bøtø Nor	54°14'N	11°45'E	20,000 ha	1a,b; 2a; 4a Partly protected

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	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
35.	Waters between south coast of Sjaelland, Lolland, Falster & Møn, including-			c.78,000 ha	1a,b; 2a; 4a Partly protected
*a)	coastal area of North Korsør to Basnaes Nor, incl. Agersø, Omø, Skaelskør & Glænø	55°10'N	11°30'E	16,000 ha	
*b)	Karrebaek, Dybsø & Avno Fjords	55°10'N	11°45'E	15,000 ha	
*c)	Praestø Fjord, Jungshoved Nor, Ulfshale & Nyord	55°05'N	12°15'E	20,000 ha	
d)	Fanefjord & the waters to the west of this area	54°54'N	12°10'E	1,200 ha	
*e)	North coast of Lolland to Fejø & Femø	54°55'N	11°30'E	27,000 ha	
*36.	Christiansø (Ertholmene)	55°19'N	15°11'E	1,500 ha	1a; 2a; 3a,b; 4a Protected
<b>Additional Ramsar Convention site</b>					
*	Sea area north of Anholt I.	56°42'N	11°34'E	8,000 ha	Unassessed Partly protected
<b>Wetlands of mainly limnological interest</b>					
37.	Lake Furesø	55°48'N	12°25'E	940 ha	2b,c; 3b Protection planned
38.	Lake Esrom	56°00'N	12°22'E	1,730 ha	2b,c; 3b Partly protected

# DENMARK



## DETAILS OF LISTED AREAS

### 1. VADEHAVET (Waddensea)

**Criteria for inclusion** 1a, b, c, d, e; 2a, b, c; 3a, b, c; 4a, c.

**Geographical location** 55°20'N 8°30'E. The Danish sector of the Waddensea extends from the border with the Federal Republic of Germany northwards along the North Sea coast to Esbjerg.

**Area** About 10,000 sq. km.

**Altitude** Sea level.

**Water depth** Shallow, varying with tides and wind direction and force. The area is interspersed with sandbanks, mudflats and marshes, as well as low islands.

**Wetland types** 1, 2, 3, 5, 6, 7, 10, 11.

**Ecology** The following habitat types can be identified in the Danish Waddensea as a whole, together with its surrounding area: (1) tidal zones between the islands and the mainland of Jutland; (2) open sea areas west of the islands and sandbanks; (e) coastal salt marshes; (4) pastures and marshes behind dikes (Mana, Rømø, Ballum and Højer); (5) islands with pastures, freshwater ponds and encircling marshes; (6) Lake Rudbøl; and (7) the Varde river estuary.

The area is vitally important for breeding, feeding, moulting and roosting waterfowl. Surface-feeding duck include moulting Shelduck *Tadorna tadorna* and

roosting Mallard *Anas platyrhynchos*, Wigeon *A. penelope*, Teal *A. crecca* and Shoveler *A. clypeata*. Numbers can sometimes reach 150,000. The island of Mana may have 30,000 moulting and up to 74,000 roosting Eider *Somateria mollissima* (some of which stay to breed), as well as up to 200,000 (December 1972) roosting Scoter *Melanitta nigra*. The area is also important to roosting geese, particularly Dark-breasted and Pale-breasted Brent, *Branta bernicla bernicla* and *B. bernicla hrota* (600), and the Pink-footed Goose *Anser fabalis brachyrhynchus* (4,000). Many waders breed in the area but the concentrations are greatest during migration periods. The common seal *Phoca vitulina* population is c.300.

**Legal status** The Skallingen peninsula and a few other small areas, mostly dunes, have been afforded habitat protection. The southern part of the Waddensea (about 100 sq. km) is a game reserve. The Rømø dam and surrounding area (about 20 sq. km) is not open to the public. The Albuebugt off Fanø island (about 9 sq. km) is a game reserve.

**Tenure** State ownership.

**Management practices** No information.

**Threats** The Waddensea is threatened by reclamation plans.

**Scientific research** Mostly concerned with waterfowl and including a ringing programme.

**Principal reference material**

Joensen, A. H. 1974. Waterfowl populations in Denmark 1965–1973. A survey of the non-breeding populations of ducks, swans and coot and their shooting utilization. Communication No. 120, Viltbiologisk Station, Kalø, 8410, Rønde, Denmark 1.

### 3. RINGKØBING FJORD

**Criteria for inclusion** 1a, b, c, d, e; 2a, b; 3a, b, c; 4a.

**Geographical location** 56°00'N 8°15'E, West Jutland, about 70 km north of Esbjerg on the North Sea coast.

**Area** About 250 sq. km.

**Altitude** Sea level.

**Water depth** Shallow, less than 4 m.

**Wetland types** 5, 6, 7, 8, 9, 11.

**Ecology** A shallow brackish-water fjord, its surrounding area including the reedbeds and coastal marshes of the Tipperne-Vaernengene peninsula and the needles and pastures of Klaegbanken island. The area is of limnological interest because of the changes in salinity, associated with presence or absence of connection to the North Sea, which affect the flora and fauna. The fjord is at present linked to the sea.

Ringkøbing is of great importance to waterfowl, especially as a roosting and moulting area. Species which have their moult here include Mallard *Anas platyrhynchos* (about 2,000 on Klaegbanken), Goosander *Mergus merganser*, Red-breasted Merganser *M. serrator*, Goldeneye *Bucephala clangula* (about 400) and Mute Swan *Cygnus olor* (about 1,500). The largest concentrations of roosting birds occur from August to November and from March to May. Surface feeding ducks



## DENMARK

can then exceed 50,000 in number (*Anas platyrhynchos* up to 15,000, Teal *A. crecca* up to 10,000 and Pintail *A. acuta* up to 40,000) and diving ducks over 10,000 (including 3,000–5,000 Goosanders *Mergus merganser*). Numbers of roosting geese include about 2,000 Dark-breasted Brents *Branta bernicla bernicla*, 5,000 Pink-foot *Anser fabalis brachyrhynchus* and 500 Greylags *A. anser*. About 300 Whooper Swans *Cygnus cygnus* and 1000 Bewick's Swans *C. columbianus bewickii* are present in winter or during migration periods. Over 25,000 Coot *Fulica atra* may be present (maximum 40,000 in autumn).

The Tipperne-Vaernengene peninsula is of importance as a breeding area for sandpipers Limicolae and gulls Laridae (notably Black-tailed Godwit *Limosa limosa*, Ruff *Philomachus pugnax*, Avocet *Recurvirostra avosetta* and Sandwich Tern *Sterna sandvicensis*).

**Legal status** No precise information has been received. Tipperne and Klaegban-ken are known to be scientific reserves, where shooting is forbidden over a total area of 35 sq. km.

**Tenure** No information received: the fjord is reported to be state-owned.

**Management practices** Disturbance increases after 1 October when the season opens for shooting from motor boats. Birds then concentrate in the two reserves and in more open waters further out from land.

**Scientific research** A field station has been established at Tipperne. The natural history of the fjord has been investigated in considerable detail, particularly the period during which there was no link with the sea.

### Principal reference material

Johansen, A. C. & Blegvad, H. 1933–36. *Ringkøbing Fjords Naturhistorie i Brakvandsperioden 1915–1931*. Copenhagen 252 pp.

Joensen, A. H. 1974. *Waterfowl populations in Denmark 1965–1973*. A survey of the non-breeding populations of ducks, swans and coot and their shooting utilization. Communication No. 20, Viltbiologisk Station, Kalø, 8410, Denmark.

# EGYPT

## SUMMARY OF WETLAND SITUATION

The Nile Delta, formerly one of the richest and most important areas of waterfowl concentration in winter in the whole of the eastern Mediterranean region, has suffered some very drastic changes since about the middle of the present century. The annual flooding, which used to deposit fertile sediment on the land, ceased after the completion of the Aswan High Dam in 1964. Most of the delta zone to the north of Cairo has been canalized and irrigation is effected through a system of smaller channels. Many of the canals and branch channels have become obstructed by water hyacinth *Eichhornia crassipes* since the flow of the river was diminished.

Little information about the present waterfowl situation has been available until recently when an IWRB mission visited Egypt in January 1976 and three years later, in January/February 1979 when a Netherlands Ornithological Expedition collected some still more detailed information (P. L. Meininger and W. C. Mullié, *pers. comm.*). Lake Burullus the great lagoon along the coast immediately east of Rashid, was found to be harbouring big concentrations of Wigeon *Anas penelope* (23,400), Shoveler *A. clypeata* (63,458), Pochard *Aythya ferina* (8,316) and Ferruginous Duck *A. nyroca* (6,582). Coot *Fulica atra* were also present in very large numbers (the count came to 153,525). Elsewhere, substantial but generally somewhat smaller concentrations of waterfowl were seen on Lake Manzala (adjoining Port Said on the west), for example Shelduck *Tadorna tadorna* (1,011), Coot *Fulica atra* (22,293) and on the inland lake Qarûn, 75 km south-south-west of Cairo, where 2,808 Great Crested Grebes *Podiceps cristatus*, 10,758 Black-necked Grebes *P. nigricollis* and 5,180 Tufted Duck *Aythya fuligula* were counted. It is also noteworthy that Lakes Burullus and Manzala are the most important wintering area known of the Whiskered Tern (*Chlidonias hybrida*) in the Western Palearctic region, as shown by counts of 17,400 and 7,080 respectively.

Some of the mudflats in the Bay of Suez provide suitable feeding grounds for waders, notably Grey Plover *Pluvialis squatarola*, Little Stint *Calidris minuta* (5,000) and Redshank *Tringa totanus*. Good numbers of waders were also observed round the salt lakes of Qarûn, again, and of the Wadi el Natrun half way between Qarûn and Alexandria. Large numbers of Cattle Egrets *Bubulcus ibis* (estimated at 12,900) were observed in the Nile valley between Cairo and Aswan and Egyptian Geese *Alopochen aegyptiacus* proved to be fairly common (with a count of 659).

Several hunting reserves exist in the cultivated zone of the delta, such as those of El Abassa near Tell el Kebir between Cairo and Ismâ'îliya and Dahshûr beyond Saqqara 30 km south of Cairo. Unconfirmed reports suggest the existence of suitable waterfowl habitat in the shallows along the shores of Lake Nasser which was formed by the construction of the Aswan High Dam. At the opposite end of the country the Sabkhet el Bardawil on the Mediterranean coast of the Sinai Peninsula is said to be particularly rich in migrating waterfowl in autumn and spring but few data have yet been published. The Flamingo *Phoenicopterus ruber* is known to be frequently present (8,000 in January 1973) and it apparently bred in 1970 not far away in the saltmarshes of El Tina south-east of Port Said (about

**EGYPT**

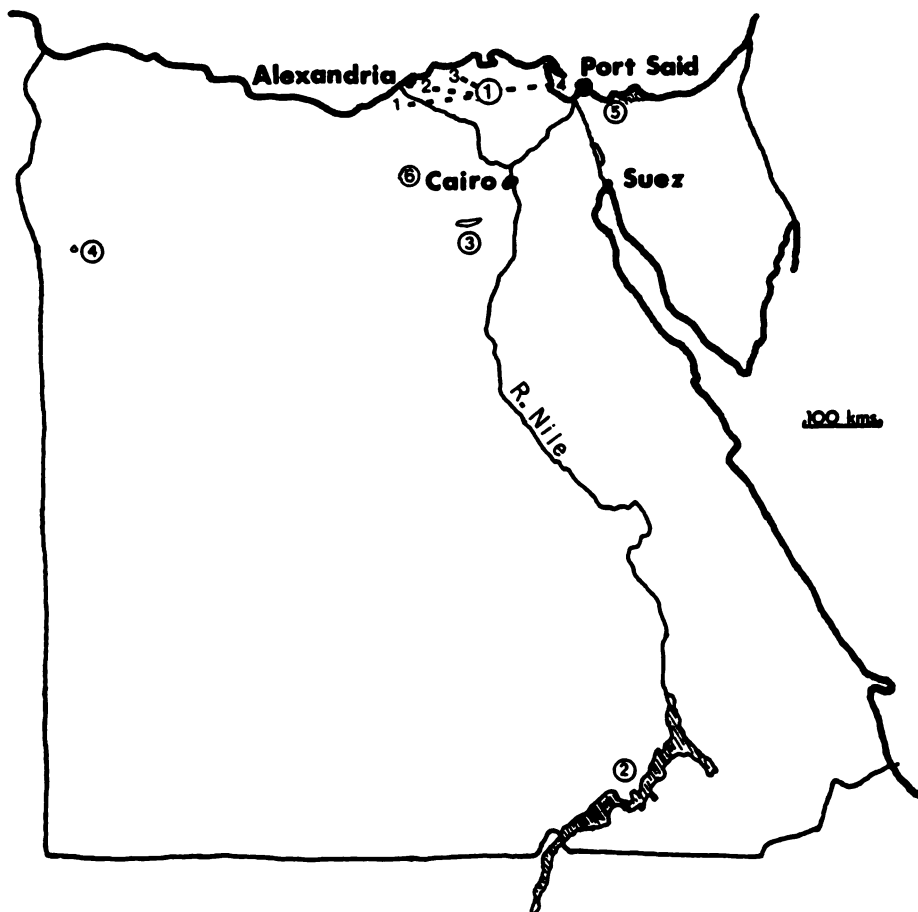
500 pairs), where in winter up to 11,000 have been sighted (January 1973, Uzi Paz, pers. comm.).

Among the sites of outstanding limnological importance in addition to several of those already mentioned, is the Siwa Oasis, in the Western Desert near the border with Libya, which includes a complex of springs and pools, many of them with evidence of a marine origin, extending over an area of about 2,000 ha. For detailed information on the hydrology, limnology and hydrobiology of the Nile in general the reader is recommended to consult the classic study entitled *The Nile; Biology of an ancient river* (Rzóska, J. 1976; W. Junk B. V., The Hague).

**WETLANDS OF INTERNATIONAL IMPORTANCE**

	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criterial Conservation status</i>
1.	The River Nile and its Delta:				1a,b,d,e; 2a,b; 3a,b,c; 4a
1.1	Bahra Maryut	31°10'N	20°55'E	6,000 ha	Unprotected
1.2	Bahra el Idku	31°20'N	30°15'E	12,600 ha	Unprotected
1.3	Bahra el Burullus	31°25'N	30°40'E	42,600 ha	Unprotected
1.4	Bahra el Manzala	31°20'N	32°00'E	140,000 ha	Unprotected
2.	Lake Nasser	21°-24°N	31°-33°E	525,000 ha in Egypt (c. 100,000 ha in Sudan)	1e; 2a,b; 4a,c Unprotected
3.	Birket Qarûn	29°30'N	30°40'E	20,000 ha	1b,d,e; 2a; 3a,b; 4a Unprotected
4.	Siwa Oasis	29°11'N	25°31'E	2,000 ha	1c,d,e; 2a,c; 3b; 4a Unprotected
5.	Sabkhet el Bardawil	31°10'N	33°15'E	60,000 ha	1a,b,e; 2a,b; 3b; 4a Unprotected
6.	Wadi el Natrûn	30°20'N	30°25'E	c. 300 ha	2a,b,c; 4b Unprotected

## EGYPT

**DETAILS OF LISTED AREAS****1. THE NILE AND NILE DELTA****1.2 BAHRA EL IDKU (LAKE EDKU)**

**Criteria for inclusion** 1b, d, e; 2a, b; 3a, b, c; 4a.

**Geographical location** 31°20'N 30°15'E, on the Mediterranean coast 20 km east of Alexandria.

**Area** 12,600 ha.

**Altitude** Sea level.

**Water depth** 0–1.5 m; mean 1 m.

**Wetland types** 7, 17.

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**Ecology** A brackish-water lagoon narrowly separated from the sea, with eutrophic conditions being fed by water both from the Mediterranean and from the surrounding agricultural land. Parts of the lake have been reclaimed.

**Legal status** Unprotected.

**Tenure** State owned.

**Management practices** Some areas have been drained; the lake is fished commercially.

**Threats** Some sections are still liable to reclamation.

**Scientific research** Limnological and fishery studies have been undertaken.

### Principal reference material

A number of limnological studies on plankton and the biological productivity of the lake have been published in *Notes et Memoires*, Alexandria.

## 2. LAKE NASSER

**Criteria for inclusion** 1e; 2a, b; 3a, b; 4a, c.

**Geographical location** 21°–24°N 31°–33°E. Upstream of the Aswan Dam and extending up the Nile 150 km into the Sudan, also 90 km south-east up the 'Allaqui and associated wadis.

**Area** 525,000 ha in Egypt; with a maximum of a further 100,000 ha in the Sudan.

**Altitude** 185 m.

**Water depth** Maximum depth 90 m; mean 25 m.

**Wetland type** 15.

**Ecology** A man-made reservoir, created by the construction of the Aswan Dam and filling a section of the Nile valley and its local tributaries. The shoreline is very irregular, and more than 7,900 km in length. The centre, in the bed of the old valley, retains some riverine or semi-riverine characteristics, whereas the northern section, nearer to the dam, and the flooded wadis along either bank are more typically lacustrine. Shallower areas bordering the shores may well be utilized by waterfowl, gulls and terns, but to what extent remains to be ascertained.

**Legal status** Unprotected.

**Tenure** State owned.

**Management practices** The lake is used for hydro-electric power; some fisheries are being developed; various treatments are applied to control malaria and schistosomiasis (bilharzia).

**Threats** None reported.

**Scientific research** Studies of changes in progress are being undertaken by the Lake Nasser Development Centre project.

### Principal reference material

Raheja, P. C. 1973. Lake Nasser. In *Man-Made Lakes: Their Problems and Environmental Effects* (W. C. Ackermann, G. F. White and E. B. Worthington eds). American Geophysical Union, Geophysical Monograph 17, pp. 234–245 (recording the development of the Lake up to 1970).

### 3. BIRKET EL QARUN (Lake Qarun)

**Criteria for inclusion** 1b, d, e; 2a; 3a, b; 4a.

**Geographical location** 29°30'N 30°40'E. In the Western Desert 30 km north-west of El Faiyûm and 75 km south-south-west of Cairo.

**Area** 20,000 ha.

**Altitude** 45 m below sea level.

**Water depth** Maximum 7 m; mean 3 m.

**Wetland type** 17.

**Ecology** A salt lake lying within a depression in the Western Desert. The water has become progressively more saline and marine fish including Mullet *Mugil saliens* and Sole *Solea vulgaris* have been introduced for fishery purposes. Waterfowl records include about 10,000 duck and Coot *Fulica atra* in January 1976 and over 13,500 Great Crested and Black-necked Grebes *Podiceps cristatus* and *nigricollis* and 5,000 Tufted Duck *Aythya fuligula* in January/February 1979.

**Legal status** Unprotected.

**Tenure** State ownership.

**Management practices** Used for fishery purposes; several new species have been introduced.

**Threats** Increasing salinity, fishery development and land drainage with possible accompanying pollution.

**Scientific research** Limnological and fishery studies were initiated prior to 1971.

**Principal reference material**

Naguib, M. 1961. Studies on the ecology of Lake Qarûn (Faiyûm, Egypt). *Kieler Meerforschungen*, Band 17.

### 4. SIWA OASIS

**Criteria for inclusion** 1c, d, e; 2a, c, 3b; 4a.

**Geographical location** 29°11'N 25°31'E. West of the Qattara depression, near the Libyan border.

**Area** 2,000 ha.

**Altitude** 30 m below sea level.

**Water depth** No information.

**Wetland type** 20.

**Ecology** An area of pools and springs formed in a depression. Some pools contain marine relict species and many are more or less saline. Reputedly poor in birdlife, but it is possible that the enormous influxes of migrants recently (1969) detected in the Sarir oasis in Libya, c. 400 km south-west of Siwa, (which included 250 Little Egrets *Egretta garzetta* and 150 Squacco Herons *Ardeola ralloides*), may also occur.

**Legal status** Unprotected.

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**Tenure** Presumably state ownership.

**Management practices** The oasis is largely planted up with date palms.

**Threats** None reported.

**Scientific research** A 1935 expedition produced several papers on the Chemistry and Biology of the oasis (see next section).

**Principal reference material**

Reports of the Armstrong College Expedition to Siwa oasis 1935. In *Proceedings of the Egyptian Academy of Sciences*, Vol. III, 1947 and Vol. IV, 1948.

Moreau, R. E. 1972. *Palaeartic-African Bird Migration Systems*. Academic Press, London & New York.

Hogg, P. 1974. Trans-Saharan Migration through Sarir, 1969–70. *Ibis* 116: 466–476.

**5. SABKHET EL BARDAWIL**

**Criteria for inclusion** 1a, b, e; 2a, b; 3b; 4a.

**Geographical location** 31°10'N 33°15'E. This lagoon lies along the northern shore of the Sinai Peninsula, occupying more than half the length of its Mediterranean coastline. It is 95 km long and 25 km wide at maximum.

**Area** 60,000 ha.

**Altitude** Sea level.

**Water depth** Maximum depth 3 m; mean 1 m.

**Wetland types** 7, 10, 11.

**Ecology** A saline lagoon separated from the sea by a narrow strip of land forming a barrier 300–1000 m wide, its height varying from a very few metres to over 60 m. Three man-made entrances permit free exchange of water from the sea. The lagoon is a vast area of shallow water with peninsulas and small islands, marshes and saltflats. Some parts are used for sand extraction. Vegetation on foreshore and islands consists mainly of halophytes and is of varying density. The lagoon is a permanent habitat for about 1,500 Flamingos *Phoenicopterus ruber* (a maximum of 8,000 being recorded for January 1973) but no signs of attempted breeding have been found (though a colony has been discovered in the El Tina area not far to the west). Little Terns *Sterna albifrons*, Kentish Plover *Charadrius alexandrinus* and Spurwing Plover *Hoplopterus* (= *Vanellus*) *spinosus* breed in important numbers on the sandy beaches of the lagoon and on the islands. Other possible breeding species include the Greater Sandplover *Charadrius leschenaultii* and Avocet *Recurvirostra avosetta*.

During the autumn, huge numbers of migrating birds pass along the length of the lagoon which constitutes an extremely important resting place. Counts during a six week survey in autumn 1973, included about 165,000 aquatic birds, comprising 61 species, among which were 96,000 Garganey *Anas querquedula*, 22,000 gulls Laridae, 7,000 herons Ardeidae, 33,000 plovers Charadriidae and 5,500 Avocets.

**Legal status** Unprotected.

**Tenure** No information; presumably State ownership.

**Management practices** In a transitional stage following the return of Sinai to Egypt.

**Threats** Eggs and fledglings of breeding waterbirds are gathered extensively by the local fishermen for food and probably sale. Excessive sand extraction.

**Scientific research** Survey by Israeli scientists during autumn migration of 1973.

**Principal reference material**

None listed.



# FINLAND

## SUMMARY OF WETLAND SITUATION

Finland with its long irregular coastline, its archipelagos comprising over 30,000 islands and islets, and its lakes which number approximately 62,000, is extremely rich in waterfowl habitats. Most of them provide suitable breeding sites for Anatidae and waders but some are typical resting and feeding places during the autumn migration, for example the coastal marshes of Bölsvik (No. 39 in the list which follows), Preiviikki (23) and the lake Höytiäinen (19). The density of breeding pairs of waterfowl is highest on or around small eutrophic lakes and they are likely to be far more thinly scattered in the vast peatland areas of Finland. It is therefore necessary, for effective and successful conservation, to protect enough of both kinds of wetland complex, those which consist of large numbers of small lakes and some much larger ones typical of peatland areas.

The section dealing with the Finnish wetlands in the List of Wetlands of Nordic Importance published in 1973, included 42 sites. Of these, thirteen were designated by Finland for inclusion in the Schedule of the Ramsar Convention, when it ratified the Convention in 1974. They comprise eight sites in the archipelagos (their numbering in the Finnish checklist which follows this summary being quoted in brackets): Aspskär (32), Söderskär (38), Långören (37), Björkör (40), Lagskär (42), Signilskär (34), Valassaaret-Björkögrunden (14) in the Gulf of Bothnia and Krunnit (8) also in the Gulf of Bothnia; two coastal marshes Ruskis (31) and Viikki (33); and three peatland complexes Suomijärvi-Patvinsuo (17), Martimoaapa-Lumiaapa (7) and Koitilaiskaira (4).

Short notes on habitat and the number of breeding pairs of the most characteristic species of waterfowl in Finland were included in the country report presented by Urpo Häyrinen and Pertti Rassi at the International Conference on Conservation of Wetlands and Waterfowl held at Heiligenhafen, Federal Republic of Germany, in 1974 (see pp. 34–38 of the Proceedings published by the International Waterfowl Research Bureau in 1976).

As for sites of mainly limnological interest, the International Biological Programme Handbook No. 21 (Luther, H. and Rzóska, J. 1971. *Project Aqua*. Blackwell Scientific Publications, Oxford and Edinburgh, pp. 15–18) lists 14. At least three of these satisfy criteria of international importance on which the present volume is based, and have been included as representative examples in the checklist which follows. They comprise the three interconnected rivers marking the border with Sweden from its most northerly point to the Gulf of Bothnia (43), the two rivers along the north-western section of the border with Norway together with the two tributaries rising in the Kevo National Park area (44) and the Tvärminne Zoological Station and its surroundings (45). The latter has been a centre for research in hydrobiology and mainly marine biology since 1900. It is noted for a successful campaign in 1970 against a proposal to site an oil refinery in its vicinity, which if it had gone ahead might well have jeopardized the essential and effective ecological monitoring of the Baltic Sea.

## WETLANDS OF INTERNATIONAL IMPORTANCE

## \*Nominated for inclusion in the Ramsar Convention list

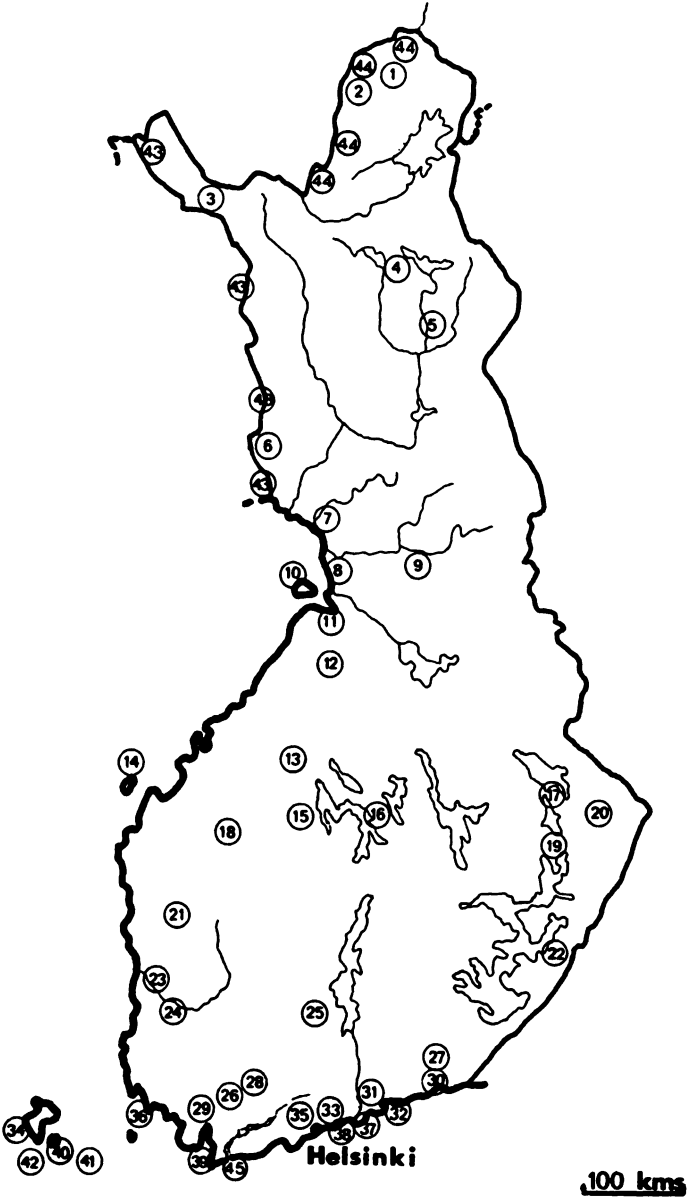
	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
1.	Sammuttijänkä	69°30'N	27°30'E	100,000 ha	1d; 2a Unprotected
2.	Piesjärvensuo	69°25'N	26°10'E	5,200 ha	1d; 2a Unprotected
3.	Lätäseno	68°35'N	22°20'E	26,000 ha	1c,d; 2a Unprotected
*4.	Koiti-laiskaira	67°45'N	27°00'E	34,400 ha	1a,d; 2a Protected
5.	Lämsänaapa	67°22'N	27°30'E	4,600 ha	1a,d; 2a Unprotected
6.	Portimojärvi	66°22'N	23°55'E	500 ha	1d; 2a Unprotected
*7.	Martimoaapa- Lumiaapa	65°49'N	25°15'E	8,000 ha	1c,d; 2a Partly protected
*8.	Krunnit	65°23'N	25°00'E	4,600 ha	1a,d; 2a; 3a,b; 4a Protected
9.	Olvassuo	65°17'N	27°10'E	3,800 ha	1a,c,d; 4a Partly protected (1,400 ha)
10.	Kirkkosalmi- Pöllänlahti	65°00'N	24°45'E	1,300 ha	1a Unprotected
11.	Liminganlahti	64°50'N	25°20'E	6,000 ha	1a; 2a Unprotected
12.	Ainalin järvet- Köyryrimpi	64°13'N	25°25'E	2,280 ha	1d; 2a Unprotected
13.	Pilvineva	63°28'N	24°00'E	3,000 ha	1a,d; 2a,b Unprotected (Listed by Project TELMA for the conservation of peatlands)
*14.	Valassaaret- Björkögrunden	63°25'N	21°05'E	17,700 ha	1a,d; 2a; 3a,b,c; 4a Protected
15.	Salamajärvi	63°16'N	24°45'E	6,400 ha	1d; 2a Protected (TELMA list)
16.	Suvantojärvet	63°08'N	26°10'E	1,000 ha	2a,b Unprotected
*17.	Suomujärvi- Patvinsuo	63°05'N	29°45'E	10,000 ha	1c,d,e; 2a; 4a,b Protected (TELMA list)
18.	Vanhaneva	63°04'N	23°30'E	500 ha	1d; 2a Unprotected
19.	Höytiäinen	62°38'N	29°40'E	150 ha	1a,c; 2a Partly protected (77 ha) and included in TELMA list
20.	Kesonsuo- Juurikkasuo- Pitsonsuo	62°50'N	30°50'E	4,000 ha	1a,d; 2a Unprotected

## FINLAND

	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
21.	Kauhaneva	62°12'N	22°25'E	2,200 ha	1a,d; 2a Partly protected (TELMA list)
22.	Siikalahti	61°34'N	29°35'E	3,500 ha	1d Unprotected
23.	Kokemäensjoen suisto-Preiviikki	61°30'N	21°45'E	3,210 ha	1a,d; 2a Unprotected
24.	Puuzijärvi	61°15'N	22°32'E	2,200 ha	1d; 2a; 4a Unprotected
25.	Saarioisjärvi- Jokijärvi- Tykölänjärvi- Vähäjärvi	61°12'N	24°23'E	350 ha	1d; 2a Unprotected
26.	Omenajärvi	60°26'N	23°34'E	190 ha	1a,d; 2a Unprotected
27.	Kirkkojärvi- Lupinlahti	60°35'N	27°13'E	700 ha	1d; 2a; 3c Unprotected
28.	Torransuo Talpianjärvi	60°44'N	23°40'E	3,000 ha	1a,d; 2a Unprotected (TELMA list)
29.	Paimionlahti	60°24'N	22°38'E	240 ha	2a Unprotected
30.	Ulko-Tammio	60°20'N	27°20'E	2,710 ha	1a,d; 2a; 3c; 4a Protected
*31.	Ruskis	60°22'N	25°40'E	230 ha	1d; 2a; 3c; 4a Protected
*32.	Aspskär	60°16'N	26°25'E	370 ha	1a,d; 3a,b,c; 4a Protected
*33.	Viikki	60°13'N	25°00'E	250 ha	1a,e; 2a; 3c Protected
*34.	Signilskär	60°13'N	19°25'E	2,300 ha	1d,e; 2a; 3a,b,c; 4a Protected
35.	Laajalahti (Bredviken)	60°12'N	24°50'E	150 ha	2a; 3c Unprotected
36.	Laajoen suisto	60°31'N	21°52'E	150 ha	2a Partly protected
*37.	Långören	60°09'N	25°38'E	8,250 ha	1d; 2a; 4a Protected
*38.	Söderskär	60°07'N	25°25'E	1,380 ha	1d; 2a; 3a,b; 4a Protected
39.	Bölsvik-Svanvik- Henriksberg	59°57'N	22°59'E	380 ha	1a; 2a Unprotected
*40.	Björkör	59°56'N	20°10'E	5,300 ha	1d; 2a; 4a Protected
41.	Klåvskär	59°50'N	20°35'E	4,300 ha	1a,d; 2a Protected
*42.	Lagskär	59°50'N	19°50'E	450 ha	2a; 3a,b; 4a Protected
43.	The river system along the Swedish border Könkämäeno	68°56'N	20°56'E	14,255 ha (catchment)	2a; 4c Unprotected (listed in Project AQUA)

	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
	to the Muonionjoki	68°29'N	22°18'E		
	to the Tornionjoki	67°10'N	23°37'E		
	to the Gulf of Bothnia	65°48'N	24°27'E		
44.	The river system along the north- west section of the Norwegian border			5,095 ha (catchment)	2a; 4c Partly protected by the Kevo National Park
	Inarinjoki (Anarjokka)	68°36'N	25°00'E		
	to the Tenojoki (Tana)	69°27'N	25°58'E		
	(turning north across the border at and the tributaries:–	70°04'N	28°00'E)		
	Kevonjoki source	69°30'N	26°30'E		
	to confluence	69°54'N	27°01'E		
	and the Vetsikkojoki				
	from its source	69°42'N	27°30'E		
	(Vetsikkojärvi)				
	to its confluence	69°58'N	27°20'E		
	with the Tenojoki				
45.	Pojoviken- Tvärminne	59°52'N	23°15'E	720 ha	1d,e; 3a,b,c; 4a Partly or fully (Tvärminne Zoological Station) protected

# FINLAND



# FRANCE

## SUMMARY OF WETLAND SITUATION

The wetlands along the Atlantic coast are situated on one of the main migration routes of Palearctic waterfowl. The shallow bays and estuaries with extensive mudflats exposed at low tide offer excellent feeding and roosting sites for huge numbers of Anatidae and Limicolae and indeed usually form an ecological entity with the coastal marshes and the marshes further inland that provide the essential feeding areas at night for the surface-feeding ducks which roost on the sea or mudflats during the day. As hunting pressure is high in almost all parts of France, the creation of reserves in areas of vital importance for waterfowl is an absolute necessity and, wherever they have been established, an increase in waterfowl numbers has nearly always been noticed.

Along the Pas de Calais and Normandy coasts the Baies de l'Authie (near Etaples), de la Canche (Berck) and de Veys (at the mouth of the river Vire) have lost much of their importance over recent decades as a result of dike building, sand sedimentation and drainage of most of the inland marshes, as well as heavy hunting pressure. However, the creation of a reserve in the Baie de la Somme has had a favourable effect and the wintering population of several species is at present on the increase.

Further to the south and west, the Baie de Mont St. Michel supports very substantial numbers of waders (January counts have been reported to average about 140,000). The Baie de St. Brieuç, not yet included in the list, is worthwhile considering as an internationally important site, since it at times supports over 20,000 waders. Another site probably meriting inclusion is the Rade de Brest, apparently the major concentration area of wintering Red-breasted Merganser *Merganser serrator* (500 to 900) in France.

In the Bay of Biscay, the Golfe de Morbihan is of exceptional value as it harbours approximately 70% of the population of Brent Geese *Branta bernicla* wintering in France, representing about 25% of the world population of this until recently endangered species.

Most of the bays and estuaries of the north and west in fact support flocks of Brent Geese, although in smaller numbers than in the Golfe de Morbihan. The most important ones are the Baie de Mont St. Michel, Baie de Morlaix, Estuaire de la Vilaine and Rade de Pénerf, Presqu'île de Guerlande, Baie de Bourgneuf, Baie de l'Aiguillon, Ile de Ré and Anse de Fourras, Anse de Saint Frouet-Oléron and the Bassin d'Arcachon. The total Brent population wintering in France is now estimated to be about 40,000, and is recovering from the serious decline in the species during the 1950s, which took place when its most important food, the Eel-grass *Zostera marina*, was decimated by disease.

The Golfe de Morbihan is also of major importance for wintering Wigeon *Anas penelope* in numbers varying between 1,200 and 35,000 and Pintail *A. acuta* (500 to 2,000) and the January average of wader numbers is reported to be 45,700.

The Estuaire de la Vilaine and the Rade de Pénerf at the Loire rivermouth are important roosting sites for the various species of duck which feed at night in the nearby marshes, including Mallard *Anas platyrhynchos*, Wigeon *A. penelope*

(1,000–3,000), Teal *A. crecca*, Pintail *A. acuta* (400–3,000) and Pochard *Aythya ferina* (500–5,000). The Estuaire de la Vilaine also holds the biggest concentration of Scaup *Aythya marila* (800–2,000) on the Atlantic coast.

The Lac de Grand Lieu, south of the upper end of the Loire estuary and privately owned, is another important wintering area for Pochard *Aythya ferina* (1,000–7,000) and also contains the biggest breeding colony of Grey Heron *Ardea cinerea* in France, formerly numbering 1,000 pairs but down to only 300 pairs by 1974. Unfortunately, the Loire estuary is now under serious threat from plans for industrial and port development.

Further to the south the scientifically interesting Marais d'Olonne harbours the only colony of Avocets *Recurvirostra avosetta* in western France, and the Baie de l'Aiguillon and Marais de Vendée form one of the most important wintering areas on the whole Atlantic coast for several species of Anatidae including Shelduck *Tadorna tadorna* (4,000–8,000), Wigeon (2,000–3,000), Teal (1,000–6,000), Pintail (6,000–12,000) and Shoveler *Anas clypeata* (up to 4,000). The vast mudflats offer excellent feeding grounds for thousands of waders such as Avocet *Recurvirostra avosetta* (3,000–4,000), Ringed Plover *Charadrius hiaticula* (1,000–2,000), Grey Plover *Pluvialis squatarola* (10,000–40,000, many staying to moult in August), Dunlin *Calidris alpina* (30,000–50,000), Knot *C. canutus* (20,000–40,000) and Redshank *Tringa totanus* (3,000–20,000). The mudflats of the Fier d'Ars and the Anse de Fouras near the Ile de Ré are important for Brent Geese, Shelduck, Mallard, Wigeon, Teal and Pintail (400 to 1,000). The estuary of the Gironde provides little suitable wader habitat, as all the sandbars at the entrance are submerged at high tide, while hunting pressure is reported to be very high.

Numbers of wintering waterfowl have increased considerably in the Bassin d'Arcachon since the creation of several reserves. Dunlin, in particular, occur in numbers up to 220,000 and some 2,500 Brent Geese winter. Since it became a reserve, the Banc d'Arguin situated in the entrance to the Bassin has been the site of a colony of 3,000 pairs of Sandwich Tern *Sterna sandvicensis*. The Bassin d'Arcachon, Golfe de Morbihan, Baie de Bourgneuf and several other bays along the Atlantic coast are, incidentally, also of economic importance for oyster culture.

On the French Mediterranean coast, the most important and best studied wetland is the Camargue, in the Rhône Delta, of which a detailed description follows. From the Camargue westward to the Spanish border the Etangs de Languedoc have suffered heavy pressure from hunters and tourism developments, but could once more become important for breeding and wintering waterfowl if the few protected areas of the region can be improved and extended. Several of the lagoons provide valuable feeding grounds for large numbers of Greater Flamingos *Phoenicopterus ruber*, of which c.6,000 pairs nest in the Camargue. The Etang de Thau is the main site for ostreiculture on this coast.

Inland, the most important concentrations of waterfowl are found in the Rhine valley (Ried d'Alsace), Champagne Humide, Sologne, la Brenne, Bresse, les Dombes and along the shores of Lac Léman (see also under Switzerland). The Sologne region, south and south-west of Orléans, with its numerous small ponds separated by woods and heaths, still lacks sufficient protection from very considerable hunting pressure. A nature reserve in the pond area of la Brenne would be especially desirable, since not only hunting but also agricultural and recreational pressures are reported to be increasing. The Dombes area, north-east of Lyon, with over 300 small lakes and ponds, is of particular scientific interest because of its rich flora and fauna: breeding birds include Bittern *Botaurus stellaris*, Little Bittern *Ixobrychus minutus*, Night Heron *Nycticorax nycticorax*, Squacco Heron *Ardeola ralloides*, Little Egret *Egretta garzetta* and Grey Heron *Ardea cinerea*,

together with several species of duck, notably the Red-crested Pochard *Netta rufina*. The area is also of importance to migrating and wintering waterfowl, raptors and many other birds.

Lastly, on the island of Corsica, the Etang de Biguglia harbours internationally important numbers of waterfowl in winter and Audouin's Gull *Larus audouinii*, classified as rare in the Red Data Book, nests on several islets off the coast.

The network of coastal and inland reserves is still being extended and recently two new reserves have been established in the Champagne Humide region, on part of the Seine reservoir complex in the Département Aube (Lac de la Forêt d'Orient) and on the Lac du Der in the Département Marne.

Of the thirteen French wetlands listed in Project AQUA as being of limnological interest at the international level, three form part of the Camargue complex, which as already mentioned is France's most valued and best studied wetland, and a fourth coincides with the Lac Léman site (No. 22). Of the remaining nine AQUA sites, the five which are perhaps of the greatest significance have been added in a separate sub-section at the end of the checklist which follows.

### References

In 1977, the Direction de la Protection de la Nature of the Ministère de l'Environnement et du Cadre de Vie published an 'Atlas des Réserves d'Avifaune Aquatique', which covered all the waterfowl reserves in the country at that date.

Other publications include:

Brosselin, M. 1973. Valeur internationale pour l'avifaune migratrice des zones humides de la façade occidentale de la France. *Penn Ar Bed* 9(74), Société pour l'étude et la protection de la nature en Bretagne, Brest.

Hémery, G., Houtsa, F., Nicolau Guillaumet, P. and Roux, F. 1979. Distribution géographique, Importance et Evolution Numérique des Effectifs d'Anatidés et de Foulques hivernant en France (Janvier 1967-1976). *Bull. mensuel, Office National de la Chasse*, Mai.

## WETLANDS OF INTERNATIONAL IMPORTANCE

	Locality	Latitude	Longitude	Size	Wetland criteria/ Conservation status
Côte Atlantique					
1.	Complex of estuaries in Picardie			c.55,000 ha	2a,b; 3c; 4a
1.01	Baie de la Canche	50°32'N	1°33'E		
1.02	Baie de l'Authie	50°22'N	1°32'E		
1.03	Baie de la Somme	50°13'N	1°38'E		Partly protected
2.	Baie de Veys	49°18'-25'N	1°00'-15'W		1b,d Partly protected
3.	Baie de Mont St Michel & Marais de Dol	48°33'-47'N	1°20'-2°00'W	c.30,000 ha	1a,b,d,e; 2a,b; 3a,c; 4a
4.	Golfe de Morbihan	47°30'-40'N	2°40'-3°00'W	c.5,000 ha	1a,b,c,e; 2a; 3a,b,c; 4a Partly protected

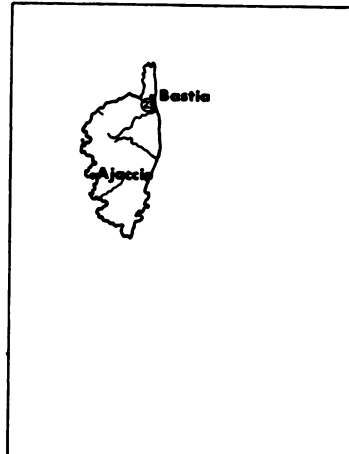
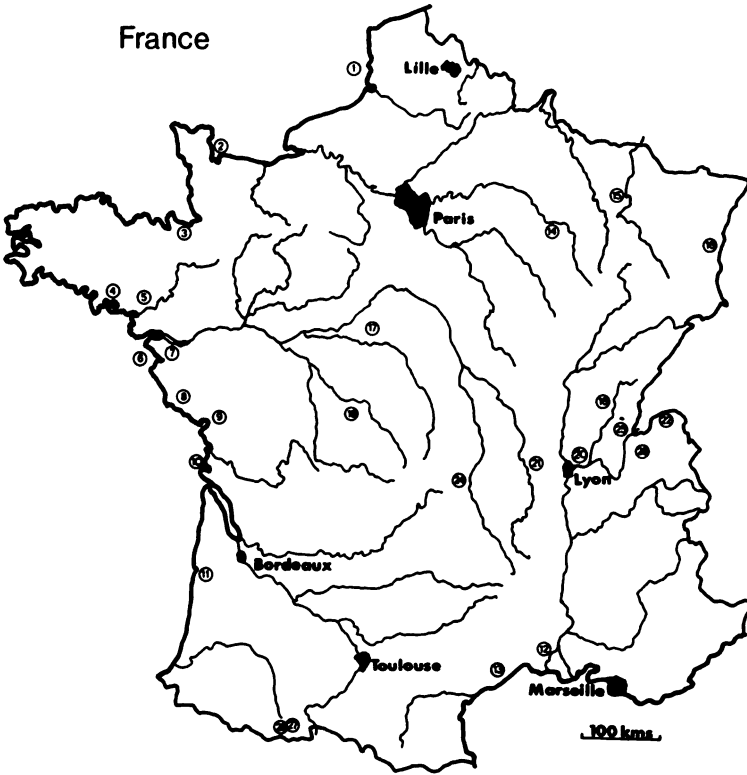


## FRANCE

	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
5.	Embouchure de la Vilaine & Marais de Redon, Baie de Keroyal	47°23'–44'N	1°50'–2°30'W	c.11,000 ha	1a; 2a; 4a Partly protected
6.	Baie de Bourgneuf & Marais annexes	46°42'– 47°07'N	1°49'–2°12'W	7,000 ha mudflats 43,000 ha marshes	1b,d,e; 2a; 4a Partly protected
7.	Basse Loire, Brière & Lac de Grand Lieu	47°00'–20'N	1°35'–2°15'W	c.20,000 ha	1d; 2a,b; 3c; 4a
8.	Marais d'Olonne	46°30'–35'N	1°47'–50'W	c.1,500 ha	1d,e; 2a; 3c; 4a Partly protected
9.	Anse de l'Aiguillon & "Marais" du Sud de la Vendée	46°12'–28'N	0°45'–1°25'W	c.100,000 ha	1a,b,c,d,e; 2a; 3a,b,c; 4a Partly protected
10.	Anse de l'Oléron (Anse de Fouras)	45°55'N	1°06'W	No figure quoted: estimated at 900 ha	1a,b,d; 2a; 3c; 4a
11.	Basin d'Arcachon	44°37'–48'N	1°00'–18'W	c.10,000 ha	1a,b,c,d,e; 2a,b; 3a,b,c; 4a Partly protected
<b>Côte Méditerranéenne</b>					
12.	Camargue	43°20'–35'N	4°15'–50'E	c.142,500 ha	1a,b,c,d,e; 2a,b; 3a,b,c; 4a Partly protected as landscape reserve (Parque Régionale), partly as strict nature reserve
13.	Etangs de Languedoc			No figures quoted but estimated size of each site is as follows	1a,b,e; 2a; 3a,b,c; 4a Some relatively small reserves, in which shooting is forbidden, have been established on some of the sites
13.1	Etang de Mauguio	43°33'N	4°00'E	2,500 ha	
13.2	Etang de Pérols	43°33'N	3°57'E	800 ha	
13.3	Etang de Vic	43°29'N	3°50'E	1,000 ha	
13.4	Etang de Thau	43°23'N	3°36'E	6,400 ha	
13.5	Etang de Gruissan, Etang de l'Ayrolle	43°05'N	3°03'E	100 ha 1,200 ha	
13.6	Etang de Bages	43°05'N	3°01'E	3,000 ha	
13.7	Etang de Lapame	42°58'N	3°01'E	600 ha	
13.8	Etang de Leucate	42°51'N	3°00'E	6,500 ha	
13.9	Etang de Canet	42°40'N	3°01'E	800 ha	
<b>Inland Areas</b>					
14.	Champagne Humide			No figures quoted: estimated at	1a,e; 2a; 4a Partly protected
14.1	Lac de la Forêt d'Orient	48°15'N	4°27'E	9,100 ha	

	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
14.2	Lac de la Forêt du Der (Réservoir de Champaubert)	48°32'N	4°47'E	1,500 ha	
15.	Etangs de Lorraine	48°44'–49°39'N	5°47'–6°57'E	c.22,500 ha	1d,e; 2a; 4a Unprotected
16.	Reid d'Alsace	48°15'N	7°30'E	c.30,000 ha	1a,b,e; 2a; 3b; 4a Partly protected
17.	Sologne	47°20'–47'N	1°25'–2°30'E	c.375,000 ha incl. 30,000 ha of étangs	1a,d,e; 2a; 3a,c; 4a Unprotected
18.	La Brenne	46°35'–47°00'N	1°05'–35'E	c.100,000 ha, incl. 6,000 ha of étangs	1e; 2a; 3c; 4a Unprotected
19.	Bresse, incl. Inundation areas in the Saône & Doubs valleys	46°25'–47°20'N	4°50'–5°30'E	c.180,000 ha	1a,?; 2a No information on protected status
20.	Les Dombes	45°–55'–46°10'N	4°55'–5°20'E	c.100,000 ha, incl. 11,000 ha of étangs	1d,e; 2a,b; 3a,b,c; 4a Partly protected
21.	Plaine du Forez	45°07'–45'N	4°00'–25'E	c.50,000 ha	1d,e; 2a,b; 3a; 4a Unprotected
22.	Lac Léman, between Yvoire, Excevenex & Séchex	46°21'N	6°21'E	shoreline of c.10 km	1a,c,d; 2a; 3b,c; 4a Unprotected
<b>Corsica</b>					
23.	Etang de Biguglia	42°34'–40'N	9°27'–28'E	c.1,500 ha	1a,b,d; 2a; 3a,b,c; 4a Partly protected
<b>Other wetlands of international importance, mainly for their limnological/hydrobiological values</b>					
24.	Lac Pavin	45°30'N	2°53'E	44 ha	2a,b,c; 3b,c; 4a Unprotected
25.	Lac de Sylans	46°10'N	5°40'E	49.7 ha	2c; 4a Unprotected
26.	Lac d'Annecy	45°54'N	6°07'E	2,704 ha	2b,c; 3a,b,c; 4a Unprotected
27.	Grand Lac de Port-Biehl	42°50'N	0°11'E	16.5 ha	2a,b; 3a,b,c; 4a Within the Parc National des Pyrénées occidentales
28.	Ruisseau d'Estaragne	42°44'N	0°09'E	c.4-5 km in length	2a,b; 3a,b,c; 4a Within the peripheral zone of the Parc National des Pyrénées occidentales

# FRANCE



## DETAILS OF LISTED AREAS

### 12. CAMARGUE

**Criteria for inclusion** 1a,b,c,d,e; 2a,b; 3a,b,c; 4a.

**Geographical location** 43°20'–43°35'N 4°15'–4°50'E. Delta of the river Rhône, which divides just north of Arles into the Grand Rhone and Petit Rhône, between which lies the Camargue. A sector known as the Petit Camargue lies west of the Petit Rhône, to the south-east of a line drawn from the town of St. Gilles through Aigues Mortes to the sea.

**Area** About 142,500 ha.

**Altitude** Sea level to 4 m, except that the highest dunes in the Petit Camargue and the Beauduc area rise to 9 m and 7 m, respectively.

**Water depth** Average depth 0.4–0.6 m with a maximum of 1.8 m in some of the étangs.

**Wetland types** 5, 7, 9, 11, 12, 23, 24, 25.

**Ecology** There is a natural succession of varied habitats, through five main types: (1) shore, (2) dunes, (3) low-lying salt-steppe ('sansouire') with brackish pools, (4) upper 'sansouire' with freshwater marshes and (5) riverine forest.

(1) The chief feature of the **Shore** zone is a beach of fine sand stretching for nearly 100 km from Grau-du-Roi near Aigues Mortes to Fos-sur-Mer near Port-de-Bouc, and in places several hundred metres wide. The inshore waters are fairly shallow, especially in the Golfe de Beauduc, in the centre, and are an important feeding area for the gulls and terns Laridae nesting in zone (3). Kentish Plover *Charadrius alexandrinus* and Oystercatcher *Haematopus ostralegus* nest along the beach.

(2) The **Dune** zone borders the greater part of the shore and is generally about 100 m wide but in the Petit Camargue extends several kilometres inland. Its dominant vegetation is marram *Ammophila arenaria* and sea medick *Medicago marina* but there is also a rich herbaceous flora at its best in May and June and damp hollows with rainwater pools persist for part of the year. Stands of stone pine *Pinus pinea* in the Petit Camargue sector have an undergrowth of such species as Mediterranean mezereon *Daphne gnidium*, sage-leaved cistus *Cistus salvifolius*, *Asphodelus cerasifer* and *Rosmarinus officinalis*.

Insect life is plentiful, particularly Coleoptera (beetles), burrowing Hymenoptera (ants, bees, wasps) and Orthoptera (grasshoppers), the latter providing food for several Laridae such as the Gull-billed Tern *Gelochelidon nilotica*. The reptiles and amphibians of the zone are also noteworthy and include the Ladder Snake *Elaphe scalaris*, the Western Spadefoot Frog *Pelobates cultripes*, Spanish Sand Lizard *Psammodromus hispanicus* and, only in Petit Camargue, the Green Lizard *Lacerta viridis*.

(3) The **low-lying 'sansouire'** zone consists mainly of saline flats, often partially flooded after autumn or winter rains. The dominant plants are glassworts *Arthrocnemum* and *Salicornia* and brackish pools, some of them permanent and often linked by channels, are widespread. In the heart of the zone, at the southern end of the Etang de Vaccarès, the biggest lake of the Camargue and within the strict Reserve, a ridge of old dunes, the 'Bois de Rièges' supports a magnificent and relatively undisturbed cover of *Juniperus phoenicea* and *Pistacia lentiscus* (Mastic-tree). Part of the zone has, however, been transformed into operational salt-pans.

In the more open parts of the zone, particularly the salt pans and saline lagoons, breeding birds include the Greater Flamingo *Phoenicopterus ruber* (up to 6,000 pairs), a small colony (up to 20 pairs) of Slender-billed Gull *Larus genei*, Black-headed Gull *L. ridibundus*, sometimes a few pairs of Mediterranean Gull *L. melanocephalus*, Herring Gull *L. argentatus*, Gull-billed Tern *Gelochelidon nilotica*, Sandwich Tern *Sterna sandvicensis*, Common Tern *S. hirundo* and Little Tern *S. albifrons*. Other characteristic breeding species are Shelduck *Tadorna tadorna*, Mallard *Anas platyrhynchos*, Gadwall *A. strepera*, Red-crested Pochard *Netta rufina*, Black-winged Stilt *Himantopus himantopus* and Avocet *Recurvirostra avo-setta*. Cormorants frequent the lagoons (in which about 7 freshwater species and 15 saltwater species of fish occur) from autumn to spring and numerous waders stop here on both migrations to feed along the muddy shores.

(4) The upper 'salsouire' zone comprises drier steppe of which only some lower parts are flooded in winter. The *Salicornia* gives way to a more varied vegetation on the less saline soils, dominated by sea lavender *Limonium (Statice)* spp., a false-brome grass *Brachypodium phoenicoides* and *Phillyrea angustifolia*. The artificial drainage channels are often fringed with *Tamarix gallica*, which is generally found in association with the slightly brackish pools scattered through the zone. This is the main area in which the cattle (chiefly for bull-fighting purposes) and semi-wild horses have been introduced in large numbers and where on the higher ground large flocks of sheep are also grazed from September to May. Substantial areas have also been put under cultivation for rice, maize, wheat and vines and, recently, fish-farming has become an established activity.

Reptiles and amphibians of the zone include, in addition to the *Lacerta viridis* and *Elaphe scalaris* of zone (2), the Ocellated Lizard *Lacerta lepida*, Wall Lizard *L. (=Podarcis) muralis*, Three-toed Skink *Chalcides chalcides*, Montpellier Snake *Malpolon monspessulanus*, Grass Snake *Natrix natrix*, Viperine Snake *N. maura* and Southern Smooth Snake *Coronella girondica*. The mammals include Rabbit *Oryctolagus cuniculus*, Red Fox *Vulpes vulpes*, Badger *Meles meles*, Weasel *Mustela nivalis* and Wild Boar *Sus scrofa* and the breeding birds Lapwing *Vanellus vanellus*, Stone Curlew *Burhinus oediacnemus* and (nowadays rare) Collared Pratincole *Glareola pratincola*.

However, the habitat in zone (4) of the greatest importance for waterfowl is the open marsh and freshwater lakes. These have a submerged vegetation of spiked water milfoil *Myriophyllum spicatum* and fennel pondweed *Potamogeton pectinatus*, with tassel pondweed *Ruppia spiralis* in the more brackish waters. They are also fringed with rushes and reeds *Scirpus* and *Phragmites* and the fresher waters support good populations of Western Spadefoot Frog *Pelobates cultripes*, Common Tree Frog *Hyla arborea* and Marsh Frog *Rana ridibunda*. The birds nesting in and around the marshes include Bittern *Botaurus stellaris*, Little Bittern *Ixobrychus minutus*, Purple Heron *Ardea purpurea* (285 pairs in 1979), Grey Heron *A. cinerea* (over 300 pairs, 1979), Coot *Fulica atra*, Moorhen *Gallinula chloropus*, Water Rail *Rallus aquaticus* and one or more of the smaller crakes *Porzana* spp. Similarly dense stands of trees scattered over a wide area also support a few mixed colonies of Night Herons *Nycticorax nycticorax* (642 pairs in 1979), Squacco Heron *Ardeola ralloides* (nearly 100 pairs, 1979), Cattle Egret *Bulbulcus ibis*, which have built up to 323 pairs (1979) having first colonized the area at the end of the 1960s, and Little Egret *Egretta garzetta* (1,335 pairs in 1979). Three breeding species present, which in western Europe tend to have a more southerly range, are the Great Spotted Cuckoo *Clamator glandarius*, European Bee-eater *Merops apiaster* and Roller *Coracias garrulus*, while the Marsh Harrier *Circus aeruginosus* is the commonest raptor.

In winter this zone of the Camargue teems with ducks and coots. They total about 150,000 and the most numerous species are Mallard *Anas platyrhynchos* (January max. 45,000 in 1965), Gadwall *A. strepera* (Jan. max. 13,500, 1973), Wigeon *A. penelope* (Jan. max. 26,500, 1976), Teal *A. crecca* (Jan. max. 55,000, 1973), Red-crested Pochard *Netta rufina* (Jan. max. 5,500, 1975), Tufted Duck *Aythya fuligula* (Jan. max. 7,500, 1972), Pochard *A. ferina* (Jan. max. 20,000, 1974) and Coot *Fulica atra* (Jan. max. 41,000, 1972).\*

(5) The riverine forest zone, which fringes the two great branches of the Rhône and occasional stretches of other channels, is composed of poplar *Populus alba*, willow *Salix alba*, alder *Alnus glutinosa*, ash *Fraxinus oxycarpa* and, on sections of bank less liable to flooding, white oak *Quercus pubescens*. There is often a dense shrubby undergrowth and the habitat as a whole provides a home for the Beaver *Castor fiber*, which has managed to survive on the lower Rhône and its tributaries, and unfortunately also for the Coypu *Myocaster coypus*, which has been introduced and become numerous in freshwater areas.

**Legal status** The Regional Park of the Camargue was set up by a law of 1973 and embraces almost the whole delta zone between the Grand and Petit Rhône. Its purpose is to maintain a balance between the wild areas and traditional land use practices of the region. The Réserve de la Camargue is a strict nature reserve, dating from 1928 and now within the park. It includes most of the Etang de Vaccarès, and its islands, with the Bois de Rièges, and some other adjacent areas. It is not open to the public.

**Tenure** Central government ownership of the Reserve. Regional authority (Département) ownership of what was originally classified as 'hunting reserve' but now presumably forms part of the Regional Park (see also the description of the Camargue in the World Directory of National Parks and other Protected Areas, IUCN, 1977).

**Management practices** These are confined to maintaining all the important ecosystems of the Reserve. Thus an artificial island was constructed to attract Flamingos and provide them with a safe and secure nesting site, and has proved a great success. Another measure which has had to be taken is to reduce the population of Herring Gulls *Larus argentatus*, which had increased out of all proportion and predation by which was seriously affecting the breeding success of several other species.

**Threats** Intermittent air pollution from the industrial complexes around the Salin de Giraud and Fos-sur-Mer may well be one and pollution carried by the Rhône and irrigation canals into cultivated areas is certainly another. The water draining from such areas into the Etang de Vaccarès, is changing the brackish character and other features of the ecosystems of that lake, and may also introduce toxic agricultural chemicals. Hunting pressure has been reported to be locally destructive from time to time.

**Scientific research** Several groups from ORSTOM, the Institut Pasteur, the Faculty of Science of Marseille, the Faculties of Science and Medicine of Montpellier, and the CNRS, have undertaken research programmes. Most of the recent research work has been carried out by the Centre Ecologique de la Camargue (a CNRS Laboratory, which specializes in hydrology, botany and the enumeration and feeding ecology of the waterfowl); and the Station biologique de la Tour du Valat

\* The figures are quoted by kind permission of Mr. A. Tamisier of the Centre d'écologie, CNRS Laboratory, le Sambuc, Camargue.

## FRANCE

(a privately run institution, established in 1954 and transferred to the ownership of the 'Fondation Sansouire' in 1978). Both are near le Sambuc, 24 km south-south-east of Arles. The Tour du Valat programme specializes in the wetland conservation and management problems of the whole Mediterranean basin, but currently (1980) is concentrating on the ecological needs, protection and habitat management of Camargue bird communities. The three main sections of this research concern avian ecology; wetland classification including the detailed study of plants, invertebrates, fish and amphibia; and the impact of herbivorous mammals on wetland vegetation together with its management implications. Several universities have collaborated in basic studies of the last-mentioned topic, with special reference to the social structure and population dynamics of the Camargue's famous herd of feral horses.

Finally, from the limnological point of view the sites that have been best studied are the Cerisières ponds, the St. Seren, Relongues and Baisse Salée marshes and the Fornelet, Vaccarès and half a dozen smaller étangs.

### Principal reference material

- Hoffman, L., 1958. An ecological sketch of the Camargue. *British Birds* 51(a): 321–350. (Many references to geophysical, botanical and zoological literature).
- Luther, H. & Rzoska, J. 1971. *Project AQUA*, a source book of inland waters proposed for conservation, IBP Handbook No. 21/IUCN Occasional Paper Blackwell Scientific Publications, Oxford. (Includes a long list of limnological references).
- Biber, O. 1975. *Compte Rendu d'Activité de la Station Biologique de la Tour du Valat*, pp. 16–53. This publication contains a complete bibliography of the Camargue.

## 24. LAC PAVIN

**Criteria for inclusion** 2a,b,c; 3b,c; 4a.

**Geographical location** 45°30'N 2°53'E. Near to Besse en Chandesse, Department of Puy de Dôme, Auvergne.

**Area** 44 ha.

**Altitude** 1,197 m.

**Water depth** Maximum 92 m; mean 52.2 m.

**Wetland type** 19.

**Ecology** The lake occupies the former crater of a volcano whose cone collapsed following an explosive eruption. Its waters originate from springs flowing from a considerable depth and therefore free from pollution. There is a thermal inversion at a deep level and the hypolimnion is very stable and unusually rich in silica and iron and also in hydrogen sulphide. The site is particularly noted for a formation of diatomaceous sediment. Fish species include trout, char and crayfish, all of which have been present for a considerable period and maintain a balanced population.

**Legal status** Property of Besse commune but unprotected.

**Tenure** Communal ownership.

**Management practices** The fishing rights are leased to private developers together

with the tourist development. The site is very attractive and is a noted tourist spot.

**Threats** Facilities for visitors are already quite well developed and it is to be hoped that further development will be kept within strict limits. There is a risk that more fish species may be introduced, which could have adverse consequences.

**Scientific research** The fish population is of particular interest since the introductions are of long standing. Earlier studies dating from the beginning of the century were mainly descriptive but since 1939 a series of limnological monographs has been published.

**Principal reference material**

Pelletier, J. P. 1968. Un lac méromictique, le Pavin (Auvergne). *Annls. Stn. biol. Besse*. 3: 147–170.

## 27. GRAND LAC DE PORT-BIELH

**Criteria for inclusion** 2a,b; 3a,b,c; 4a.

**Geographical location** 42°50'N 0°11'E in the Néouvielle massif of the central Pyrenees, Commune of Vielle-Aure, Hautes Pyrénées.

**Area** 16.5 ha.

**Altitude** 2,285 m.

**Water depth** Maximum 19 m; mean 9 m.

**Wetland type** 19.

**Ecology** A high mountain lake of glacial origin, which maintains an ice cover for 7 months of the year, this being from 2.5 to 3 m in thickness in April. After the ice thaws at the end of June, the water temperature rises rapidly during July and August to a maximum of 14°C. Thermal stratification is apparent shortly after the thaw but has disappeared by September. Ice formation occurs once more by the end of November. The waters are very transparent with a high pH, sometimes over 9, and oligotrophic, only very small amounts of phosphate, nitrate and silica being present. Fish include Brown Trout *Salmo trutta*.

**Legal status** Within the Parc National des Pyrénées.

**Tenure** Property of the Commune.

**Management practices** Fishing is permitted.

**Threats** No information.

**Scientific research** Of particular interest as a typical high mountain lake. It was the subject of intensive study during the International Biological Programme.

**Principal reference material**

Capblancq, J. & Laville, H. 1972. Etude de la productivité du lac de Port-Bielh, Pyrénées centrales. In *Productivity Problems of Freshwaters* (eds Z. Kajak and A. Hillbricht-Ilkowska) pp. 73–88. Warsaw-Krakow.



# GERMAN DEMOCRATIC REPUBLIC

## SUMMARY OF WETLAND SITUATION

Particularly since the latter part of the 1960s, the wetlands of international and national importance, of which there are a large number, have been very well studied. Detailed descriptions of many sites are now obtainable from the Zentrale für Wasservogelforschung der DDR (the Bureau for Waterfowl Research), which is based at the Pädagogische Hochschule 'Karl Liebknecht', 15 Potsdam-Sanssouci. The DDR acceded to the Ramsar Convention on 31 July 1978 and nominated 8 sites for the Convention list. One of these has two distinct sectors, so that 9 entries in the checklist which follows this Summary, are marked with asterisks as 'Ramsar sites'.

The Baltic coast areas of the Rostock District from the Wismarbucht to Stralsund and the island of Rügen are of great importance to breeding, migrating and wintering waterfowl. Apart from the Wismarbucht itself, the areas of special interest are the peninsula and islands of Dierhagen, Darss and Zingst, the bays of Saaler Bodden and Der Grabow which they enclose, the vicinity of Stralsund, and the waters around Rügen and Hiddensee islands, including parts of the Greifswalder Bodden to the south-east. Mallard *Anas platyrhynchos* (13,376, Dec. 1976), Tufted Duck *Aythya fuligula* (17,198, Dec. 1976), Scaup *A. marila* (7,581, March 1976), Long-tailed Duck *Clangula hyemalis* (1,558, Nov. 1974) and Goldeneye *Bucephala clangula* (8,728, March 1976) are the most numerous of the wintering ducks. The area is also of importance to wintering 'sawbills' *Mergus* spp., Coot *Fulica atra*, Mute Swans *Cygnus olor* (of which over 7,000 were counted in Jan. 1974) and Whooper Swans *C. cygnus* (at least 500 in most winters); in September/October the island of Rügen itself is a concentration area for Cranes *Grus grus* which have nested in Scandinavia.

Moving inland to the Schwerin and Neubrandenburg districts, one finds many lake complexes with suitable breeding conditions for such Anatidae as *Cygnus olor*, Greylag Goose *Anser anser*, *Anas platyrhynchos*, *Aythya fuligula*, Red-crested Pochard *Netta rufina* and, in small numbers, Goosander *Mergus merganser*. They also support considerable autumn and winter concentrations of White-fronted Goose *Anser albifrons* and Bean Goose *A. fabalis*. The Müritz lake area south-south-east of Rostock, besides being of particular limnological interest is another concentration area for *Grus grus* in autumn. Apart from Müritz, other outstanding wetlands of the two districts include the Lewitz Fishponds south of Schwerin city, the Krakower Obersee and Plauer See a further 40 km to the east, Tollense See close to Neubrandenburg city and the Galenbecker Seen to the north-east of it.

Approaching Berlin the long and complex waterways of the Havel River and Lakes in the Potsdam district are important for wintering *Anas platyrhynchos* and *Fulica atra* and are frequented by flocks of *Anser albifrons* and *A. fabalis* in autumn and late winter, which sometimes stay if the winter is mild. The sewage farms (Rieselfelder) on the outskirts of the city attract large numbers of migrating waders Limicolae in season, while on the western border of the district one of the main research centres of the Zentrale für Wasservogelforschung is the Gülper see.

To the east of Berlin the two most valuable wetlands of the Frankfurt district

are the Untere Odertal and Oderbruch, both of which have some excellent breeding habitat for waterfowl. They also provide wintering grounds for geese, principally *Anser fabalis*.

Of the more southerly districts, Halle is of importance for wintering Mallard *Anas platyrhynchos*; a count in December 1973, when the weather was mild, produced the exceptionally high figure of over 40,000. The margins of the Berga-Kelbra reservoir, to the south of the Harz mountains, offer some suitable habitats for migrating waders. In the neighbouring Leipzig district abandoned opencast mine-pits at Witznitz, the Torgau Grossteich in the north-east and the Wildenhainer Bruch/Zadlitzbruch areas are known to support breeding populations of several species, the last-mentioned also being important as a winter roost of *Anser fabalis*. Still further to the north-east, in the Cottbus district, the ponds known as the Peitzerteiche are reported to be much used as a staging post by migrating waders. The same probably applies to the pond area of Königswartha in the vicinity of Bautzen, Ober Lausitz region, which also has its own rich and varied avifauna.

Many of the inland wetlands of the German Democratic Republic are of economic importance for fish-culture and for raising domestic ducks. The consequent increased eutrophication of such sites and its ecological effects are currently under study. Publications concerning waterfowl research are regularly listed in the bulletins (Mitteilungen und Berichte) of the Zentrale für die Wasservogelforschung der DDR. There is also a considerable literature on limnological aspects of the East German wetlands, including many interesting papers in such journals as *Limnologica* and *Wiss. Z. Karl-Marx-Univ. of Leipzig*.

## WETLANDS OF INTERNATIONAL IMPORTANCE

### \*Nominated for inclusion in the Ramsar Convention list

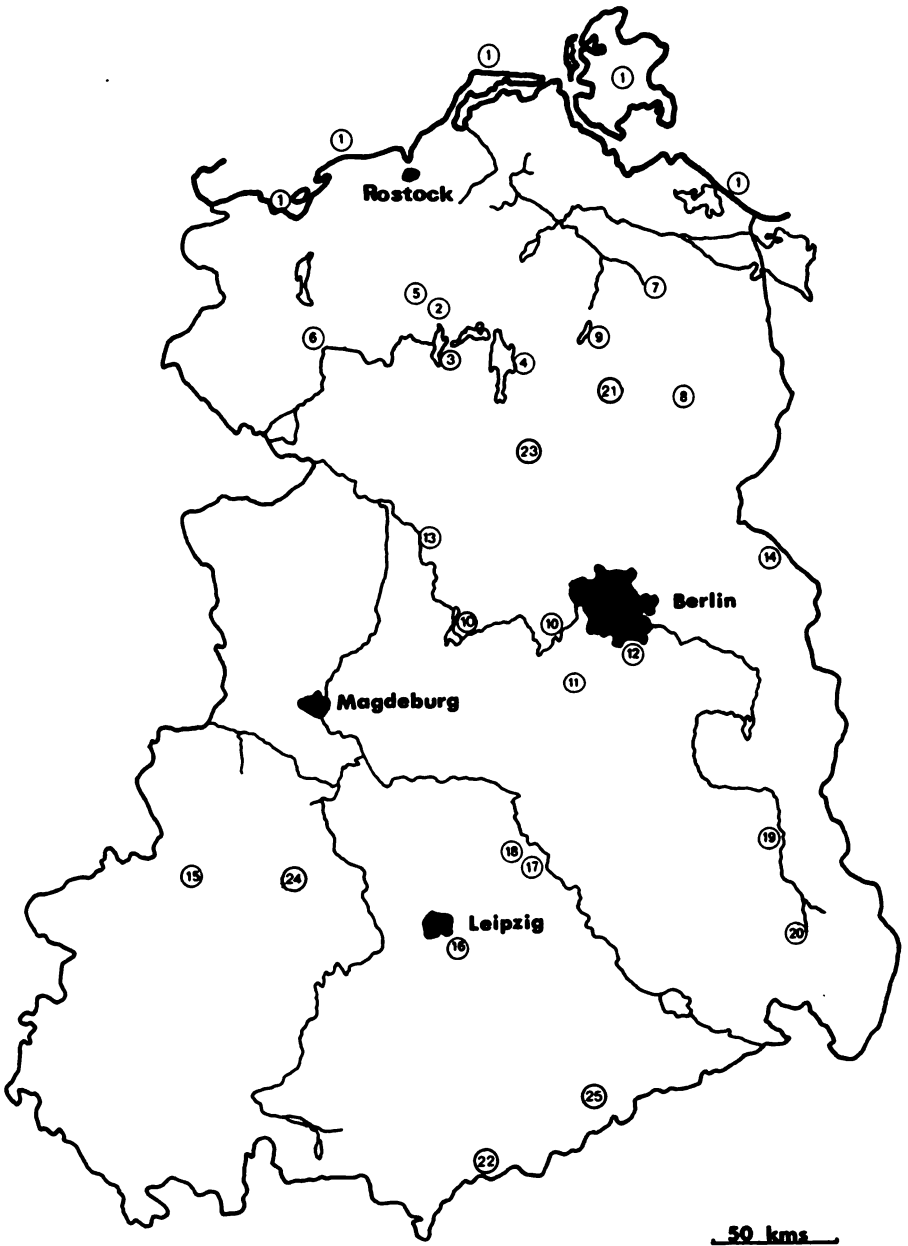
	Locality	Latitude	Longitude	Size	Wetland criteria/ Conservation status
1.	Baltic Sea Coast			c.145,000 ha	1a,b,c,d,e; 2a,b; 3a,b,c Mostly unprotected
	Rostock district				
*1.1	Coast and coastal waters from Wismarbucht to Stralsund, including the peninsula of Dierhagen-Darss, the island of Zingst, and the enclosed bays of Saaler Bodden and Der Grabow	53°55'– 54°29'N	11°13'– 13°06'E		Partly protected 24,800 ha of the two sectors are included in the Ramsar Convention list
*1.2	The islands of Rügen and the Hiddensee, with their inland and coastal waters, including parts of the Greifswalder Bodden	54°11'–41'N	13°00'–55'E		

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	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
<b>Inland Sites</b>					
<b>Schwerin and Neubrandenburg districts</b>					
*2.	Krakower Obersee	53°37'N	12°18'E	1,500 ha	1a,d,e; 2a; 3a,b Partly protected 870 ha Landscape Reserve; whole area Ramsar Convention site
3.	Plauer See	53°28'N	12°19'E	c.40,000 ha	1a Conservation status uncertain
*4.	Müritz See	53°25'N	12°42'E	117,000 ha	1a,d,e; 2a; 3a,b Partly protected Bird Sanctuary; Project AQUA site: 5,800 ha of E. shore Ramsar Convention site
5.	Bolzer See	53°41'	12°00'E	110 ha	1a; 2a; 3b Partly protected
6.	Lewitz Fischteiche (fishponds)	c.53°30'N	11°35'E	920 ha	1a,b,e; 2a; 3b Partly protected
*7.	Putzarer See/ Landgraben Niederung and Galenbecker See/ Friedlander Grosse Wiesen	53°42'N	13°40'E	c.12,000 ha	1a,b,c,d,e; 2a; 3a,b,c Partly protected 1,015 ha nature reserve; Project AQUA site; 1,400 ha Galenbeckersee Ramsar Convention site
8.	Unterueckersee	53°15'N	13°50'E	1,900 ha	1a; 2a; 3b Unprotected
9.	Tollense See and Lieps	53°30'N	13°14'E	2,351 ha	1a,c,d,e; 2a; 3b,c Partly protected
<b>Potsdam district</b>					
*10.	Havel Seen and Havel River	c.52°20'N	12°15'– 13°00'E	3,000 ha	1b,e; 2a; 3b Partly protected With area 13 forms a 7,600 ha Ramsar Convention site
11.	Blanken und Grössen Seen	52°15'N	13°08'E	750 ha	1a,e; 2a,b; 3b,c Unprotected
12.	Rieselfelder Berlin	c.52°23'N	13°20'E	15,000 ha	1a; 2b; 3b Unprotected
*13.	Gülper See	52°45'N	12°16'E	c.1,200 ha	2a; 3a,b,c Protected See No. 10 above
<b>Frankfurt district</b>					
*14.	Odertal und Oder Bruch	52°42'– 53°04'N	14°15'–20'E	5,700 ha	1a,b,c,d,e; 2a; 3a,b,c Ramsar Convention site

GERMAN DEMOCRATIC REPUBLIC					
	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
<b>Halle district</b>					
*15.	Reservoir Berga-Kelbra	51°25'N	11°02'E	1,430 ha	1b; 3b 800 ha Ramsar Convention site
<b>Leipzig district</b>					
16.	Opencast mine-pits Witznitz	51°09'N	12°29'E	150 ha	1a; 3b Unprotected
17.	Torgau Grossteich	51°30'N	13°00'E	325 ha	1a,c,d,e; 2a; 3b Unprotected
18.	Wildenhainer Bruch and Zadlitzbruch	51°33'N	12°46'E	338 ha	1a,c,d; 2a; 3a,b,c Protected
<b>Cottbus district</b>					
*19.	Peitzer Teiche	51°52'N	14°25'E	750 ha	1e; 2a; 3a,b,c Unprotected
<b>Ober Lausitz region, near Bautzen</b>					
20.	Pond area of Königswartha	51°19'N	14°20'E	500 ha	1d,e; 2a; 3b Unprotected
<b>Sites of limnological interest</b>					
21.	Schmaler Luzin	53°21'N	13°27'E	340 ha	2a; 3b Protected (Nature Reserve)
22.	Grosser Kranichsee	50°26'N	12°36'E	293 ha	1d,e; 2a; 3b Protected (Nature Reserve)
23.	Grosser Stechlin-See	53°07'N	12°53'E	1,774 ha	2a,c; 3b Protected (Nature Reserve)
24.	Süsser See	51°30'N	11°40'E	c.650 ha	1d; 2c; 3b Partly protected (Nature Reserve 52 ha)
25.	Saidenbach Reservoir	50°44'N	13°14'E	146 ha	2c; 3b Partly protected (State-owned water supply)

# GERMAN DEMOCRATIC REPUBLIC



## DETAILS OF LISTED AREAS

### 4. MÜRITZ SEE

**Criteria for inclusion** 1a,d,e; 2a; 3a,b.

**Geographical location** 53°25'N 12°42'W, about 80 km SSE of Rostock and immediately south of Waren, Neubrandenburg district, North German Plain.

**Area** 117,000 ha.

**Altitude** 63 m.

**Water depth** Maximum 20 m.

**Wetland types** 18.

**Ecology** The largest inland lake of northern Germany occupying a glacial basin in the ground moraine left by the Weichsel glaciation. It is of great national importance for both ornithological and limnological studies. The water is eutrophic. Birds breeding in the area include Mute Swan *Cygnus olor*, Greylag Goose *Anser anser*, Mallard *Anas platyrhynchos*, Tufted Duck *Aythya fuligula* and Red-crested Pochard *Netta rufina*. Autumn concentrations of Cranes *Grus grus* are of particular interest.

**Legal status** Partly protected. Landscape reserve established 15.4.1962. An area of 5,000 ha along the eastern shore has been nominated for the Ramsar Convention list.

**Tenure** No information.

**Management practices** Used for recreational purposes and for fishing.

**Threats** Discharge of sewage effluent into lake leading to increasing eutrophication.

**Scientific research** Important for limnological and ornithological studies, especially of crane migrations. These have been undertaken by several different biological stations in the vicinity.

**Principal reference material**  
Not listed.

### 7. PUTZARER SEE/GALENBECKER SEE COMPLEX

**Criteria for inclusion** 1a,b,c,d,e; 2a; 3a,b,c.

**Geographical location** 53°42'N 13°40'E, headwaters of the Landgraben and Zarrow rivers, due south of Anklam.

**Area** c. 12,000 ha.

**Altitude** 10 m.

**Water depth** Maximum 2 m; mean 1 m.

**Wetland types** 18.

**Ecology** Residual lakes lying in a basin formed by glacial retreat and now in the process of being infilled by natural colonization. The waters are shallow and extremely eutrophic. A nature reserve which covers 1,015 ha of the wetland, is an

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outstanding bird sanctuary, noted for its breeding population of Mute Swans *Cygnus olor*, and as an important stopping-place for migrants. Rare plant species include Bird's-eye Primrose *Primula farinosa*. Carp have been introduced, presumably of the species *Cyprinus carpio*.

**Legal status** State Nature Reserve. The 1,400 ha Gallenbecker See has been nominated for the Ramsar Convention list.

**Tenure** State ownership.

**Management practices** Intensive carp fishery; some recreational use; facilities for bird observation.

**Scientific research** Ornithological, limnological and vegetation studies have been and continue to be undertaken.

**Principal reference material**

Not listed.

# FEDERAL REPUBLIC OF GERMANY

## SUMMARY OF WETLAND SITUATION

There are more than 30 wetlands of international importance as waterfowl habitat in the German Federal Republic. Many of them comprise a large number of sites of great interest. This is especially the case in the northern part of the country and along the shores of the North Sea and the Baltic as they are on the main migration route of waterfowl which winter in the Netherlands, Great Britain, Ireland and thence south along the Atlantic coast. The Waddensea (Wattenmeer; No. 1 on the checklist), which West Germany shares with the Netherlands and Denmark, is certainly the biggest and most important wetland for migrating waterfowl in western Europe. In the FRG sector fairly extensive areas have been set aside as nature reserves, including some small islands and parts of some larger ones, to form the 'Wattenmeer National Park'.

Along the lower course of the Elbe River (Niederelbe; No. 4 on the list) several sites are of value to migrating and roosting Bewick's Swans *Cygnus columbianus bewickii*, Barnacle Geese *Branta leucopsis* and White-fronted Geese *Anser albifrons*, which in mild winters often prolong their stay. These sites are greatly threatened by industrial development which is tending to spread along the river downstream from Hamburg.

Several sites in the north also have importance for moulting waterfowl. The best known is Knechtsand (1.02.01 in the checklist which follows), where tens of thousands of Shelduck *Tadorna tadorna* concentrate in August. The Selenter See (3.02) on the Ostholsteinische Seenplatte is a traditional moulting area for Tufted Duck *Aythya fuligula* and Great Crested Grebes *Podiceps cristatus*. To the south-west of Hamburg, the Dümmer and Diepholzer Moorniederung (Nos. 10 and 11), although much affected by human activities (peat digging, farming), are of considerable geological interest and still offer suitable nesting and feeding sites for waterfowl. The Rieselfelder (sewage farms) near Münster (17) attract large numbers of migrant waders, while the reservoirs on the rivers Ruhr (19) and Möhne (20) provide winter quarters for hordes of diving ducks and coots. The Rhine valley as a whole has favourable conditions in winter and spring for wintering and migrating waterfowl: flocks of Bean Geese *Anser fabalis* frequent areas near the border with the Netherlands and, at the opposite extreme, along the higher reaches from Kehl, across the river from Strasbourg, south to Lörrach, in the same position vis-à-vis Basel, great numbers of duck can be found wintering.

In the south, the Bodensee (Lake Constance) is not only of great limnological interest but also attracts huge numbers of wintering waterfowl, since it only partly freezes over. Up to 200,000 ducks alone can be present during the cold season. The lake is also used extensively by moulting Pochard *Aythya ferina* and Red-crested Pochard *Netta rufina*. Another important wintering area for waterfowl is the Ismaninger Reservoir (31) just outside München on the north-east. Indeed all the reservoirs along the Inn valley and to the east and south of München up to the border with Austria, are attracting increasing numbers of breeding and wintering waterfowl.

A few other sites calling for special mention because of their combination of



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geological, botanical and waterfowl interest, are NSG Heiliges Meer (18) (Nordrhein-Westphalen), Mohrweiher am Moorhof (36) (Bayern) and the Würzacher Ried (37) and Federsee (25) (Baden-Württemberg). Finally, the Donauauen and Donaustauseen (27, 28) (Bayern and Baden-Württemberg), comprising the complex of Danubian reservoirs and swamplands, provide many ducks, grebes and other waterfowl with suitable feeding grounds in winter and nesting places in spring and summer. The riverine forest in this area is one of the last remaining examples of this kind of vegetation outside the upper Rhine valley.

The Federal Republic of Germany ratified the Ramsar Convention on 26th February 1976. Seventeen areas have so far been entered in the schedule to the Convention and are marked with an asterisk in the checklist which follows. A further seventeen sites, considered in the 'Project AQUA' handbook (No. 21) of the International Biological Programme to have a high degree of limnological interest, are also listed. An excellent study of the Wetlands of International Importance by K. Haarmann and P. Pretscher was published in 1976, entitled *Die Feuchtgebiete internationaler Bedeutung in der Bundesrepublik Deutschland* (Kilda Verlag, D-4402 Greven).

WETLANDS OF INTERNATIONAL IMPORTANCE

\* Nominated for inclusion in the Ramsar Convention list

	Locality	Latitude	Longitude	Size	Wetland criteria/ Conservation status
1.	Wattenmeer (Waddensea)			c.394,000 ha (Listed sites total 221,911 ha)	1a,b,c,d,e; 2a,b; 3a,b,c; 4a
1.01	Nordfriesisches Wattenmeer			c.12,341 ha	
1.01.01	Rantum-Becken	54°48'N	8°19'E	560 ha	Protected
1.01.02	Rodenäs Vorland	54°53'N	8°42'E	525 ha	Protected
1.01.03	Hauke-Haien-Koog			546 ha	Protected
1.01.04	Hamburger Hallig	54°36'N	8°49'E	801 ha	Protected
1.01.05	Nordstrander Damm	c.53°40'N	7°00'E	875 ha	Protected
1.01.06	Westerhever Vorländereien	c.54°23'N	8°38'E	2,131 ha	Protected
1.01.07	St. Peter-Ording/ Süderhöft	c.54°25'N	9°06'E	525 ha	Unprotected
1.01.08	Grüne Insel	c.54°17'N	8°54'E	486 ha	Unprotected
1.01.09	Karolinenkoog Vorländereien	c.54°17'N	8°58'E	127 ha	Unprotected
1.01.10	Hedwigenkoog/ Heringsand Vorländereien	c.54°11'N	8°51'E	c.200 ha	Unprotected
1.01.11	Trischen	c.54°04'N	8°40'E	c.962 ha	Unprotected
1.01.12	Blauort & Tertius Sände	c.54°05'N	8°05'E	c.643 ha	Unprotected
1.01.13	Meldorfer Bucht	c.54°05'N	9°05'E	1,534 ha	Unprotected
1.01.14	Dieksander-, Kaiser Wilhelm- und Neufelder-Koog Vorländereien	c.53°59'N	8°55'E	c.2,426 ha	Unprotected
*1.02	Elbe-Weser triangle			38,460 ha (total)	
1.02.01	Knechtsand	c.53°50'N	8°25'E	33,600 ha	Protected (Europareservat)
*1.03	Jadebusen and western side of the Weser rivermouth			49,490 ha (total)	

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	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
1.03.01	Mellumplate	c.53°40'N	8°15'E	3,500 ha	Protected (Europareservat)
1.03.02	Jadebusen and the area to the west enclosed by dikes, incl. Friedrich-Augustgroden	c.53°27'N	8°12'E	c.18,066 ha	Protected (Europareservat)
*1.04	Ostfriesisches Wattenmeer			121,620 ha (total)	
1.04.01	Borkum	c.53°36'N	6°42'E	c.2,700 ha	Partly protected
1.04.02	Memmert	c.53°38'N	6°54'E	c.2,200 ha	Partly protected (Europareservat)
1.04.03	Nordseeküste: Westeraccumersiel – Nessmersiel	c.53°40'N	7°29'E	c.2,000 ha	Unprotected
1.04.04	Elisabeth-Aussengroden	c.53°42'N	7°53'E	c.774 ha	Partly protected
1.04.05	Dollart	c.53°15'N	7°10'E	c.3,980 ha	Partly protected
2.	Ostseeküste (Baltic Sea Coast)			c.79,619 ha (total)	1a,b,c,d,e; 2a,b; 3a,b,c; 4a,b
2.01	Flensburger Aussenförde	54°49'N	9°45'E	8,893 ha	Partly protected
2.02	Schlei und Schleimündung	54°40'N	10°00'E	6,529 ha	250 ha Nature Reserve/Landscape Reserve
2.03	Eckernförder Bucht	54°30'N	10°00'E	11,563 ha	Landscape Reserve
2.04	Kolberger Heide, incl. Barsbecker See	54°27'N	10°20'E	c.5,205 ha	Partly protected
2.05	Hohwacher Bucht	c.54°20'N	10°45'E	c.6,849 ha	Landscape Reserve
2.06	Coastal waters off Heiligenhafen & western Fehmarn	c.54°22'N	10°59'E	c.37,700 ha	Partly protected
2.07	Fishponds of south-western Fehmarn	c.54°28'N	11°08'E	c.220 ha	Landscape Reserve
2.08	Brodtener Ufer	c.53°59'N	10°52'E	c.2,660 ha	Partly protected (landscape reserve)
3.	Ostholsteinische Seenplatte			5,668 ha	1a,b,e; 2a,b,c; 3b,c; 4a
3.01	Dobersdorfer See	54°19'N	10°18'E	303 ha	Landscape Reserve
3.02	Selenter See	54°18'N	10°27'E	2,141 ha	Landscape Reserve
3.03	Selent-Plön fishponds	54°18'N	10°27'E	251 ha	Partly protected
3.04	Grosser Plöner See	54°08'N	10°24'E	2,973 ha	Landscape reserve & small nature reserve
4.	Niederelbe			c.26,322 ha (total)	1a,b,c,d,e; 2a; 3a,b,c; 4a 11,760 ha incl. in Ramsar Convention site
4.01	Elbufer-Störmündung	53°49'N	9°24'E		Unprotected
4.02	Right bank of Elbe: Schulau – Pagensand	53°35'N	9°24'E		Unprotected
4.03	Asseler Sand-Schwarztonnensand	53°42'N	9°27'E		Unprotected
*4.04	Area outside the Elbe dikes round the mouth of the Oste from Otterndorf to Freiburg and Barnkrug	c.53°40'–50'N	9°00'–27'E	11,760 ha	Partly protected (2,600 ha)

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	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criterial Conservation status</i>
*5.	Elbe: Schnackenburg – Lauenburg			7,560 ha (total)	1a,b,c; 3c; 4a
5.01	Elbe: Schnackenburg – Hitzacker	53°03'–09'N	11°03'–34'E	2,836 ha	Mainly landscape reserve
5.02	Elbe: Bleckede – Lauenburg	53°18'–23'N	10°33'–44'E	1,329 ha	Protected
6.	Hunteniederung	53°03'N	8°27'E	4,369 ha	Unprotected
7.	Ostfriesische Meere (Grosses Meer, Hieve, Loppersumer Meer, Uphuser Meer und Bansmeer)	c.53°25'N	7°17'E	7,931 ha	Landscape Reserve
8.	Allermarsch: Schwarmstedt-Westen	c.52°39'N	9°40'E	7,536 ha	50 ha Landscape Reserve
9.	Ostenholzer Moor – Meissendorfer Teiche	52°44'N	9°45'E	3,959 ha	Unprotected
*10.	Dümmer	52°32'N	8°23'E	c.3,600 ha	1b,c,d,e; 2a,b,c; 4a Protected (Europareservat)
*11.	Diepholzer Moorniederung	52°30'–40'N	8°20'–55'E	17,849 ha	1c,d,e; 2a,b; 3a; 4a Partly protected (5,619 ha in Nature and Landscape reserves: 15,060 ha Ramsar Convention site)
12.	Weser Stauseen bei Schlüsselburg und Landesbergen	52°29'N	9°04'E	281 ha	Landscape Reserve
*13.	Steinhuder Meer	52°28'N	9°15'–25'E	5,730 ha	480 ha Nature Reserve; 4,000 ha Landscape Reserve
14.	Riddagshausen – Weddeler Teiche bei Braunschweig	52°16'N	10°34'E	c.665 ha	474 ha Nature Reserve; 176 ha Landscape Reserve; 350 ha Game Reserve (Europareservat)
15.	Niedersächsischer Drömling	52°29'N	11°04'E	c.30,513 ha	40 ha Nature Reserve; 7,200 ha Landscape Reserve
16.	Zwillbrocker Venn & Vredener Wiesen	52°03'N	6°42'E	c.4,127 ha	158 ha Nature Reserve
17.	Rieselfelder bei Münster	51°58'N	7°37'E	c.582 ha	1b,e; 2a,b; 3a,b,c; 4a 22 ha Nature Reserve
18.	Heiliges Meer	52°20'N	7°35'E	544 ha	1d; 2b; 3a,b,c; 4a Protected
19.	Ruhrstauseen: Echthausen – Kettwig			c.924 ha	1b; 3a,c; 4a,b
19.01	Geisecke-See	51°27'N	7°37'E	c.30 ha	Unprotected
19.02	Wickede-See	c.51°30'N	7°45'E	c.194 ha	Unprotected
19.03	Harkort-See	51°24'N	7°25'E	c.204 ha	Unprotected
19.04	Baldeney-See	51°24'N	7°03'E	c.256 ha	Unprotected

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	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criterial Conservation status</i>
19.05	Hengstey-See	51°25'N	7°28'E	c.240 ha	Unprotected
20.	Möhnestausee	51°29'N	8°05'E	c.1,057 ha	1b; 3a,c; 4a,b 224 ha protected
21. 21.01	Unterer Niederrhein Rheinwiesen (Rhine meadows): Bislich- Rees (mit Reesereiland)	51°41'N	6°29'E	c.12,473 ha	1b,e; 2a,b; 4a 223 ha Nature Reserve
21.02	Reeserschanz	51°45'N	6°42'E		c.340 ha Nature Reserve
21.03	Halbinsel Salmorth	51°50'N	6°08'E		Unprotected
21.04	Altrhein Bienen- Praest-Dornick	51°49'N	6°18'E		339 ha protected
21.05	Rheinwiesen: Rees – Dornick (incl. Reeserward claypits)	51°46'N	6°24'E		Unprotected
21.06	Rheinwiesen: Dornick – Emmerich	51°55'N	7°09'E		Unprotected
21.07	Water meadows of the Hetter				Unprotected
21.08	Meadows around Niel, north of Kranenburg	51°49'N	6°01'E		Unprotected
21.09	Rheinwiesen: Emmerich – Hühthum	51°50'N	6°15'E		Unprotected
*22.	Rhein: Eltville – Bingen (Mariannenaue, Rüdesheimer Aue, Fulder Aue, Ilmen- Aue)	49°59'– 50°02'N	7°56'–8°08'E	c.475 ha	1a,b; 2a,c; 4a Protected (Europareservat)
23.	Oberrhein: Lörrach – Kehl	47°39'– 48°28'N	7°32'–7°50'E	c.4,500 ha	1a,b; 2a; 3a,c; 4a
23.01	Rhein: Märkt – Rheinweiler	c.47°39'N	7°32'E	187 ha	Unprotected
23.02	Rhein: Zienken – Hartheim	c.47°50'N	7°35'E	202 ha	Unprotected
23.03	Rhein: Burkheim – Sasbach	c.48°06'N	7°36'E	146 ha	Unprotected
23.04	Rheinstau Weisweil	c.48°12'N	7°41'E	c.35 ha	Unprotected
23.05	Rhein: Weisweil – Kappel	c.48°18'N	7°45'E	c.193 ha	Unprotected
23.06	Former riverbed and riverine forest on the Rhine right bank floodplain; Weisweil – Wittenweiher	c.48°20'N	7°45'E	c.2,657 ha	1,740 ha Landscape Reserve
23.07	Rhein: Kappel – Nonnenweiher	c.48°21'N	7°46'E	94 ha	Unprotected
23.08	Rhein: Nonnenweiher – Meissenheim	c.48°24'N	7°46'E	118 ha	Unprotected
23.09	Rückstaubecken (reservoirs) bei Krafft/Plobsheim (Rhein: Meissenheim – Goldscheuer)	c.48°28'N	7°50'E	212 ha	Unprotected
24. 24.01	Bodensee Konstanzer Bucht	c.47°35'N	9°25'E	c.53,900 ha c.225 ha	1a,b; 2a; 3a,b,c; 4a Landscape Reserve

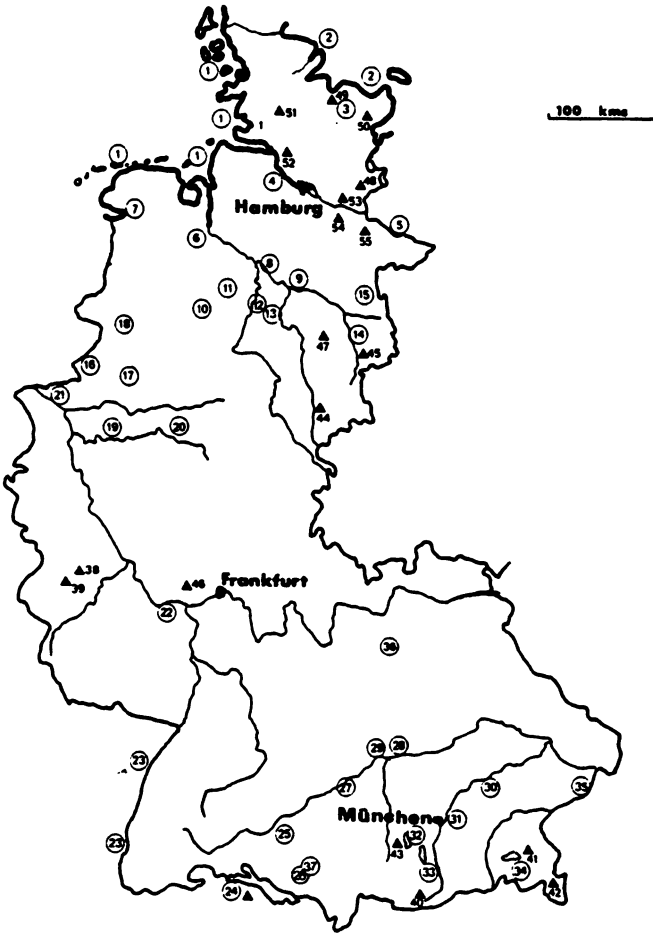
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	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
*24.02	Wollmatinger Ried/ Ermatinger Becken (Untersee) – Giehrenmoos/ Hegnabucht des Gnadensees (Untersee)	c.47°42'N	9°09'E	c.1,087 ha	Protected area 776.8 ha (Europareservat) Ramsar Convention site 1,080 ha, inclusive of site 24.05 below Protected
24.03	Untersee-Ende bei Öhningen	c.47°40'N	8°45'E	164 ha	Protected
24.04	Hornspitze/Untersee – Mündung des Radolfzeller Aach (Zellersee) – Halbinsel Mettnau bei Radolfzell (mit Markelfinger Winkel des Gnadensee und Untersee)	c.47°42'N	9°03'E	818 ha	Protected
*24.05	Mindelsee bei Radolfzell	c.47°45'N	9°01'E	301 ha	Partly protected (see 24.02 above)
24.06	Bays between Mainau island and the mainland	c.47°42'N	9°12'E	63 ha	Protected
24.07	Eriskircher Ried bei Friedrichshafen	c.47°39'N	9°29'E	562 ha	Protected
25.	Federsee	48°05'N	9°38'E	1,402 ha	1c,d,e; 2a,b; 3a,b,c; 4a Protected
26.	Rohrsee	47°52'N	9°50'E	71 ha	Protected
27.	Opfinger Donaustausee	48°17'N	9°48'E	146 ha	Unprotected
28.	Donaustauseen, Donauauen und Donaumoos (Danube reservoirs and swampland)	48°28'–45'N	10°03'– 11°15'E	c.17,360 ha	1a,b,e; 2a; 4a
*28.01	Donaumoore und Donauwiesen	48°28'N	10°03'–26'E	8,000 ha	Partly protected
28.02	Faimingerstausee	48°34'N	10°24'E	210 ha	Unprotected
28.03	Donaumoos und Donauried	48°40'N	11°15'E	c.9,000 ha	Landscape Reserve; small Nature Reserve
*28.04	Bertoldsheimer- stausee	48°44'N	11°03'E	c.150 ha	Grouped with next site in Ramsar Convention list
*29.	Lechstausee bei Feldheim	48°41'N	10°54'E	82 ha	See 28.04 above
30.	Isarstauseen bei Moosburg	48°25'–29'N	11°58'– 12°05'E	320 ha	Unprotected
*31.	Ismaninger Speichersee	48°13'N	11°41'E	c.1,028 ha	1a,b,e; 2a; 3a,b,c; 4a Nature Reserve (900 ha Ramsar Convention site and Europareservat)
*32.	Ammersee	47°56'– 48°06'N	11°08'E	6,517 ha	1a,b; 2a; 3c 2,150 ha Landscape Reserve

## GERMANY, FEDERAL REPUBLIC OF

	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criterial Conservation status</i>
*33.	Starnberger See	47°55'–59'N	11°18'E	c.5,720 ha	1a,b,e; 2a; 3c Landscape Reserve
*34.	Chiemsee	47°49'–56'N	12°21'–33'E	8,500 ha	1a,b; 3c
*35.	Unterer Inn: Haiming – Neuhaus			1,955 ha	1a,b,e; 2a; 3a,c; 4a,b Partly protected Partly protected
35.01	Stausee Egglifing – Obernberg	48°20'N	13°19'E		Partly protected
35.02	Stausee Ering – Frauenstein	48°18'N	13°09'E		Partly protected
35.03	Stausee Schärding – Neuhaus	48°28'N	13°26'E		Partly protected
35.04	Stausee Simbach– Braunau (Salzachmündung)	48°16'N	13°01'E		Partly protected
36.	Mohrweiher bei Erlangen	c.49°36'N	11°01'E	620 ha	1d; 2a; 4a Landscape Reserve
37.	Würzacher Ried	47°55'N	9°53'E	1,300 ha	1c,d,e; 2a; 3a Protected
<b>Other wetlands of international importance, mainly because of their limnological interest</b>					
38.	Totenmaar (Weinfelder Maar)	50°10'–11'N	6°51'–52'E	16.8 ha	Unprotected
39.	Schalkenmehrener Maar	50°10'–11'N	6°51'–52'E	21.6 ha	Unprotected
40.	Osterseen	47°47'N	11°18'E	211 ha	Landscape Reserve
41.	Seeoner Seen (Kloster-, Seileiten-, Brunn- und Griessee)	47°58'N	12°26'E	153 ha	Landscape Reserve
42.	Königsee	47°33'N	12°59'E	517 ha	Nature Reserve
43.	Breitenbach, Rohr– Wiesenbach und Weiherbach	50°40'N	9°15'E		Partly protected
44.	Fuldafluss (source– Gersfeld)	50°27'–30'N	9°55'–57'E		A small part is nature reserve
45.	Adamstal und Rabengrund (groundwater layer)	50°05'N	8°15'E		Unprotected
46.	Weser bei Liebenau (groundwater sounding station)	52°37'N	9°06'E		Unprotected
47.	Schluensee	54°11'N	10°28'E	c.150 ha	Unprotected
48.	Plussee	54°15'N	10°38'E	14.3 ha	Partly protected by its private ownership
49.	Grebner See	54°12'N	10°30'E	128 ha	Unprotected
50.	Kossaufluss	54°12'–18'N	10°24'–38'E		Unprotected
51.	Schöhsee	54°10'N	10°27'E	79 ha	Unprotected
52.	Kleiner Ukleisee	54°09'N	10°28'E	2.5 ha	Landscape Reserve
53.	Garrensee	53°41'N	10°31'E	17.8 ha	Landscape Reserve
54.	Pinnee	53°38'N	10°25'E	8 ha	Landscape Reserve

# FEDERAL REPUBLIC OF GERMANY



## DETAILS OF LISTED AREAS

### 1. WATTENMEER (Waddensea)

**Criteria for inclusion** 1a,b,c,d,e; 2a,b; 3a,b,c; 4a,b.

**Geographical location** 53°27'–54°48'N 7°00'–9°06'E, Niedersachsen. This vast wetland comprises the entire North Sea coastline of the German Federal Republic from the border with Denmark to the border with the Netherlands, situated within the Länder of Schleswig Holstein and Niedersachsen.

**Area** 394,000 ha. (listed sites 221,911 ha.)

**Altitude** Sea level to c. 34 m (highest dunes).

**Water depth** Maximum over 20 m; mean about 3–4 m; tidal variation 1.70–3.50 m.

**Wetland types** 1, 3, 5, 6, 7, 8, 10, 11 and 15.

**Ecology** The natural character of the ecosystem has largely survived. Human intervention has hitherto been largely restricted to construction of sea defences along the mainland coast and on islands and draining of newly-formed marshlands after separating them from the sea by dikes. More recently major projects have been initiated, such as building of dikes in the North-Friesian Waddensea and of an outer harbour at Neuwerk Scharhorn and industrial development along the coast.

Fine mud or coarser sandy sediments are constantly being deposited. The muddy areas are rich in nutrients and provide excellent feeding for Limicolae and other waterfowl; the generally more elevated areas of sand are mainly of importance as roosting places at high tide.

Tidal movements, with in summer the relatively warm temperature of the shallow water and intense ultraviolet radiation and, in winter, rapid formation of ice, together with the complication of a salt content ranging from 22 to 32 per cent, tend to produce the sort of extreme conditions to which only rather specialised animals are adapted. These consist mainly of such bottom fauna as mussels, worms and crabs, although, as the water recedes with the falling tide, more mobile species such as fish and some crabs can and do retreat into the multiplicity of branching creeks so typical of the Wadden or into the sea itself.

The following more important habitat types can be distinguished:

- a) Mudflats (locally with a rich vegetation of eel-grass *Zostera* sp.).
- b) Newly formed land-areas with glasswort *Salicornia herbacea* and the rice grass *Spartina townsendii*.
- c) Sandy beaches and saltings on the seaward side of sea-walls. The beaches often merge into sand-dunes where marram *Ammophila arenaria* and lyme-grass *Elymus arenarius* tend to be dominant. The saltings, which now seldom penetrate inside the sea-walls, having been replaced by pasture and cultivation, are typically composed of a sward of the common saltmarsh grass *Puccinellia maritima*, sea lavender *Limonium vulgare* and sea wormwood *Artemisia maritima*.

The Waddensea is undoubtedly the most important habitat for waterfowl in the Federal Republic of Germany. The islands and the outer side of the sea-walls not only provide sites for numerous seabird colonies, but also feeding grounds both for these colonies and for huge numbers of migrating, moulting, summering and wintering waterfowl coming from Scandinavia, NE Europe and Siberia. During the migration season several million Anatidae, Limicolae and Laridae are present in the area. The Knechtsand and Trischen island, west and north, respectively, of Cuxhaven, are the moulting area of practically the whole European population of Shelduck *Tadorna tadorna*. The area also supports a population of about 2,000 Common Seals *Phoca vitulina* and is rich in fish.

**Legal status** Large parts of the Waddensea, several small islands and parts of the bigger islands are now nature reserves. The most important of them are the 'Nordfriesische Wattenmeer' (140,000 ha) and 'Wattenmeer Knechtsand/Eversand' (32,500 ha). Three sectors (numbered 1.02, 1.03 and 1.04 in the checklist and estimated at 209,570 ha) have been nominated for the Ramsar Convention list.

**Tenure** 80% state owned; 20% privately owned.

**Management practices** To protect rare and vulnerable habitats and species, re-



erves have been created by the State governments concerned and also by private organizations which have purchased land or have promoted other measures to increase and maintain protected areas. Outside the sea-walls the saltmarsh is still often used for grazing sheep, while as previously mentioned most of the land on the inward side of the dikes has been put under pasture or cultivation. Hunting is strictly regulated.

**Threats** Construction of more dikes, particularly in Schleswig Holstein; industrial development, particularly along the Elbe and Weser, near Scharhorn, Wilhelmshaven and Emden; and increasing recreational activities, pollution and other forms of habitat destruction in several areas. Threats from such forms of recreation as fishing, sailing and hunting are, however, less damaging provided that they are properly controlled.

**Scientific research** Zoological, botanical, ecological, geographical, geological, hydrobiological and hydrographical studies are being carried out by the –

- 1) Universities of Kiel, Hamburg and Bremen;
- 2) Senckenberg Institute for Marine Geology and Marine Biology in Wilhelmshaven;
- 3) Institut für Vogelforschung 'Vogelwarte Helgoland', also in Wilhelmshaven, and its field stations on Helgoland and other islands;
- 4) Institute for Marine Research in Bremerhaven;
- 5) Biologische Anstalt Helgoland, in Hamburg, with its field stations on Helgoland and Sylt; and
- 6) State Institute for Fisheries in Hamburg.

Numerous private associations and working groups are active in the field of seabird protection and ornithological studies in general.

**Principal reference material**

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**2. OSTSEEKÜSTE (Baltic Sea Coast)**

**Criteria for inclusion** 1a,b,c,d,e; 2a,b; 3a,b,c; 4a,b.

**Geographical location** 54°20'–40'N 10°00'–45'E, Schleswig Holstein. The area comprises the entire coastline between Flensburg and Lübeck, except for the central section in and around the town of Kiel.

**Area** 79,619 ha.

**Altitude** Sea level to about 0.5 m.

**Water depth** Maximum 28 m; average c. 7 m.

**Wetland types** 5, 6, 7, 11.

**Ecology** Still largely natural. Two types of coastland can be distinguished: the 'fjord-coast' in the north (Flensburger Förde, Schlei, Eckernförder Bucht, Kieler Förde); and the 'bay-coast' in the south, less narrowly indented (Hohwachter Bucht, Fehmarnsund, Lübecker Bucht). In both sectors the waters are shallow, the sand and shingle beaches sometimes steep (e.g. Brodtener Ufer) sometimes almost level (as along the west and north of Fehmarn). The hinterland is intensively used for agriculture and for forestry.

There is little exchange of water with the North Sea and in general this part of the Baltic is no more than brackish, ranging from between 13 and 20 per cent salinity near Kiel to almost fresh in the Förden (especially the Schlei). Narrow tongues of land and hooked spits are typical of this coast (e.g. Oehe-Schleimunde, Bottsand, Graswarder-Heiligenhafen).

Both the sand or shingle spits and coastal grasslands with their numerous shallow pools provide ideal nesting places for waterfowl. The margins of lagoons which have become separated from the sea by the constant development of sandbanks and which have therefore become less salty, are equally important for breeding and migrating waterfowl (e.g. Schwansener See, Kleiner Binnensee and the Strandseen-am-Fehmarn) and the construction of dikes has removed or reduced the risk of such areas being flooded during periods of strong easterly winds. Off-shore the coastal waters are an important haunt of waterfowl, particularly in winter and for such species as divers, ducks, swans, gulls and coot, for which there is abundant food in form of molluscs, crabs and small fish. In mild winters the numbers of such birds are estimated to reach 200 to 400 thousand, dropping to between 80 and 100 thousand when the winter is severe.

**Legal status** Nature or landscape reserves have been established in some places.

**Tenure** State owned 80%; privately owned 20%.

**Management practices** Until recently these have been limited to wardening of certain seabird colonies, but it is clear that areas open for recreation will in future have to be restricted, if remaining vital habitats are to be safeguarded. Small areas are still used for grazing and some of the ponds on Fehmarn have been adapted to fish farming. Hunting is regulated but only within the 3-mile limit from the high tide line.

**Threats** Increase of tourism and recreation (construction of resorts, hotels, parking-places, beaches). Eutrophication and pollution of the Baltic by urban and industrial sewage.

**Scientific research** The Institutes of Natural History of the Universities of Kiel and Hamburg and also a number of private associations have been carrying out ornithological and faunistic studies for well over half a century.

**Principal reference material**

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### 3. OSTHOLSTEINISCHE SEENPLATTE

**Criteria for inclusion** 1a,b,e; 2a,b,c; 3b,c; 4a.

**Geographical location** 54°08'–19°N 10°18'–27'E, Schleswig Holstein; Plön district, 25 km south-east of Kiel and 90 km north of Hamburg. Comprises four sections, from north to south the Dobersdorfer See, Selenter See, Selent-Plön fishponds and Grosser Plöner See.

**Area** 5,668 ha.

**Altitude** 19–37 m.

**Water depth** Maximum 60 m; average varies between the wetlands from 2 to 16 m.

**Wetland types** 18, 24.

**Ecology** This wetland complex, in the hill and lake country of Ost-Holstein, consists of three big lakes formed during the receding of the Scandinavian land-ice mass by the water remaining in the basins of previous glacier tongues. A group of fishponds is a recent adjunct of the wetland area. All the lakes are eutrophic, their shorelines varying from flat to steep and locally fringed with vast *Phragmitetum* and *Typhetum* reed-beds and some alder bog (*Alnetum glutinosae*). Milfoil and water-lilies (*Myriophyllo* – *Nupharetum*) cover the surface in several areas. The fishponds, a collection of numerous small ponds created by dams, sometimes have marshy (*Scirpo-Phragmitetum*) patches or wide reed and sedge belts or small islands with *Phragmites* stands.

The whole area is of international importance as a breeding, moulting, feeding and wintering area for waterfowl. The Grosse Plönersee is the most important breeding area in Schleswig Holstein, while the Selenter See has developed into the most important moulting area for Tufted Duck *Aythya fuligula* and Great Crested Grebes *Podiceps cristatus* in Central Europe. The number of moulting Gadwall *Anas strepera* is also substantial, reaching about 2,000.

**Legal status** Three small nature reserves are located in this wetland; large parts belong to landscape reserves.

**Tenure** State ownership 40%; private ownership 60%.

**Management practices** Hitherto limited to the establishment and wardening of reserves on sites of importance to threatened bird species. More protected areas and precise management measures for them would be highly desirable. Fishing is allowed in the lakes as well as in the fishponds, hunting is regulated and agriculture and forestry are practised in the surrounding areas.

**Threats** Eutrophication is increasing due to influx of sewage and consequent de-oxygenization; little water exchange occurs. Catches of high quality fish species are decreasing. Holiday traffic and tourism are having an increasing impact, with more bathing, boating and building of roads round the lake shores.

**Scientific research** Classical site of modern lake studies and establishment of European systems of lake classification by Thienemann (1918). Biological, chemical, sedimentation and eutrophication studies are being carried out by the Max

Planck Institut for Limnology in Plön. A private working group is doing research on the avifauna.

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## 4. NIEDERELBE

**Criteria for inclusion** 1a,b,c,d,e; 2a; 3a,b,c; 4a.

**Geographical location** 53°35'–50'N 9°17'–42'E, between Hamburg and the mouth of the river Oste from about 10 km downstream from Hamburg to about 10–20 km from the North Sea. Four zones are distinguished: the Elbufer-Störmündung; the Schulau-Pagensand sector on the right bank of the Elbe; the Asseler Sand-Schwarztonnensand; and the area outside the dikes, along the left bank, around the Oste mouth and between Ostemündung and Freiburg.

**Area** 26,322 ha.

**Altitude** About sea level; dikes up to c. 8 m high.

**Water depth** Maximum c.12 m; average 3–5 m; tidal variation up to 2.3 m.

**Wetland types** 8, 10, 11.

**Ecology** Downstream from Hamburg the Elbe becomes an estuary 2–5 km wide. It occupies a channel dating from the Weichsel glacial period. The sandy terraced slopes of the hills bordering the valley are 10 km or more apart, the plain between them being protected by dike walls from spring tides and storm floods. The water gradually becomes saltier towards the mouth of the estuary (having a salinity of 17‰ near Otterndorf, to the west of the Oste mouth as opposed to only 5‰ near Schulau, with a major jump in salinity where the river flows between Glückstadt on the right bank and Wischhafen on the left. Sandbanks, islands and mudflats up to a kilometre wide at a low tide are other features, and the shores are fringed with rushes *Scirpus* and *Schoenoplectus* spp., *Phragmites* reeds and, in some places such as the Drommel-Pinnau rivermouth, a scattering of willows *Salix* sp. Short grass meadows intersected by ditches lie behind the dikes and are used for grazing, and the riverine marshes are gradually being reclaimed for the growing of crops. However, much of the area is still natural wetland, providing breeding, summering, migration and wintering grounds for huge numbers of waders and other waterfowl, for example, in recent counts, up to 6,000 Teal *Anas crecca*, 5,000 Mallard *A. platyrhynchos*, 2,500 Pintail *A. acuta*, 600 Bewick's Swans *Cygnus columbianus*

*bewickii* and over 10,000 Barnacle Geese *Branta leucopsis*.

The freshwater mudflat area of Fährmannsand (2–3 sq. km) supports a remarkably high biomass (up to 150,000 worms, crabs, molluscs or insect larvae per sq. m), which plays an important role in purifying the river. The mudflats also act as a nursery and growth area for a diversity of animals which provide food for birds, fish and, ultimately, man.

**Legal status** Limited parts of the wetland are protected in three nature reserves lying within a Landscape Reserve. An area of 11,760 ha between Barnkrug and Otterndorf has been nominated for the Ramsar Convention list.

**Tenure** State ownership 80%; private ownership 20%.

**Management practices** At present the sites of three nesting colonies of waterfowl (one of them in a nature reserve) are wardened. What is now needed is a comprehensive development plan for the whole of the Niederelbe, which would provide where necessary for additional protective measures. Present land use includes cattle raising, fruit farms and agriculture. Hunting is controlled.

**Threats** The Niederelbe is undergoing rapid industrialization, causing both atmospheric and water pollution problems. Traffic is increasing and the river is to be deepened to 13.5 m so that it can be used by larger sea-going ships; this will necessitate dumping dredged materials and contribute to a lowering of the water-table. More areas outside the sea-walls are also to be diked and reclaimed for agriculture.

**Scientific research** Several Institutes of the University of Hamburg have been studying the hydrobiological, limnological and ecological problems of the wetland. Avifaunal studies are mostly undertaken by private ornithological societies.

**Principal reference material**

Caspers, H., Garms, R., Kötter, F., Kothe, P., Schultz, H. and Schumacher, A. 1961. Biologische Untersuchungen des Elbe-Aestuars. *Archiv. Hydrobiol.* suppl. Bd.26(1–4): 1–462.

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Kurth, D. 1970. Die Vögel der Wedeler Marsch (Zweiter Teil) Hamburg. *Avifaun. Beitr.* 8: 155–189.

Haarmann, K. 1970. Die Vögel der Wedeler Marsch (Dritter Teil) Hamburg. *Avifaun. Beitrag* 8: 193–216.

**10. DÜMMER**

**Criteria for inclusion** 1b,c,d,e; 2a,b,c; 4a.

**Geographical location** 52°32'N 8°23'E, Niedersachsen. About 65 km south-south-west of Bremen and 85 km due west of Hannover.

**Area** 3,600 ha.

**Altitude** 37.4–40.2 m.

**Water depth** Maximum 1.5 m; average 1 m.

**Wetland types** 12, 18, 25.

**Ecology** The wetland is of largely natural origin; the shallow lake fills about 1,600 ha of the level, rather sandy, bottom of a valley formed in the last glacial period. The characteristic features of the landscape are raised bogs, peatbogs, inland sand-dunes and moraines. The catchment of the Dümmer extends over 400 sq. km. Only remnants are left of the ancient plant associations involved in the colonization process. Thus the pondweeds *Potamogeton* and stonewort *Chara* spp. have mostly disappeared and although in places water lilies *Nymphaea* and *Nuphar* together with *Phragmites* and *Typha* reeds form a thick belt of vegetation along the lake shore, which can be as much as 800 m wide, there are only relict patches of the alder-bogs and sedge meadows which resulted from this vegetational fringe. Most of the bogs (for instance the Ochsenmoor) were for a time intensively used as farmland but abandoned again when drainage failed.

Notwithstanding the fact that man has greatly altered the habitat, the Dümmer is still an important area for waterfowl. Many threatened and rare species breed, roost or winter. Several of those which used to nest have ceased to do so, for example the Dunlin *Calidris alpina*, or have declined considerably (e.g. Black Tern *Chlidonias niger* and Common Tern *Sterna hirundo*). Protective measures are urgently necessary to halt this trend.

**Legal status** Some 820 ha are protected as nature reserve and 1,778 ha as game reserve (Europareservat) and there are two landscape reserves. Together they constitute the 'Dümmer Nature Park'. The whole area has been nominated for the Ramsar Convention list.

**Tenure** The lake itself is owned by the State, the surrounding land is a mixture of privately-owned and state-owned properties.

**Management practices** Priority is given to slowing down the rate of eutrophication by improving the sewage purification system. Other measures taken have aimed at reducing the amount of mud and creating suitable artificial habitats for waterfowl nesting. Fishing is permitted and hunting also, though this is regulated. The zone surrounding the lake is used for livestock grazing.

**Threats** Severe eutrophication and deposition of mud caused by sewage inflow and indicated by fish mortality and algal blooms; disturbance by recreational activities such as bathing, boating (over 2,500 boats) and urbanization from the construction of week-end houses; changing water levels due to the use of the lake as a storage reservoir; over-fishing; disruption of the natural water flow by construction of dikes (1953); and the drainage and conversion to agricultural uses of the peatbogs.

**Scientific research** As indicated in the next section a considerable amount of work has been done on the geology, limnology, ecology and ornithology of this wetland.

**Principal reference material**

Hölscher, R., Müller, G. B. K. & Petersen, B. 1959. Die Vogelwelt des Dümmer - gebietes. *Biolog. Abl. Heft 18-21*: 124 pp.

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Heckenroth, H. & Lüderwaldt, D. 1974. Der Dümmer, Einige Vorschläge zur Biotoperhaltung und Gestaltung zur Abschwächung wasserbaulicher Eingriffe. *Natur und Landschaft* 49: 139–141.

## 11. DIEPHOLZER MOORNIEDERUNG

**Criteria for inclusion** 1c,d,e; 2a,b; 3a; 4a.

**Geographical location** 52°36'N 8°40'E, Niedersachsen. Osnabrück, about 37 km south-south-west, is the nearest large town and the Dümmer (No. 10 on the list) is on the outskirts of the peatland area which extends east to the vicinity of the small town of Uchte 8°54'E.

**Area** 17,849 ha.

**Altitude** 34.5 – 48.2 m.

**Water depth** In parts of the peatland which have been dug, may reach a maximum of 1 m.

**Wetland types** 21, 22.

**Ecology** A wetland of natural origin, greatly changed by man's activities. Vast areas of diluvial sand, partly covered by raised bogs, and some isolated areas of end-moraines are characteristic of the landscape. The most important raised bogs are: Geestmoor near Kellenberg, Neustädter Moor, Renzeler Moor and Grossen Moor near Uchte; peat digging has taken place in many parts of these and other bogs and their present day vegetation tends to be dominated by birch *Betula* sp., cross-leaved heath *Erica tetralix*, ling *Calluna vulgaris* and purple moor-grass *Molinia caerulea*. The original bog flora survives only in some pools or basins and includes species like *Sphagnum* moss, bog myrtle *Myrica gale* and cotton grass *Eriophorum* sp. Low-lying meadowlands and fens are found in much of the surrounding area (for instance to the north of Grossen Moor) and there are also small patches of coniferous woodland or wooded end-moraines.

The raised bogs are a breeding area for several uncommon or even threatened bird species. The most important of these is the southern race of the Golden Plover *Pluvialis apricaria apricaria*, of which it is estimated that there are only 45–50 pairs. In 1972 it was thought that there were only 30–35 pairs in the whole of Niedersachsen, so the Diepholzer Moorniederung certainly plays an important part in the plover's conservation. Other species benefitting from the efforts to maintain habitats essential to their survival, for example treeless heathland, include Black Grouse *Lyrurus tetrix* (c. 150), Teal *Anas crecca* (40 pairs), Curlew *Numenius arquata* (80 pairs), Black-tailed Godwit *Limosa limosa* (80 pairs) and Redshank *Tringa totanus* (40 pairs).

**Legal status** 432 ha are protected in two nature reserves and five landscape reserves cover a further 5,187 ha. A slightly larger total area of 5,730 ha has been nominated for the Ramsar Convention list.

**Tenure** A mixture of State and private ownership. The National section of the World Wildlife Fund owns part of the Neustädter Moor Nature Reserve.

**Management practices** Steps have been taken to prevent further destruction of the raised bog areas. A proposal to drain the Neustädter Moor Nature Reserve

was successfully resisted; several of the heather areas are being rehabilitated and birch trees are being cleared in order to restore natural raised bog areas. Prohibition of peat digging and drainage and better protection in several additional areas would be desirable. Most of the low-lying meadows are being used for grazing domestic livestock.

**Threats** Intensification of agricultural activities could well lead to drainage or to the eutrophication of the bogs. Industrial exploitation of peat is destroying vast bog areas, and unless urgent management measures are taken, the dried-out remains of peatlands eventually develop into birchwoods. Hunting needs to be more restricted and in particular, the shooting of *Lyrurus tetrix* should be forbidden, as its numbers are much reduced.

**Scientific research** No specific information but see next section.

**Principal reference material**

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Berndt, R. 1973. Status und Situation der mittel europäischen Population des Südlichen Goldregenpfeifers, *Pluvialis apricaria apricaria*. *Ber. Dtsch. Sekt. Int. Rat. Vogelschutz* 13: 91–92.

## 17. RIESELFELDER bei MÜNSTER

**Criteria for inclusion** 1b,e; 2a,b; 3a,b,c; 4a.

**Geographical location** 51°58'N 7°37'E, Nordrhein-Westfalen, 6 km north of Münster.

**Area** 582 ha.

**Altitude** c.50 m.

**Water depth** Shallow, c.0.5 m.

**Wetland type** 25.

**Ecology** A man-made wetland, consisting of an urban sewage treatment farm established in 1901, of which about 160 ha are used for agricultural purposes and 22 ha are nature reserve. The latter comprises two small ponds, created by dredging and surrounded by a mixed wood, and a bog with stands of pine and birch *Pinus* and *Betula* spp. The remaining area is divided into 400 one-hectare plots, irrigated by sewage which has previously been partly purified mechanically. A drainage system carries the fully purified water into the rivers Ems and Aa. Sedimentation of the fine material results in areas of mud and eventually of vegetation which consists mainly of *Phragmites* and *Typha* reeds and canary grass *Phalaris* sp.

The habitats are therefore rich and varied, including bare and overgrown areas, meadows, reedbeds and shallow water of varying depth. Migrant waterfowl are naturally very attracted by what is an almost ideal, undisturbed area offering an abundance of such food as the waterflea *Daphnia* and blood-worm *Chironomus*. It is the most important stopping-place for migrating Limicolae in West Germany and a moulting-place of great significance for Ruffs *Philomachus pugnax* (numbering about 1,500), Common Snipe *Capella gallinago* (4,000) and Garganey *Anas querquedula* (800).



**Legal status** Except for the small nature reserve (Gelmer Heide und Huronensee, 21.9 ha) which is located in the wetland area, the rest of the wetland has no legal protection.

**Tenure** Owned by the municipality of Münster.

**Management practices** Should the sewage farm become obsolete in the near future, as expected, and not be taken over for some other as yet undefined purpose, measures for its maintenance and further development as a reserve have been planned (admission of visitors, observation tower, paths, information centre etc.). Irrigation with partly treated water and habitat management including the creation of areas of deep water and maintenance of open mud areas are envisaged.

**Threats** The municipality of Münster should by now have opened a new central installation for the treatment of sewage, bringing to an end the operation of the sewage farm. The proposal is that 171 ha should be maintained by the Ornithological Society of Westfalen as a bird reserve with recreation facilities. The remaining two thirds of the area could be used for the disposal of litter and for agricultural purposes. The principal threat to this plan is an alternative proposal to use the site for a nuclear power plant.

**Scientific research** A Biological Station set up at the Rieselfelder has been carrying out faunistic, ringing, moulting and ecological studies of ducks and waders for some years.

**Principal reference material**

Harengerd, M., Pölking, F., Prünste, M., Speckmann, M. 1972. Die Tundra ist mitten in Deutschland. Kilda Verlag, Greven. 94 pp.

Harengerd, M., Prünste, W., Speckmann, M. 1973. Zugphänologie und Status der Limikolen in den Rieselfeldern der Stadt Münster. *Vogelwelt* 94: 81–118; 121–146. (Contains many other references).

**18. HEILIGES MEER (Nature Reserve)**

**Criteria for inclusion** 1d; 2b; 3a,b,c; 4a.

**Geographical location** 52°20'N 7°35'E, Nordrhein-Westfalen. About 50 km due north of Münster near Hopsten, just inside the State boundary.

**Area** 54.4 ha.

**Altitude** 42.9–43.5 m.

**Water depth** In the Erdfallsee-Grosses Heiliges Meer section, up to 13 m; in the fishponds section, the maximum does not exceed a metre.

**Wetland type** 15, 19, 20, 24.

**Ecology** A natural wetland much influenced by man's activities. With its damp, sandy, poor soil it belongs to the oak/birch woodland but many centuries of grazing have transformed it into a mixture of damp and dry moorland, which can only be maintained with difficulty. Its situation on the eastern limit of the Atlantic weather zone accounts for the presence of many rare species in its plant associations. Apart from several small ponds, three markedly different types of wetland are involved: (a) about 2 ha of shallow oligotrophic or dystrophic moorland pools, with a low humus content; (b) Erdfallsee (7 ha); (c) Grosses Heiliges Meer (c.12.6 ha), formed like the last by an 'earthfall' some 1000–1500 years ago, eutrophic with

luxuriant 'landforming' vegetation in the shallows along its shores. The various woodland associations (pure birch, mixed oak and birch in damper places, pine and alder), which can be found in close proximity, have been well studied (138 scientific papers having been published by 1975). The area is of great educational value, a field station of the Landesmuseums für Naturkunde in Münster being responsible for the biological courses.

**Legal status** The entire area is protected as a nature reserve.

**Tenure** Held by the State Nordrhein-Westfalen.

**Management practices** The aim is to maintain or restore the old state of the wetland. Thus grazing by livestock is used to inhibit the growth of trees and shrubs and nutrient-laden water flowing off the surrounding agricultural areas is diverted to by-pass the reserve.

**Threats** Eutrophication due to the use of artificial fertilizers in peripheral farmland. Possible effect of visitor pressure (c. 80,000 per annum) on flora and fauna. This is kept under constant review.

**Scientific research** Main focus of studies over the past 40 years has been on geology, plant sociology, limnology, entomology, avifauna and mammals.

**Principal reference material**

Ant, H. 1974. Die biologische Station 'Heiliges Meer' bei Hopsten (Westfalen) als Forschungs und Lehre Stätte. *Natur und Landschaft* 49:134–138 (quotes numerous other references).

Franziskret, L. 1974. Die biologische Station in NSG 'Heiliges Meer'. *Natur und Landschaft* 49: 130–133.

## 19. RUHRSTAUSEEN

## 20. MÖHNESTAUSEE

**Criteria for inclusion** 1b; 3a,c; 4a,b.

**Geographical location** 51°24'–30'N 7°03'–8°05'E, Nordrhein-Westfalen. Mostly just to the south of the Ruhr industrial complex of Essen-Dortmund, but the Möhne dam about 35 km due east of Dortmund on the Möhne river, the Ruhr tributary after which it is named.

**Area** 1,981 ha.

**Altitude** 51–214 m.

**Water depth** Maximum depths of the reservoirs ranges from 6.5 to 34 m and average depths from 2 to 13 m.

**Wetland type** 15, 16.

**Ecology** A complex of artificial wetlands consisting of six reservoirs made by damming the Ruhr and Möhne valley, namely the Geiseckesee, Wickedesee, Harkortsee, Baldeneysee, Hengsteysee and Möhnesee.

The first five form a unit, the reservoirs of Baldeney, Harkort and Hengstey being used for water purification, the two latter also for generating energy, and the Geisecke and Wickede Seen mainly for drinking water supplies (despite the vicinity of industrial complexes and urban centres, the river Ruhr is now a clean

river which can also be used for recreational purposes). The slopes bordering its upper reaches are wooded, the lower part of the valley cultivated, some poplars *Populus* and willows *Salix* representing the last remnants of former riverine forest. Colonizing vegetation is largely absent due to frequent substantial changes in water level, the relatively steep banks of the lakes and the recreational activities along them, but there are some small patches of water lilies *Nymphaea* and *Nuphar* and of *Phragmites* reeds. More extensive reedbeds have however developed along some sections of the river between the reservoirs. The Möhnesee (10 km long, 250–750 m wide and about 14 km upstream of the confluence of the River Möhne with the Ruhr) is much the biggest of the reservoirs, with a storage capacity of 70 million cubic metres, and is used for drinking water, protection against flooding and hydroelectric purposes; its shores are devoid of vegetation.

Because of this lack of suitable cover, the group of reservoirs is of little significance as a breeding place for waterfowl, but rates as an internationally important staging-post on migration and wintering area for birds which move freely between the six lakes. The biggest concentrations occur on the Möhnesee, with peak populations of over 10,000, mostly Mallard *Anas platyrhynchos*, Pochard *Aythya ferina*, sawbills *Mergus* spp. and Coot *Fulica atra*.

**Legal status** The Baldeney, Harkort, Hengstey, Geisecke and Möhne Sees are incorporated in the Arnsberger Wald Nature Park, part of which forms the Möhnesee Nature Reserve (224 ha).

**Tenure** The lakes are owned by two corporations, the Ruhrverband and the Ruhrtalesperrenverein.

**Management practices** These are primarily directed towards economic exploitation and recreational purposes, and it is only in so far as they do not conflict with these objectives that nature conservation and waterfowl protection can and do receive some attention.

**Threats** Provided that the protected zones referred to under Legal Status are respected, the value of this wetland complex for migrant and wintering waterfowl should not be impaired.

**Scientific research** No details available, except for the ornithological work indicated in the next section.

**Principal reference material**

Eber, G. 1968. Die wichtigsten Wasservogelgebiete in Nordrhein-Westfalen. *Anthus* 5: 41–108.

Stichmann, W. 1969. Die Gewässer, Talsperren und Stauseen der Ruhr und ihrer Nebenflüsse. In Peitzmeier, J. (ed) *Avifauna von Westfalen, Abh. Westf. Landesmus. Naturk.* 31: 126–131.

Stichmann, W. Prünke, W. & Raus, T. 1969. Beiträge zur Avifauna des Möhnesees. Quantitative und phaenologische Studien. *Anthus* 6: 45–148.

**21. UNTERER NIEDERRHEIN**

**Criteria for inclusion** 1b,e; 2a,b; 4a.

**Geographical location** 51°41'–55°N 6°01'–7°09'E, Nordrhein-Westfalen. On the Netherlands border, 30 km north-west of Duisberg in the Wesel and Kleve districts.

**Area** 12,473 ha.

**Altitude** 13–22 m.

**Water depth** Maximum 3–5 m; average 2 m.

**Wetland type** 12.

**Ecology** A natural wetland, though greatly affected by human activities, forming part of the Lower Rhine flood plain on both sides of the river downstream from Wesel and Xanten and gradually merging into the Rhine-Maas marshland and Rhine Delta in the Netherlands. The meadows are used for grazing. The former riverine forest has practically disappeared, except for some *Salix* stands, and is now replaced by *Populus* plantations. Annual rainfall averages 680 mm. The groundwater level is high and the backwaters of the Rhine, ditches and canals form an excellent wintering area for big flocks of ducks, geese and waders. Despite the construction of dikes, canalization of the river and cutting off of old sections of the riverbed, there are still big areas between kilometre posts 820 and 865, which flood occasionally. Flooding also occurs on the meadows near Niel and the low ground along the Hetter 3 or 4 km from the Rhine. Lastly, the clay and gravel pits of Bislicher Insel and in the meadows along the Rhine between Emmerich and Hüthum are of great importance both for breeding birds and for huge numbers of wintering waterfowl.

**Legal status** There are two nature reserves in this wetland, namely the Xantener Altrhein (223 ha) and the Alter Rhein (near Bienen-Praest: 339 ha), both of them Bird Sanctuaries, while part of the wetland also constitutes a landscape reserve.

**Tenure** Partly state-owned, but private persons; associations and corporations also hold considerable areas.

**Management practices** At present confined to improving conditions for waterfowl and wardening of the nature reserves. Measures to make old gravel-pits more suitable and attractive, by water management and establishing better cover, are also being planned. The areas surrounding the wetland are generally under cultivation.

**Threats** The constant efforts to improve the Rhine as a major economic artery and proposals for turning meadows and pastures into agricultural fields are certain to lead to a lowering of the water table. Further destruction of the wetland habitats will also be brought about by building of more roads and opening up of new gravel pits.

**Scientific research** Some work has been done on the avifauna and conservation needs of the wetland.

**Principal reference material**

Eber, G. 1968. Die wichtigsten Wasservogelgebiete in Nordrhein-Westfalen. *Anthus* 5: 41–108.

Solmsdorf, A. and H. 1975. Schutzwürdige Bereiche im Rheintal. *Natur und Landschaft* 50: 99–102.

**23. OBERRHEIN: LÖRRACH-KEHL sector**

**Criteria for inclusion** 1a,b; 2a; 3a,c; 4a,c.

**Geographical location** 47°39'– 48°28'N 7°32'–50'E, Baden-Württemberg. A series of wetlands along the Rhine where it forms the border between Germany and

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France. Freiburg, 15 km east of the Burkheim-Sasbach subdivision of the wetland (No. 23.03 in the list), is the nearest large town (in Germany).

**Area** The wetlands along the right bank of the river, in the Federal Republic, are somewhat less extensive than those of the (French) left bank and estimated to total about 4,500 ha.

**Altitude** 142–241 m.

**Water depth** Maximum 5 m; average 2–3 m.

**Wetland types** 12, 15.

**Ecology** A natural wetland but greatly altered by human activities. The Oberrhein floodplains are part of the 25–40 km wide 300 km long sector of the Rhine valley between Basel and Mainz, its floor covered by a sheet of marine and glacial debris up to 200–300 m thick. Due to slight variations in the level of these deposits, the river had a tendency to meander, with the result that there are now numerous backwaters, networks of smaller streams and ox-bow lakes, though the fringes of riverine forest seldom retain any of their original character or appearance. Numerous projects for straightening the river and improving navigation have been undertaken, dating back to the beginning of the 19th century. Thus the Rhein-Seiten Kanal from Basel north to Breisach reduced the river to a secondary stream and canals also by-pass four dams or barrages between Breisach and Kehl. Erosion of the river bed (near Basel by up to 7 m, near Breisach 2 m) will need further remedial measures. Meanwhile, the length of the stream network has been shortened by 14%, the meanders by 37% and the groundwater level lowered by 2 to 20 m. Despite all these changes to the river regime, the wetland as a whole and especially the reservoirs have become suitable wintering habitat for very large numbers of duck (Mallard *Anas platyrhynchos* and Pochard *Aythya ferina* predominate but up to 1000 Gadwall *Anas strepera* have been counted, and other waterfowl include Black-necked Grebe *Podiceps nigricollis*, numbering around 500). Breeding birds include some 20 pairs of Common Sandpiper *Tringa hypoleucos* and 100 pairs of Common Tern *Sterna hirundo*.

**Legal status** This Upper Rhine wetland complex lacks adequate legal protection and at least the upgrading to nature reserve status of the 1,742 ha Rheinwald Taubergiesen Landscape Reserve, which is all that at present exists, would be most desirable.

**Tenure** The water courses are state owned. Electricité de France owns long stretches of the wetland on the French side of the river.

**Management practices** Ineffective. Recommendations include proper maintenance of the riverine forest after canalization projects and dams have been completed. The water table which has been seriously lowered should be raised again by putting more water into the old river bed (Altrhein), which would help to keep the soil sufficiently moist; also perhaps by promoting artificial flooding at appropriate intervals.

**Threats** So-called improvements to the water regime are adversely affecting what was formerly a harmonious landscape. Industrial development, including construction of nuclear power plants (the effects of which have not yet been sufficiently studied), urbanization, traffic and pollution are all on the increase. Recreational activities, especially boating and bathing, are causing disturbance to breeding birds. Increased maize growing is spoiling the fallows which, under previous crops,

were favoured wintering grounds of Bean Geese *Anser fabalis*.

**Scientific research** No information.

**Principal reference material**

Holzinger, J., Knötzsch, G., Schuster, S. and Westermann, K. 1972. Feuchtgebiete (wetlands) in Baden Württemberg mit internationaler und nationaler Bedeutung für Wasservogel. *Anz. Orn. Ges. Bayern* 11: 70–100.

Solmsdorf, A. and H. 1975. Schutzwürdige Bereiche im Rheintal. *Natur und Landschaft* 50: 99–102.

## 24. BODENSEE

**Criteria for inclusion** 1a,b; 2a; 3a,b,c; 4a.

**Geographical location** 47°35'–45'N 8°54'–9°29'E, Baden-Württemberg on the border with Switzerland and Austria. The wetland comprises seven distinct areas: Konstanzer Bucht; Wollmatinger Ried – Giehrenmoos – Hegnebucht; Untersee – Ende bei Öhningen; Hornspitze – Mündung des Radolfzeller Aach – Halbinsel Mettnau, Mindelsee; bays between Mainau Island and the mainland; and the Eriskircher Ried near Friedrichshafen.

**Area** The area thus designated is about 3,020 ha, which represents only about 5.6% of the 53,900 ha of the Bodensee as a whole.

**Altitude** 395 m.

**Water depth** Maximum 55 m; average 5 m.

**Wetland types** 18, 19, 21.

**Ecology** The Bodensee is of natural origin but greatly influenced by man. It was formed both by earth movements during the formation of the Alps and also by glacial action. It is divided into the Obersee (476 sq. km) and the Untersee (63 sq. km) and the river Rhine flows through it. The Bodensee was once a typical sub-Alpine oligotrophic lake, but thanks to man's activities the Obersee is nowadays meso-eutrophic and the shallower Untersee is even more eutrophic. The lake provides water for villages and towns as far away as Stuttgart. Fishing and tourism are important resources. Whitefish *Coregonus* spp. were once the most sought after fish in the lake but they have been replaced by perch *Perca* sp., the flesh of which is of inferior quality. The lake as a whole is of importance to waterfowl, especially during migration periods and in winter; the shallow Untersee and the vicinity of Eriskirch are especially favourable, with their rich supplies of molluscs (including zebra mussels *Dreissena* sp., which first appeared in 1965 and have spread rapidly), fish and algae.

The Bodensee is an important moulting area for pochards, both Common and Red-crested, *Aythya ferina* and *Netta rufina*. Eight species of duck are known to nest, though in small numbers (c. 100 pairs) except for the Mallard *Anas platyrhynchos*. Between 100,000 and 200,000 ducks and coots winter on the lake, which never freezes over completely. When the water is low it also attracts significant numbers of migrating Limicolae. The bordering peatbog zones and damp meadows have a flora with many rarities, the presence of pontic and relict species from the glacial period being of particular scientific interest (e.g. *Iris sibirica*, *Primula farinosa*, *Gladiolus palustris*, bug orchid *Orchis coriophora* and the garlic *Allium suaveolens*). Plants more typical of drier localities can sometimes be found in the

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damp 'straw-meadows', e.g. pasque flower *Pulsatilla vulgaris*, *Carex ericetorum*, and the spring and field gentians *Gentiana verna* and *Gentianella germanica*.

**Legal status** Several of the wetland sites are protected or partly protected, for instance the Wollmatinger Ried complex by a 776.8 ha 'Europa-reservat' and the Mindelsee and Eriskircher Ried by reserves of 301 and 562 ha, respectively. Part of the last two sites, together with the Giehrenmoos and Hegenbucht, comprise a Ramsar Convention site of 1080 ha. Other areas have partial protection as landscape reserves. Better coordination with nature-protection authorities in Switzerland and Austria would be desirable.

**Tenure** The lake itself is state-owned by the three countries which border it. The shores are a mixture of private and public property.

**Management practices** No special management programme exists. Private organizations have, however, taken the initiative by creating and managing small wetlands, like those of Mettnau and Mindelsee. Thus gravel-covered floating platforms have been anchored in suitable places to provide terns with somewhere safe to nest; and wet meadows have been mowed to make them more suitable for Limicoline species. Amphibians, *Libellula* dragonflies and many rare plants also benefit from such improvements.

**Threats** Increasing eutrophication as a result of industrial and urban sewage is a major threat and others are: construction of an oil pipeline along the eastern shore, and projects for the control of the water level in the Hochrhein in order to improve the navigation. Camping, swimming and watersports need to be organized in such a way that no disturbance or damage will occur to nature reserves. Harmonization of the open seasons for waterfowl hunting in the three countries bordering the lake is highly desirable, and should be associated with a total ban in the Wollmatinger/Ermatinger Ried zone and the outlawing of more archaic and destructive hunting traditions.

**Scientific research** Several institutes are involved in the scientific and particularly the limnological study of the Bodensee:

- a) Bodenseelaboratorium der Landesstelle für Gewässerkunde, Insel Reichenau.
- b) Bodenseelaboratorium der Bodensee Fernwasserversorgung, Süßenmühle.
- c) The University of Konstanz.
- d) Max Planck Institut für Verhaltensphysiologie.
- e) Vogelwarte Radolfzell, Möggingen.

Research is also undertaken by several private organizations and by at least three major Institutes on the Swiss side of the border.

**Principal reference material**

Müller, T. 1969. Die Pflanzenwelt des Naturschutzgebietes Wollmatinger Ried. *Natur und Mensch* 11: 294-297.

Jacobi, H., Knotzsch, G. and Schuster, S. 1970. Die Vogelwelt des Bodenseegebiets. *Orn. Beob.* 67. (Contains many other references).

Luther, H. and Rzóška, J. 1971. *Project Aqua. IBP Handbook No. 21.* Blackwells Scientific Publications, Oxford and Edinburgh. Pp. 34-55.

Holzinger, J., Knotzsch, G., Schuster, S. and Westermann, K. 1972. Feuchtgebiete in Baden-Württemberg mit internationaler und nationaler Bedeutung für Wasservogel. *Anz. orn. Ges. Bayern* 11: 70-110.

Ertel, R. 1974. Wollmatinger Ried, Führer durch Natur und Landschaftsschutzgebiete in Baden-Württemberg (1). Ludwigsburg, 60 pp.

## 25. FEDERSEE

**Criteria for inclusion** 1c,d,e; 2a,b; 3a,b,c; 4a.

**Geographical location** 48°05'N 9°38'E, in the Biberach district about 50 km southwest of Ulm and the same distance north of the Bodensee.

**Area** 1,402 ha.

**Altitude** 578–581 m.

**Water depth** Maximum 2.8 m; average 0.6 m.

**Wetland types** 18, 21, 22.

**Ecology** A natural wetland but strongly influenced and altered by man. Still the largest 'Verlandungssee' of the Oberschwaben region, but now with no more than about 130 ha of open water, compared with nearly 1,400 ha of surrounding reedbeds and peatland vegetation. The lake is situated in a basin formed in the Riss Glacial Period and closed off in the Würm Glacial Period. Drainage in 1787/88 and 1808/09 led to a lowering of the water level and reduced the water area by 870 ha, but the character of the landscape and its flora and fauna survived. Experts believe that the lake may last in its present form, with all its phases from open water to peatland, for a period of anything from 50 to 200 more years. Although the impact of human activities on the site has brought about the decline or disappearance of many kinds of animal and plant, it is still noted for its birds which include Bitterns *Botaurus stellaris* (no more than 3 pairs), Little Bitterns *Ixobrychus minutus* (10 pairs), Night Herons *Nycticorax nycticorax* (a few pairs), Black Grouse *Lyrurus tetrix* (only 9 males and 15 females could be found in 1965) and 10 pairs each of Curlew *Numenius arquata* and Common Tern *Sterna hirundo*.

**Legal status** The whole area is protected as a Nature Reserve and 50 ha are kept entirely free from human interference. The area ranks as an 'Europa-reservat' and some limited hunting is allowed.

**Tenure** About 70% in private and 30% in public (State) ownership.

**Management practices** The Nature Reserve has been warded since 1958. Its peatland sectors, in particular, require considerable attention (clearing of woody vegetation, mowing of wet meadows etc.). Areas bordering the wetland are mostly under cultivation or productive forests.

**Threats** Waste water from towns and villages in the surrounding area is still being discharged into the lake and filtering installations are urgently needed to slow down eutrophication and the spread of vegetation (about 10 sq. m of open water are estimated to be colonized daily by emergent macrophytes). Maintenance of a stable water level would also help to check the colonization process. Similarly, efforts to prevent peatlands becoming overgrown by birch trees and reeds should be continued and if necessary strengthened.

**Scientific research** The Federsee has been well studied for several decades, mainly in the fields of botany, zoology (especially ornithology), climatology, archaeology and pollen analyses. The University of Tübingen maintains a biological station nearby, at Schloss Buchau, where botanical and zoological studies continue and



attention is also paid to such aspects as faunistics, parasitology and hydrobiology.

**Principal reference material**

Zimmerman, W. (ed.) 1961. Der Federsee. In *Die Natur und Landschaftsschutzgebiete Baden-Württembergs*, Vol. 2, 411 pp. Stuttgart. (Contains many further references).

Klee, O. 1971. Der Tod des Federsees. *Kosmos* 67: 464–469.

**27. OPFINGER DONAUSTAUSEE**

**28. DONAUSTAUSEEN, DONAUUAEN, DONAUMOOS**

**29. LECHSTAUSEE bei FELDHEIM**

**Criteria for inclusion** 1a,b,e; 2a; 4a.

**Geographical location** 48°17'–45'N 9°48'–11°15'E, along part of the upper course of the Donau, from about 35 km south-west of Ulm to Ingolstadt (70 km north of München).

**Area** c.17,588 ha (site 27: 146 ha; 28: 17,360 ha; 29: 82 ha).

**Altitude** 392–484 m.

**Water depth** Maximum c.5 m; average 1.5 m.

**Wetland types** 12, 15, 16.

**Ecology** A natural wetland but greatly changed by human activities. There are four main areas: 1) Opfinger Stausee, SW of Ulm; 2) Riverine forest area, floodplains and several reservoirs downstream or east of Ulm; 3) the mouth of the Lech, near its confluence with the Donau; and 4) the extensive peatlands and reed beds on the right bank (south of the river) between Donauwörth and Ingolstadt.

1) *Opfinger Stausee*. This reservoir was built in 1926, to serve a hydroelectric power station. It is an important wintering area for waterfowl (up to 3,700 Teal *Anas crecca* and 11,500 Mallard *Anas platyrhynchos* have been recorded). Due to the discharge of wastes from a nearby cellulose factory, the water is polluted and eutrophic. The thick mud layer deposited by the waste materials inhibits the growth of aquatic vegetation and only along the north shore are there some reedbeds and a small riverine forest. In the winter massive appearances of the fungus *Leptomitus lacteus*, in the polluted water, attract huge flocks of Coot *Fulica atra* and Pochard *Aythya ferina*. *Anas crecca*, in particular, benefits from the daily draw-down of about one metre, which exposes mud rich in the waste water bacterium *Spaerotilus natans* and the chironomid larvae which feed on it, both of them readily devoured by the duck.

2) *Riverine forest and reservoirs downstream of Ulm*. Canalization and construction of reservoirs on this stretch of the Donau was carried out between 1950 and 1960. The Oberelchinger, Leipheimer, Gunzburger, Offinger, Petersworther, and especially the Faiminger reservoirs are attractive to migrating and wintering waterfowl, but in the absence of mud flats and shallows less so to the Limicolae. The Faimingerstausee (210 ha, 6 km in length and with a maximum width of 600 m) is of international importance on its own (counts of 6,100 *Anas platyrhynchos*, 400 *Aythya ferina* and 780 Little Grebe *Tachybaptus ruficollis* have been made); but the whole area should be treated as a unit. The riverine forest is one of the last big samples of this vegetation-type left, apart from those on the Oberrhein,

and is the habitat of many rare and threatened species of plants and animals. A conservation plan for it would be highly desirable.

3) *Lech – Donau – Winkel*. The two reservoirs built to supply power-stations near the mouth of the Lech are also important for wintering waterfowl. A one metre draw-down on the Bertoldsheimerstausee is sufficient to prevent suitable nesting-places being available but parts of the Lechstausee shores support vegetation and an increasing number of breeding waterfowl have been noted.

4) The very extensive peatland and reedbed sector downstream of Donauwörth and mostly included in a Landscape Reserve, with one small Nature Reserve, is of considerable botanical interest and is also an important breeding area for both aquatic and moorland birds.

**Legal status** Several landscape reserves have been established along the Donau and at least one nature reserve, as just mentioned; but further protection measures are desirable. Meanwhile, some 8,000 ha of the areas numbered (2) and (4) above, and 230 ha of area (3), have been nominated, respectively, as two Ramsar Convention sites.

**Tenure** A mixture of State, municipal and private ownership.

**Management practices** Efforts are made to provide better protection for plants and animals, but otherwise little is yet being done to maintain the remaining natural areas and there has been no coordination of landscape planning on a regional scale by the Bayern and Baden-Württemberg 'länder'.

**Threats** Gravel pits, uncontrolled dumping of urban waste and reafforestation with conifers, which is endangering riverine forests, are the principal threats. Others are:– casual and unplanned location of industrial enterprises, including a test-ground for a new type of public transport in the Gundelfingen and Dillingen area (half way between Ulm and Donauwörth); boating; and ubiquitous hunting and bird-shooting (which ought to be restricted to the reservoirs).

**Scientific research** Apart from the extensive ornithological studies indicated in the next section, no information available.

#### **Principal reference material**

Bezzel, E. 1969. Die Bedeutung der Gewässer Bayerns als Durchzugs – und Rastbiotope für Schwimmvogel. *Anz. orn. Ges. Bayern* 8: 556–557.

Bezzel, E. 1970. *Vogelparadiese in Bayern*. Garmisch Partenkirchen, 78 pp. (Contains further references).

Holzinger, J. Knötzsch, G., Schuster, S. and Westermann, K. 1972. Wetlands (Feuchtgebiete) in Baden-Württemberg mit internationaler und nationaler Bedeutung für Wasservogel. *Anz. orn. Ges. Bayern* 11: 70–110. (Contains further references).

Heiser, F. 1973. Die Brutbestände der Entenvogel im Lech-Donau-Winkel. *Ber. naturw. Ver. Schwaben* 77: 38–43.

Holzinger, J. and Mickley, J. (ed.) 1974. Existenzbedrohte Landschaften, Donaumoos und Auenwälder zwischen Ulm und Dillingen, Illertal zwischen Vohringen und Ulm. *Umweltschutz in Baden-Württemberg* 3: 248 pp. (Numerous further references).

### 31. ISMANINGER SPEICHERSEE

**Criteria for inclusion** 1a,b,e; 2a; 3a,b,c; 4a.

**Geographical location** 48°14'N 11°41'E, Oberbayern. About 5 kilometres outside München to the north-east.

**Area** 1,028 ha.

**Altitude** 496 m.

**Water depth** Maximum 2–3 m; average 1.5 m.

**Wetland types** 15, 24.

**Ecology** The Reservoir dates from 1929. It is divided into two basins. A chain of more than 30 fishponds (each 330 m long and 125 to 250 m wide) is connected to it. The pond area serves as a biological purification system for the entire chemically-purified waste water of München. It is rich in nutrients and attracts large numbers of aquatic birds throughout the year. The south shore of the reservoir has a number of plant communities varying from reed to riverine forest. A gentle current prevents the entire water surface from freezing over, which makes the area of particular interest to wintering waterfowl. Important breeding area for Tufted Duck *Aythya fuligula* (600 pairs), Pochard *A. ferina* (225 pairs), Gadwall *Anas strepera* (235 pairs); moulting area for *Aythya ferina* (20,000) and *Anas Strepera* (35,000). Important roosting and feeding area for Mallard *Anas platyrhynchos* (8,000), Coot *Fulica atra* (8,000) and Ruff *Philomachus pugnax* (1,000). Huge numbers of wintering waterfowl (85,000) are observed each January.

**Legal status** Unprotected by nature reserves or landscape reserves, but recognized as an 'Europa-reservat' by the Council of Europe and an 800 ha sector nominated for the Ramsar Convention list. A small reserve of 7.28 ha, just to the south, has lost much of its former botanical and ornithological value. The area is not open to the public. Hunting is forbidden; the fishing rights are leased.

**Tenure** Owned by Bayernwerke A.G.

**Management practices** None.

**Threats** Industrial developments in surrounding area: to the north, an airport of an international standard is planned and there is already a truck testing-ground in operation. A projected motorway will traverse the fishpond sector. Some disturbance is caused on the main lake by fishing boats. Because of destruction of suitable habitat elsewhere in the region, waterfowl numbers have increased so rapidly that the carrying capacity of the wetland for moulting ducks has been exceeded with resulting high mortality of *Aythya ferina* in particular. It underlines how essential it is that remaining waterfowl habitat, in the zone bordering the Alps to the north, should be effectively protected (e.g. the Bodensee, the lower Inn valley and the Danube reservoirs).

**Scientific research** Midwinter waterfowl counts have been undertaken by members of the ornithological associations of Bavaria, which have also been responsible for various other faunistic and ecological research projects.

#### **Principal reference material**

Einhellinger, A. 1962. Von der Pflanzenwelt der Ismaninger Speicherseen. *Ber. Bayr. Bot. Ges.* 35: 23–27.

Bezzel, E. and Wüst, W. 1965–66. Vergleichende Plantbeobachtungen zum

Durchzug der Watvögel (Limicolae) im Ismaninger Teichgebiet bei München.  
*Anz. orn. Ges. Bayern* 7: 429–474, 771–822.

Bezzel, E. 1969. *Vogelparadiese in Bayern*. Garmisch Partenkirchen. 78 pp.

Wüst, W. 1972. Europa Reservat Ismaninger Teichgebiet, Bericht: 1969–1971.  
*Anz. orn. Ges. Bayern* 11: 288–313.

### 35. UNTERER INN (Haiming – Neuhaus)

**Criteria for inclusion** 1a,b,e; 2a; 3a,c; 4a,b.

**Geographical location** 48°12'–28'N 12°52'–13°26'E, Bayern. On a section of the River Inn, which runs along the Austrian border to its confluence with the Donau, from the 19 km post just upstream of Schärding (Austria, across the river from Neuhaus) to the 75 km post near Haiming, about 80 km east of München.

**Area** 1,955 ha.

**Altitude** 316–350 m.

**Water depth** Maximum 5–7 m; average 1–2 m.

**Wetland type** 15, 16.

**Ecology** Four reservoirs have been constructed since 1943 for hydroelectric purposes, downstream from the point where the river Salzach flows into the River Inn. The wetland area thus formed includes remnants of former riverine forests and has one of the biggest inland concentrations of waterfowl in the Federal Republic. The 1–3 km-wide and 10–15 km-long reservoirs can be considered as sections of the river but with a slower current. The fine material in the water settles on the bottom, especially at quiet bends of the river, and permits the development of a varied vegetation. Reedbeds and riverine forests are to be found at many bends, on spits and along backwaters, and they provide excellent breeding sites for waterfowl. This abundance of food, combined with the disappearance of several other wetlands in the northern prealpine plains, is responsible for the increasing number of waterfowl. One quarter of the total counted in Bavaria and Austria during the IWRB midwinter counts have been located in this area. The commonest species include Tufted Duck *Aythya fuligula* (15–20,000), Pochard *A. ferina* (12,600), Mallard *Anas platyrhynchos* (10,500), Teal *Anas crecca* (4,200), Goldeneye *Bucephala clangula* (3–4,000), Lapwing *Vanellus vanellus* (8,000) and Ruff *Philomachus pugnax* (13,400). Breeding species include Night Heron *Nycticorax nycticorax* (60 pairs), Common Tern *Sterna hirundo* (50 pairs) and Gadwall *Anas strepera* (35 pairs).

**Legal status** The reservoirs of Ering-Frauenstein and Eggfling Obernberg have been made into a Nature Reserve (729.22 ha), which links up with the Hagenauer Bucht Nature Reserve (166 ha) on the Austrian side of the river. The area as a whole has been nominated for the Ramsar Convention list.

**Tenure** The river Inn belongs jointly to the Oberbayern and Niederbayern Districts. Adjacent areas are privately owned or belong to municipalities.

**Management practices** Various measures were under study in 1977, although none were yet in operation.

**Threats** Disturbance from fishing, hunting and recreation. Clearance of woodland to increase the area available for maize growing. Zoning of the reservoirs and

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their immediate surroundings, to provide properly for different kinds of utilization, would be very desirable.

**Scientific research** The Deutsche Forschungs Gemeinschaft has initiated an investigation into the 'Requirements of Waterfowl on the Unterer Inn Reservoirs', but it is uncertain whether it has been completed and published.

**Principal reference material**

Reichholf, J. 1966. Untersuchungen zur Ökologie der Wasservögel der Stauseen am Unteren Inn. *Anz. orn. Ges. Bayern* 7: 536–604.

Erlinger, G. and Reichholf, J. 1969. Neue Beobachtungen zum Vorkommen der Wasservögel an den Stauseen des Unteren Inn. *Anz. orn. Ges. Bayern*. 8: 604–609.

Reichholf, J. 1972. Ein neues Wasservögelschutzgebiet am 'Unteren Inn'. *Ber. Dtsch. Sekt. Int. Rat. Vogelschutz* 12: 76–77.

Reichholf, J. 1975. Der Einfluss von Erholungsbetrieb, Angelsport und Jagd auf das Wasservögelschutzgebiet am Unteren Inn und die Möglichkeiten und Chancen zur Steuerung der Entwicklung. *Schriftenreihe Landschaftspflege u. Naturschutz* 12.

### 36. MOHRWEIHER bei ERLANGEN

**Criteria for inclusion** 1d; 2a; 4a.

**Geographical location** 49°36'N 11°01'E, Bayern. About 30 km NNW of Nürnberg, between Erlangen and Höchststadt.

**Area** 620 ha.

**Altitude** 288–305 m.

**Water depth** Maximum about 2 m.

**Wetland type** 24.

**Ecology** A mainly artificial wetland, which is however developing quite naturally. The Mohrweiher or Mohrhof Ponds are in the centre of a landscape in which, in an area of 250 sq. km, there is a total of about 2,000 ponds of up to 20 ha in size, formed by non-porous clay layers between sandstone. Small streams have been dammed to form a chain of ponds, which are used for Carp *Cyprinus carpio* culture. The surroundings consist of damp meadows, with pinewoods on higher and drier ground. The ponds give rise to a great variety of habitats, including areas entirely overgrown with submerged and floating vegetation, reedbeds and sedges, marshland, willows and small alder bogs. The flora and fauna is consequently rich in species, the former including, for example, pillwort *Pilularia globulifera*, adder's tongue *Ophioglossum vulgatum* and the shore-weed *Litorella lacustris*; the latter such breeding birds (rare or threatened elsewhere in the Federal Republic) as the Black-necked Grebe *Podiceps nigricollis* (50–100 pairs), Garganey *Anas querquedula* (50–65 pairs) and Black-tailed Godwit *Limosa limosa* (several pairs).

**Legal status** The wetland is situated in the 680.8 ha Mohrhof Landscape Reserve. It would be desirable for it to be given full nature reserve status in its own right.

**Tenure** Partly in private partly in public ownership. The 'Blätterweiher' (8 ha)

are the property of the 'Bund für Naturschutz in Bayern'.

**Management practices** In the initial stages only. Thus, steps have been taken to keep the Blätterweiher in their present condition by annual cutting of the reeds and limited fishing. All the ponds are in fact used to some extent for fish farming, the surrounding areas for agriculture and forestry.

**Threats** Intensive fish farming is affecting the habitats, since it leads to construction of better roads, mowing of reedbeds during the waterfowl breeding-season, chopping down of border vegetation in the autumn, digging out of ponds, felling of willows and clearing of low vegetation, drainage of meadows etc. There is also severe hunting pressure and increased disturbance by recreational activities. Nevertheless the landscape reserve still offers favourable conditions for waterfowl.

**Scientific research** No information apart from the indications given in the next section.

**Principal reference material**

Kraus, M. 1958. Die Vogelwelt des Frankischen Weihergebiets. *J. Orn.* 99: 232–234.

Bezzel, E. 1970. *Vogelparadiese in Bayern*. Garmisch-Partenkirchen, 78 pp.

### 37. WÜRZACHER RIED

**Criteria for inclusion** 1c,d,e; 2a; 3a.

**Geographical location** 47°55'N 9°53'E, Baden-Württemberg. About 35 km north-east of Ravensburg.

**Area** About 1,300 ha.

**Altitude** 650 m.

**Water depth** Maximum 2 m; average 0.5–1.0 m.

**Wetland types** 21, 22.

**Ecology** Vast peat bog, in a variable stage of development and including peat digging areas, birch stands and damp meadows, which has largely maintained its character. It was formed as vegetation gradually filled a lake basin left between end-moraines, towards the end of the last glacial period, in a valley previously occupied by a glacier. The great variation in the habitat favours a rich flora and fauna. The calcium peat bogs round the 'Haidgauer Quellseen' have plant communities in which orchid species are well represented. The raised bogs of Haidgauer and Aberser Ried have stands of *Pinus mugo*, connected by peatlands in the intermediate stage. Approximately 500 flowering plant and 150 moss species have been identified in the area. Relict species of the glacial periods are numerous. Breeding birds include Teal *Anas crecca* (6 pairs), Garganey *Anas querquedula* (3 pairs), Spotted Crake *Porzana porzana* (5 pairs), Common Snipe *Gallinago gallinago* (15 pairs) and Curlew *Numenius arquata* (3 pairs). Unfortunately the Black Grouse *Lyrurus tetrix*, a sensitive species, has disappeared from the area.

**Legal status** The entire area is protected (426.5 ha as a nature reserve and 894 ha as a landscape reserve).

**Tenure** No information.

**Management practices** None reported.

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**Threats** Peat digging and drainage which should be strictly limited and, in the case of drainage, preferably terminated.

**Scientific research** Some studies have been made of the geology, botany and peat formation.

**Principal reference material**

German, R. (ed.) 1968. *Bad Wurzach. Ein naturkundlicher und geschichtlicher Führer durch die Umgebung.* Stuttgart, 75 pp.

# GREECE

## SUMMARY OF WETLAND SITUATION

Unfortunately some of the most interesting wetlands in Greece have disappeared since the Second World War. The Lagoon of Agoulinitza in the north-western Peloponnisos, Lake Karla in Thessalia (east central Greece) and the delta of the Rivers Axios, Aliákmon and Loudhias in the Thessaloniki region of Macedonia have been reclaimed, as have the Mesolongion marshes on the north shore of the Gulf of Patraí. However, several of the remaining wetlands rate as among the most important in the whole Mediterranean basin and, on 21 August 1975, Greece acceded to the Ramsar Convention, nominating eleven sites for inclusion in the Convention list. These are marked by asterisks in the checklist below.

The Gulf of Arta or Amvrakikós, bordering the Ionian Sea, harbours wintering concentrations of between 150,000 and 200,000 Anatidae and numbers of White Pelicans *Pelecanus onocrotalus* occur on migration. A few pairs of Dalmatian Pelican *Pelecanus crispus* still breed in the area, which is also notable for its breeding colonies of herons Ardeidae. The Evros Delta on the border with Turkey is another wetland with high concentrations of Anatidae and Coot *Fulica atra*, in some years numbering up to 200,000.

As a breeding place the Evros Delta is again extremely rich in Ardeidae, while Glossy Ibis *Plegadis falcinellus*, Cormorant *Phalacrocorax carbo* and Pygmy Cormorant *P. pygmaeus* are still abundant. The White-tailed Eagle *Haliaeetus albicilla*, of which 10 to 12 pairs still nested in the delta between 1960 and 1970, has declined alarmingly to no more than a pair or two, due to the effects of pesticides and of poisoned bait used for the destruction of wolves *Canis lupus* and jackals *Canis aureus*. The creation of a National Park in this area has been under study for many years but a decision still awaits the results of hydrological investigations.

There are several other important wetlands in northern Greece. Lake Kerkinitis, a shallow reservoir fed by the River Strimón 24 km south-west of the junction of the Greek, Bulgarian and Yugoslav borders, is noted for its breeding colonies of Ardeidae and Spoonbills *Platalea leucorodia* and is a wintering area for *Pelecanus crispus* (over 600 in 1973), *Phalacrocorax carbo* and *pygmaeus*, several heron species, Avocets *Recurvirostra avosetta*, Shelduck *Tadorna tadorna* (840 in 1973) and many thousands of other Anatidae. Both species of pelican frequently visit Lakes Volví and Langadha (Korónia) at the base of the Khalkidhiki peninsula, which also provide good feeding grounds for grebes Podicipitidae and Ardeidae as well as several species of diving ducks. Further to the east, on the coast SE of Xánthi, the group of lakes including Porto Lago, Bourou, Fanarion, Aroghi, Messi, Karakatzali and Mitrikou, could be considered as an entity although they vary very much in their characteristics. Lake Mitrikou, the only fresh water lake of the group, has extensive reedbeds and shore vegetation, which support breeding colonies of several species of Ardeidae, and the creation of a reserve comprising the entire lake is under study. The whole complex of lakes is important for wintering waterfowl, including Greylag Goose *Anser anser* and White-fronted Goose *Anser albifrons*. A little further to the west several wetlands in the delta of the river Nestos are of interest: not very far from Kavalla the lagoon of Gumburnou



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harbours a small colony of Mediterranean Gulls *Larus melanocephalus*, one of the few to survive since drainage brought about the disappearance of the major colony in the Axios/Aliákmon/Loudhias delta at the head of the Thermaïkos Gulf, although that delta probably still provides suitable feeding areas for large numbers of waders Limicolae and gulls Laridae on migration.

Due north and due west, respectively, of Thessaloniki, two other lacustrine wetlands, both of which extend beyond the Greek frontier, call for mention: Lake Doiran most of which is in Yugoslavia (Dojransko Jezero – see under that country) is of tectonic origin, dating back to the Pliocene, now markedly eutrophic, with a productive fishery and much studied by limnologists (a Project AQUA site); the Mikrí Prespa lake, a small part of which is in Albania, is a nesting place of both pelicans *Pelecanus crispus* and *onocrotalus* (about 150 pairs of each in 1973), both cormorants *Phalacrocorax carbo* and *pygmaeus* and several species of Ardeidae. In 1974 it became part of a National Park, which includes the Greek section of the Megali Prespa lake (the rest of which is in Albania and Yugoslavia).

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Hoffmann, L., Bauer, W. and Müller, G. 1971. Proposals for Nature Conservation in Northern Greece. Morges, IUCN Occasional Paper No. 1.

Sevastos, C. G. 1976. Greece (a detailed review of the wetland situation). In *Proceedings of the International Conference on Conservation of Wetlands and Waterfowl, Heiligenhafen, Federal Republic of Germany, 2-6 December 1974*. Slimbridge, IWRB. Pp. 97-102.

The Times Atlas of the World 1975 edition has been followed for spelling of place names.

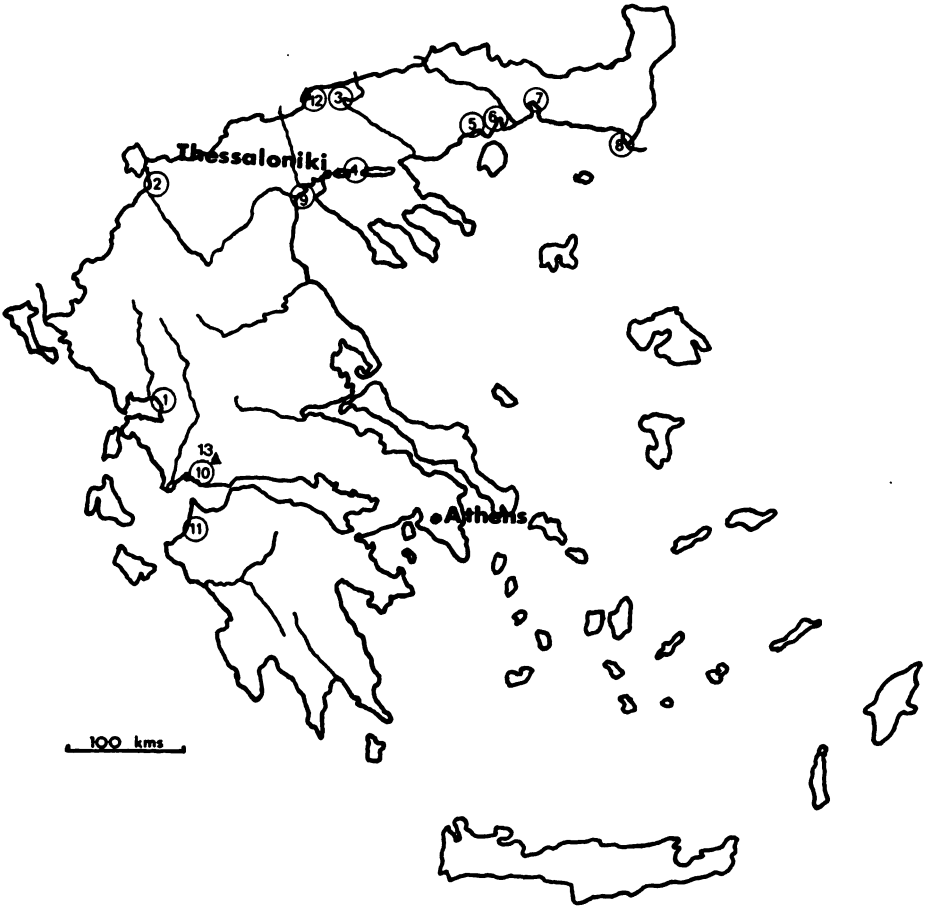
**WETLANDS OF INTERNATIONAL IMPORTANCE**

\*Nominated for inclusion in the Ramsar Convention list

	Locality	Latitude	Longitude	Size	Wetland criteria/ Conservation status
*1.	Gulf of Arta (Amvrakikós Kólpos)	39°05'N	20°50'E	c.40,000 ha	1a,b,c,d,e; 2a; 3c; 4a Unprotected
*2.	Lake Mikrí Prespa	40°35'N	21°06'E	c.4,470 ha	1a,c,d,e; 2a,b; 3a,b,c; 4a Protected
*3.	Lake Kerkinitis	41°12'N	23°09'E	c.5,000 ha	1a,b,c,d; 2a,b,(c); 3c; 4a Unprotected
*4.	Thessalonian lakes				1c,e; 2a,b; 3c; 4a Unprotected
4.1	Lake Volví	40°41'N	23°28'E	c.5,700 ha	
4.2	Lake Korónia (Langadha)	40°41'N	23°09'E	c.3,800 ha	
*5.	Lagoon of Gumburnou (near Kavalla)	40°52'N	24°31'E	c.500 ha	1e; 2a,b; 4a Unprotected
*6.	Nestos delta	40°51'N	24°44'E	No estimate available	1a,c,d,e; 2a; 3c; 4a Unprotected

	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
*7.	Thracian lakes			Over 10,000 ha	1a,b,c,d,e; 2a; 3c; 4a Unprotected
7.1	Porto Lago	41°01'N	25°07'E		
7.2	Bourou	41°03'N	25°07'E		
7.3	Fanarion	40°58'N	25°08'E		
7.4	Aroghi	40°57'N	25°10'E		
7.5	Messi	40°59'N	25°13'E		
7.6	Karakatzali	40°56'N	25°12'E		
7.7	Mitrikou	40°59'N	25°19'E		
*8.	Évros delta	40°52'N	26°12'E	c.5,000 ha	1a,b,c,d,e; 2a,b; 3a,b,c; 4a,c Included in 185,000 ha Nat. Park Project but only a few no-shooting zones as yet declared
*9.	Delta of Rivers Axios, Aliákmon and Loudhias	40°32'–37'N	22°39'E	No estimate available	1a? Unprotected
*10.	Gulf of Mesolóngion	38°24'N	21°25'E	No estimate available	1a,b? Unprotected
*11.	Lake Kotichi	38°00'N	21°18'E	c.850 ha	1a,b,d,e; 2a; 3c; 4a Unprotected
12.	Lake Doiran	41°13'N	22°44'E	1,560 ha (Yugoslav sector 2,700 ha)	1c?,e; 2a,c; 3b; 4c Unprotected (AQUA site)
13.	Lake Trikhonis	38°30'N	21°30'E	9,700 ha	1d; 2a; 4a,b Unprotected (AQUA site)

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## SUMMARY OF WETLAND SITUATION

Among the most recent accessions to the Ramsar Convention has been that of Hungary on 11 April 1979. The additional measure of protection thus extended to the 8 sites nominated for the Convention list and covering part, or in some cases the whole, of the relevant wetlands (as indicated in the checklist below) is particularly welcome in view of the past history of many such areas. Thus the formerly vast area of 'puszta' or steppe in north-eastern Hungary underwent dramatic changes over the last decade and much of its formerly characteristic flora and fauna declined in numbers or disappeared. The famous Hortobágy steppe (c.60,000 ha) became interspersed with arable land and rice fields, although fishponds still account for c.700 ha. Nevertheless, considerable numbers of geese continue to frequent the steppe on migration and in winter even if now less restricted to the traditional areas, including the White-fronted Goose *Anser albifrons* (max. 8,250, Nov. 1970), the Greylag Goose *A. anser* (Max. 3,200, Mar. 1973) and the Lesser White-fronted Goose *A. erythropus* (max. 450, Oct. 1970).

To the south-east, the Biharugra fishpond complex, situated in an 8,000–10,000 ha area of steppe and cultivation, close to the Romanian border, provides wintering grounds for upwards of 15,000 *Anser albifrons*; and further south and west, though still in the south-eastern corner of Hungary, the 100 ha natron lake of Kardoskút, surrounded by about 2,000 ha of fescue grass *Festucetum* plains, which was declared a Nature Protection Area in 1965, remains fairly free from disturbance, even on the periphery, despite some scattered cultivation, and has become attractive to geese since 1970. Over 50,000 migrating and wintering *A. albifrons* are sometimes present (Nov./Dec. 1970; Dec. 1973; Jan. 1974), together with several hundreds, sometimes thousands (6,000 in Oct. 1971) of Bean Goose *A. fabalis* and several thousand *A. erythropus*. The nearby Pitvaros area, a complex of small natron lakes in grassy plains, again with some admixture of cultivation, is also favoured by geese, their numbers building up when Kardoskút reaches saturation point. The Pitvaros lakes are of equally great limnological interest, particularly the 90 ha Fehér Tó, which is highly mineralized and eutrophic.

In central Hungary, another group of alkaline fishponds of which the best known is also called the Fehér Tó ('white lake') is situated north-west of Szeged in the Tisza River valley. It extends over about 850 ha and once attracted the country's third largest concentration of geese; although this has now declined as a result of over-hunting, oilfield exploitation and the fisheries, *A. albifrons* can still number up to 10,000 (Nov. 1973) and *A. fabalis* around 1,200 (Oct. 1972; Oct. 1973). Other natron lakes in the Pusztaszer area include the Csaj Tó, Donger Tó, Saser and Labodar, each of them surrounded by characteristic alkaline steppe and marshes fed by rainwater. Breeding birds include Avocet *Recurvirostra avosetta* and Kentish Plover *Charadrius alexandrinus*, numerous duck Anatidae, waders Limicolae and herons Ardeidae may be present during migration periods, and the area is also of considerable limnological interest. Lastly, in this region, the floodplains of the River Tisza further upstream, to the west of Hódmezővásárhely and included in the Mártély Landscape Conservation Area, are of great ornithological

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and botanical interest: 76 species of birds are known to nest regularly, 43 occasionally, whilst another 43 species visit the area on migration and no less than 81 more have been recorded.

Moving westwards, one finds a number of wetlands in the zone between the Tisza and Duna (Danube), such as the Szelidi Tó and Kunfehér Tó in the area to the east and north-east of Dunapataj, both of them eutrophic soda lakes of great limnological interest. Then, in western Hungary proper there is the Tata fishpond area, not far west of Budapest, the importance of which is enhanced by the fact that one of the ponds, the 'great lake' or Nagy Tó (340 ha), and its associated channels are fed by warm springs which prevent the water freezing. Next, Lake Velence (Velencei Tó), lying between Budapest and Lake Balaton, is again of limnological interest, as well as harbouring large flocks of *A. fabalis* in winter (max. 20,000, Nov. 1972). Lake Balaton itself is the largest lake in Central Europe (c.55,000 ha), with a typically 'Pannonian' character reflected in its flora and fauna. Its eutrophication is, however, increasing and recreational activities have eliminated much of the shallow, sparsely vegetated marginal zone formerly used by roosting geese, forcing them to roost afloat in deep open water. Little or Kis Balaton, adjoining the main lake on the south-west, has hardly any open water but its dense reedbeds provide cover for numerous nesting species, of which the Night Heron *Nycticorax nycticorax*, Squacco Heron *Ardeola ralloides*, Little Egret *Egretta garzetta*, Great White Egret *Egretta alba* and Spoonbill *Platalea leucorodia* are among the more noteworthy. The wintering geese in the Balaton area may number as many as 40,000 (Jan. 1974) and are largely *A. fabalis*, which also applies to those wintering in the fishpond complexes of southern Hungary from the vicinity of Gemenc, in the lower Duna (Hungarian Danube) valley, westwards.

### References

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- Miklos, Marian, 1975. Die Vogelwelt des Naturschutzgebietes Pusztaszer. *Aquila* 82: 81–98.
- Sterbetz, I. 1975. A vadlúdvonulás alakulása a Magyarországi Gyülekezőhelyeken (Development of wild-geese migration on the Hungarian gathering places). (In Hungarian, English summary). *Aquila* 82: 181–194.

## WETLANDS OF INTERNATIONAL IMPORTANCE

### \*Nominated for inclusion in the Ramsar Convention list

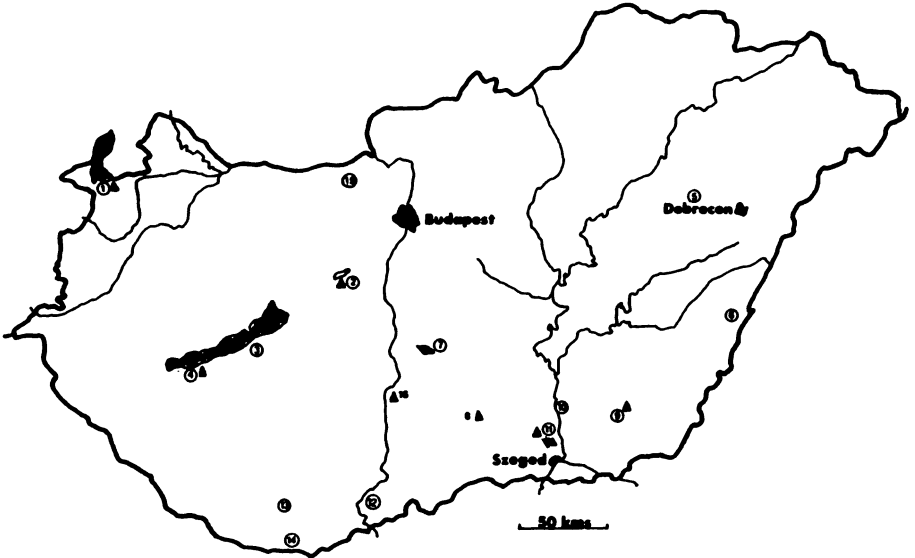
	Locality	Latitude	Longitude	Size	Wetland criteria/ Conservation status*
1.	Fertő Tó (for detailed description see under Neusiedlersee, Austria)	47°41'N	16°35'E	8,000 ha in Hungary (total 35,000 ha)	1a,b,c,d,e; 2a,b,c; 3a,b,c; 4a Partly protected AQUA site
*2.	Velencei Tó (Lake Velence)	47°13'N	18°36'E	2,590 ha	1a,b; 2a; 4a 1,000 ha protected (Nature Reserve: Ramsar Convention and AQUA site)

	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
3.	Balaton	46°50'N	17°45'E	c.55,000 ha	1a,b,e; 2a; 3a,b,c; 4a Partly protected (Tihany NP, 1,100 ha)
*4.	Kisbalaton	46°40'N	17°14'E	4,200 ha	1a,b,c,d,e; 2a,b; 3a,b,c; 4a 1,403 ha protected (Nature Reserve: Ramsar Convention and AQUA site)
*5.	Fishponds and marshes of the Hortobágy Puszta	47°15'– 48°00'N	20°45'– 21°45'E	c.15,000 ha	1a,b,c,d,e; 2a; 3a,b,c; 4a Protected (part of the 52,000 ha Hortobágy NP)
6.	Biharugra fishpond complex	46°58'N	21°36'E	720 ha of wetland; c.8,000 ha steppe and cultivation	1a,b,d,e; 2a,b; 3c; 4a,c
*7.	Szabadzállás and Fülöpszállás alkaline lake and field complex	c.46°50'N	19°00'E	c.4,000 ha	1a,d,e; 2a; 3a,b,c; 4a Protected (part of 31,000 ha Kiskunság NP)
8.	Kunféhér Tó	46°20'N	19°29'E	170 ha	2a; 3a,b; 4a Protected. AQUA site
*9.	Kardoskút and Pitvaros lake areas	46°30'N	20°28'–40'E	Ramsar Convention site 500 ha. Kardoskút 488 ha, Fehér Tó 90 ha	1a,b,c,d,e; 2a,b; 3a,b,c; 4a 578 ha protected. Fehér Tó an AQUA site
*10.	Tisza river floodplain, west of Hódmezővásárhely	46°25'–29'N	20°13'–20'E	2,300 ha	1a,c,d,e; 2a; 3a,b,c; 4a Part of Mártély Landscape Protection Area
*11.	Pusztaszer area, including Fehér Tó, Saser, Donger Tó, Csaj Tó and Labodar wetlands	c.46°15'– 20'N	20°05'–10'E	c.5,000 ha of wetlands out of the 22,000 ha total area	1a,d,e; 2a; 3a,b,c; 4a Protected. Fehér Tó and Donger Tó are AQUA sites
12.	Gemenc area, lower Duna valley	46°10'N	18°53'E	Not quoted	1a Status uncertain
<b>Fishpond complex of:–</b>					
13.1	Pellérd	46°02'N	18°09'E	Not quoted	1a; 2a Status uncertain
13.2	Sumony	45°58'N	17°55'E	Not quoted	1a; 2a Status uncertain
*14.	Szaporca reserve	45°50'N	18°06'E	250 ha	No information Protected
15.	Tata fishpond complex	47°39'N	18°18'E	340 ha	1a,b,e; 2a,b,c; 3a,b; 4a Protected

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	Locality	Latitude	Longitude	Size	Wetland criterial Conservation status
16.	Szelidi Tó	46°38'N	19°00'E	50 ha	2a; 3b,c Unprotected. AQUA site

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### DETAILS OF LISTED AREAS

#### 2. VELENCEI TÓ (Lake Velence)

**Criteria for inclusion** 1a,b; 2a; 4a.

**Geographical location** 47°13'N 18°36'E. About 45 km south-west of Budapest and 12 km east of Székesfehérvár.

**Area** 2,590 ha.

**Altitude** 104–111 m.

**Water depth** Maximum 5 m; mean 1.2 m.

**Wetland type** 18.

**Ecology** A lake of tectonic origin with shallow eutrophic waters. The margins support extensive reedbeds of *Phragmites communis* and other species. The considerable ornithological importance of the site derives from the large wintering flocks of the Bean Goose *Anser fabalis* (the maximum figure so far recorded was 20,000 in November, 1972) and from the 28 breeding species, including in par-

ticalar the Great White Heron *Egretta alba* of which less than a dozen European breeding colonies survive.

**Legal status** The 420 ha strict nature reserve of Velence-Dinnyés established in 1958 has been extended to 1,000 ha and has now been nominated for the Ramsar Convention list.

**Tenure** State ownership.

**Management practices** Reeds are harvested annually; there is a commercial fishery. The Reserve is managed by the State Office for Nature Protection, visitors, in small numbers, only being admitted on permit.

**Threats** Increasing pressure from the development of recreational facilities.

**Scientific research** There is a small research laboratory on the lake shore.

**Principal reference material**

Donászy, 1959. Das Leben des Szelider Sees. Budapest.

Ruttkay, Tilesch and Veszprémi, 1964. Nádgazdálkodás ('Reed-culture'). Budapest.

### 3. BALATON

**Criteria for inclusion** 1a,b,e; 2a; 3a,b,c; 4a.

**Geographical location** 46°50'N 17°45'E. About 85 km south-west of Budapest, the lake extending on the same bearing a further 80 km from 18°14' to 17°19'E.

**Area** c.55,000 ha, inclusive of undeveloped sections of the shoreline.

**Altitude** 104 m.

**Water depth** Maximum 11 m; mean 3.25 m.

**Wetland type** 18.

**Ecology** A typical 'Pannonian' lake with eutrophic waters and an abundant fish fauna of 41 species, of which the 'fogas' (pike-perch or zander *Stizostedion lucioperca*) is one of the most notable. A considerable growth of reeds *Phragmites* along the lake shore has led to a reduction in the length of the waterline from 225 km to 180 km. The south-west corner of the lake is now separated by a few kilometres from the Kisbalaton reserve. Its main ornithological importance is, however, as a winter refuge for the Bean Goose *Anser fabalis*, of which up to 40,000 have been recorded, although numbers have tended to decline as a result of the replacement of lakeshore vegetation and cultivated areas by human habitations.

**Legal status** The lake itself is mostly unprotected but there are one or two small reservations, notably parts of the 1,100 ha Tihany National Park or landscape conservation area on the peninsula of that name, which juts southward into the lake towards its eastern end.

**Tenure** State ownership.

**Management practices** Balaton is a popular resort in both summer and winter; several mineral springs in its vicinity have been developed as spa centres. The lake is used generally for recreational purposes, including sailing, water-skiing and



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fishing, and there are numerous campsites, hostels and hotels along its shores. Two special Government Committees are concerned with maintaining the quality of the environment.

**Threats** These developments have contributed to increasing eutrophication and are also responsible for a good deal of disturbance to the birdlife and especially to the geese, which can now only roost on deep open water (most of the lake is frozen over in a hard winter).

**Scientific research** Important centre for limnological research since the beginning of the 19th century, based on the Biological Research Institute at Tihany, maintained by the Hungarian Academy of Sciences and by its Institute of Hydrology.

### Principal reference material

The findings of the Biological Research Institute are published in the *Annales Biologiae Tihany*.

## 4. KISBALATON

**Criteria for inclusion** 1a,b,c,d,e; 2a,b; 3a,b,c; 4a.

**Geographical location** 46°40'N 17°14'E. About 5 km from the south-west corner of Balaton and the township of Balatonszentgyörgy.

**Area** 4,200 ha.

**Altitude** 104 m.

**Water depth** Generally shallow, but varies greatly and sometimes dries up completely.

**Wetland types** 12, 18.

**Ecology** Formerly part of Lake Balaton but now separated and largely covered with reeds *Phragmites communis* and an admixture of bulrush, reedmace and sedges. The water is eutrophic. The wetland is particularly noted for its large numbers of breeding waterfowl including the smaller eastern race of the Cormorant *Phalacrocorax carbo sinensis*, Night Heron *Nycticorax nycticorax*, Squacco Heron *Ardeola ralloides*, Little Egret *Egretta garzetta*, Great White Egret *Egretta alba*, Spoonbill *Platalea leucorodia* and until 1953 Glossy Ibis *Plegadis falcinellus*. Nesting duck such as Mallard *Anas platyrhynchos*, Gadwall *A. strepera*, Garganey *A. querquedula*, Shoveler *A. clypeata*, Pintail *A. acuta*, Pochard *Aythya ferina* and Ferruginous Duck *A. nyroca* are also numerous and augmented during migration seasons by large concentrations of Goldeneye *Bucephala clangula* and Tufted Duck *Aythya fuligula*.

**Legal status** 1,403 ha were established as strict nature reserve in 1951 and nominated for the Ramsar Convention list in 1979.

**Tenure** State ownership.

**Management practices** A limited amount of reed and sedge is cut. The issue of permits to visitors, other than scientists, is strictly controlled and only allowed outside the birds' nesting season.

**Threats** The silt load presumably carried in by the Zala river and run-off from surrounding cultivation is gradually reducing the size of the lake and together with the extensive reedbeds could lead to the eventual desiccation of the wetland.

**Scientific research** Field station. Studies have been mainly directed to the avifauna and other vertebrates but a considerable range of scientific work has been undertaken in what is an area of great limnological as well as ornithological interest.

**Principal reference material**

Darnay, 1934. A Kisbalaton összeszugaradása (The shrivelling of Kisbalaton). *Aquila* 55–58: 169–187.

Keve, A. 1975. Adatok a Kis-Balaton Mádarvilágához I (Beiträge zur Vogelwelt des Kis-Balaton I) (In Hungarian with German summary). *Aquila* 82: 49–79.

Keve, A. 1976. Adatok a Kis-Balaton Mádarvilágához II (Beiträge zur Vogelwelt des Kis-Balaton II) (In Hungarian with German summary). *Aquila* 83: 191–225.

## 8. KUNFEHÉR TÓ

**Criteria for inclusion** 2a; 3a,b; 4a.

**Geographical location** 46°20'N 19°29'E, between the rivers Danube and Tisza, about 50 km WNW of Szeged and 10 km due north of the town of Kiskunhalas.

**Area** 170 ha (3 ponds; combined total area).

**Altitude** 101 m.

**Water depth** 1–1.5 m.

**Wetland type** 17.

**Ecology** A group of three natron or soda ponds lying in a depression 3.5 km long and 0.5 km wide. The largest shares the name Fehér Tó ('white lake') with many other similar Hungarian ponds: it is the most southerly of the group and has water with a pH of 10–11. Kis Tó or 'small lake', the most northerly, has a pH of 8.5. The third and smallest of the ponds lies between the two. A number of studies have been made of the phytoplankton of this wetland; 186 algal taxa have been identified of which 36 are limnic species, 8 are typical brackish water organisms and 9 represent euryhaline-brackish water transitional forms. The waters are broadly eutrophic and rich in organic material. The margins have a growth of reed *Phragmites*.

**Legal status** Protection has been given to the wetland by the District Council.

**Tenure** State ownership.

**Management practices** The area has been developed both for fisheries and as a holiday resort.

**Threats** Development of recreational activities and facilities is bound to have an impact on the characteristic alkaline lake ecosystem and more especially on its unique fauna.

**Scientific research** Limnological research in this area began in the early 1920s and a research team from Szeged worked for several years in the area in the 1960s.

**Principal reference material**

Megyéri, J. 1963. Report in *Acta Biologica Szeged*: pp. 207–218.

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# ICELAND

## SUMMARY OF WETLAND SITUATION

The volcanic island of Iceland has a rich variety of wetlands, including extensive bogs, marshes and inland waters, all quite conducive to a relatively high production of waterfowl. They and the shallows and intertidal areas of an extremely indented coastline also provide excellent habitat for waterfowl migrating from the Canadian Arctic and Greenland to Western Europe and vice versa, as well as wintering grounds for several species but sea ducks in particular. Further evidence of their international importance is the fact that in several Icelandic wetlands the numbers of breeding, feeding, moulting or resting waterfowl may reach the level of fifty to one hundred thousand individuals of a single species. Moreover, the freshwater lakes, which may be of glacial, volcanic or tectonic origin, are extremely diverse in their characteristics and hence offer the limnologist a wide field of study, which underlines their scientific importance.

Human interference with Icelandic wetlands has so far been slight, but industrial and agricultural developments as well as their accompanying road construction could affect several of them in the immediate future. At present only Thjórsárver (No. 27 in the list) is seriously threatened, in this case by flooding as the result of the construction of a dam for a hydro-electric power scheme. This remote site, a wide river basin, is the nesting site of two-thirds of the world population of the Pink-footed Goose *Anser brachyrhynchus*, which as a breeding species is confined to Iceland and Greenland. Research into all aspects of the unique Thjórsárver ecosystem has been in progress since 1970, with a view to reducing and if possible compensating for the effects of the proposed inundation.

Concern is also felt about the future of the Ölfusforir wetland (No. 21), which is situated in the richest agricultural area, not far from Reykjavik. Hitherto little in the way of legal protection has been extended to wetland sites. However, the outstanding waterfowl nesting area of Lake Mývatn and its effluent river, the Laxá (constituting together the listed area No. 13) have been protected by law since 1974 and Svarfadardalur (No. 7), also in northern Iceland, has also been made into a reserve, which means that any changes in the landscape require the approval of the Nature Conservation Council and that hunting is forbidden. These measures were followed up by Iceland's accession to the Ramsar Convention on 2 December 1977. One area, the strictly protected 20,000 ha section of the Mývatn-Laxá region (No. 13 in the checklist below), has so far been nominated for inclusion in the Convention list.

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## WETLANDS OF INTERNATIONAL IMPORTANCE

## \*Nominated for inclusion in the Ramsar Convention list

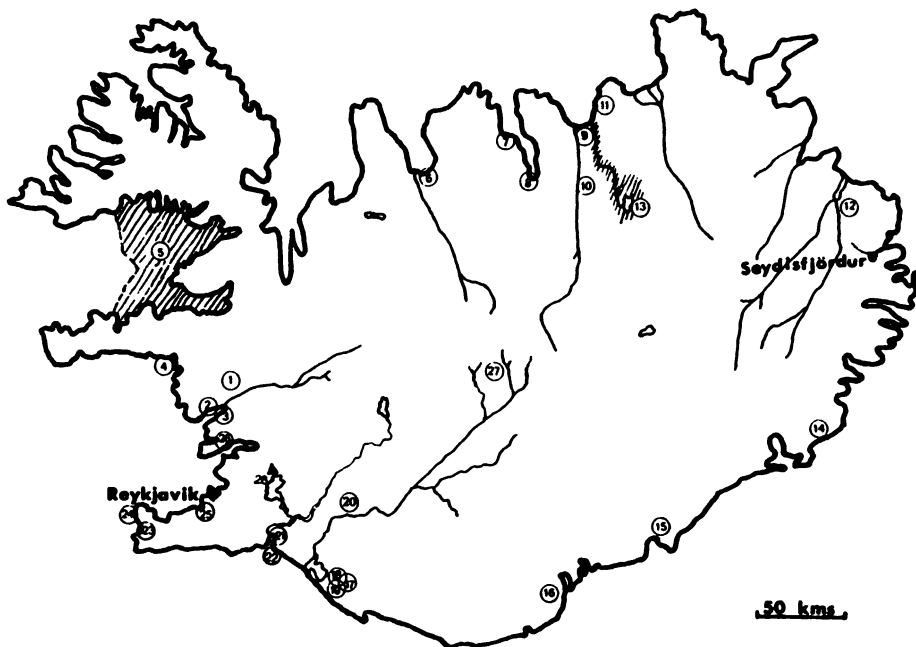
	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status**</i>
1.	Ferjubakkafloi – Hólmavag	64°38'N	21°44'W	1,500 ha	1a,d,e; 2a; 4a
2.	Borgarfjörður	64°30'N	22°00'W	7,000 ha	1a,b,e; 2a; 4a
3.	Hjörsey – Straumfjörður	64°32'N	22°00'W	6,000 ha	1a,b,d; 2a,b; 4a
4.	Löngufjörur	64°45'N	22°30'W	17,000 ha	1a,b,d; 2a,b; 4a
5.	Breidafjörður	65°20'N	23°00'W	270,000 ha	1a,b,c,d,e; 2a; 3b; 4a
6.	Skógar	65°40'N	19°35'W	2,300 ha	1a,d; 2a,b; 4a
7.	Svarfadardalur	65°57'N	18°32'W	600 ha	1a,d; 2a,b; 4a Protected
8.	Hölmarnir	65°39'N	18°04'W	700 ha	1a,d; 2a,b; 4a
9.	Sandur – Síflaekur	65°58'N	17°32'W	500 ha	1a,d; 2a,b; 4a
10.	Vestmannsvatn	65°48'N	17°25'W	500 ha	1a,d; 2a; 4a
11.	Kelduverfi – Öxarfjörður	66°10'N	17°10'W	2,500 ha	1a,d; 2a,b; 4a
12.	Hjaltastadabla	65°30'N	14°20'W	2,600 ha	1a,d; 2a,b; 4a
*13.	Mývatn – Laxá	65°36'N	17°00'W	20,000 ha	1a,b,c,d,e; 2a; 3b,c; 4a Protected (part of a 600,000 ha Nature Reserve)
14.	Lónsfjörður	64°25'N	14°40'W	2,700 ha	1a,d; 2a; 4a
15.	Salthöfdamýrar	63°42'N	16°34'W	200 ha	1d; 2a
16.	Medalland – austan Eldvatns	63°40'N	18°00'W	2,000 ha	1d; 2a
17.	Skúmsstadavatn	63°42'N	20°30'W	800 ha	1d; 2a
18.	Oddafloð	63°46'N	20°27'W	700 ha	1d; 2a
19.	Safamýri	63°47'N	20°35'W	700–2,000 ha	1a,d; 2a
20.	Pollengi	64°10'N	20°26'W	1,000 ha	1d; 2a
21.	Ölfusforir	63°57'N	21°15'W	1,000 ha	1d; 2a
22.	Hraun vid Eyrarbakka†	63°55'N	21°07'W	100 ha	1a,c,d; 2a; 4a Protection planned
23.	Ósar	63°57'N	22°40'W	400 ha	1a,d; 2a,b; 4a?
24.	Gardskagi	64°05'N	23°42'W	600 ha	1a,d; 2a,b; 4a?
25.	Álftanes	64°05'N	22°00'W	1,000 ha	1a,d; 2a,b; 4a?
26.	Laxárvogur	64°20'N	21°40'W	500 ha	1a,d; 2a,b; 4a?
27.	Thjórsárver	64°35'N	19°15'W	15,000 ha	1a,b,c,d,e; 2a,b,c; 3a,b; 4a
28.	Thingvallavatn	64°10'N	21°05'W	84,000 ha	2a,c; 3a,c; 4a Partly protected (Thingvallir NP) AQUA site

\*\* Unprotected unless otherwise stated

† The longitude of 18°00'W quoted by Gardarsson (1976) for this area, which he lists simply as

Eyrarbakki and describes as a small coastal wetland (noteworthy as the main breeding place in Iceland of the Grey Phalarope *Phalaropus fulicarius*), would place it at least 30 km inland on comparatively high ground. It is assumed that its correct location is considerably further to the west, near the township of Eyrarbakki; and the plan to establish it as a reserve may well by now have been implemented.

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### DETAILS OF LISTED AREAS

#### 5. BREIDAFJÖRDUR

**Criteria for inclusion** 1a,b,c,d,e; 2a; 3b; 4a.

**Geographical location** 65°20'N 23°00'W. Marine area off west coast, slightly west of due north and c.100 km, at its nearest point, from Reykjavik.

**Area** c.270,000 ha.

**Altitude** Sea level.

**Water depth** Shallow, with extensive intertidal zones.

**Wetland types** 1, 3, 10, 11.

**Ecology** Large shallow bays, with over 2,000 islets, the home of important seabird and seal populations. Between 80,000 and 100,000 Eiders *Somateria mollissima*

## ICELAND

breed in the area and it is also the main stronghold of the small Icelandic population of White-tailed Eagle *Haliaeetus albicilla*. The eel-grass *Zostera* flats are of great importance for the Brent Goose *Branta bernicla hrota* during spring migration. The intertidal zone is used by tens of thousands of migrating Knots *Calidris canutus* and other species of Limicolae.

**Legal status** No special legislation for the protection of the area has been enacted.

**Tenure** Details of the ownership of the numerous islands have not been reported.

**Management practices** The bladder-wrack seaweed *Ascophyllum nodosum* is being harvested, a recent development which should have negligible effects.

**Threats** Birds and seals were exploited until recently, but economic developments in Iceland and a shift of the human population into towns and villages have changed the situation and several species of waterfowl are known to be increasing in numbers.

**Scientific research** No information.

### Principal reference material

Gardarsson, A. 1976. National report for Iceland. In M. Smart (ed.) *Proc. Internat. Conf. on Conservation of Wetlands and Waterfowl, Heiligenhafen, Fed. Rep. of Germany, 1974*, p. 105. IWRB, Slimbridge.

## 13. MÝVATN-LAXÁ

**Criteria for inclusion** 1a,b,c,d,e; 2a; 3b,c; 4a.

**Geographical location** 65°36'N 17°00'W. Mývatn is 42 km from the nearest point on the north-east coast, which is close to where the Laxá river flowing from the lake reaches the sea and some 10 km south-west of the town of Húsavík.

**Area** c.20,000 ha (lake area c.4,000 ha).

**Altitude** 277 m.

**Water depth** Northern basin maximum 1.5 m – 1 m; southern basin maximum 5.0 m – 2.2 m.

**Wetland type** 19.

**Ecology** The lake is situated in a basaltic, arid area in the rain shadow of the Vatnajökull, one of the biggest expanses of glacier in Europe. It is divided into two basins, the larger southern one being mainly fed by the River Graenilaeknur which flows into the south-west corner, though cold springs (5° – 7°C) along the eastern shore also discharge into the lake. Similar cold springs feed the northern basin, but also several lukewarm (15° – 22°C) springs rich in silica. The high silica content is responsible for a high production of benthic diatoms and there is a diatomite deposit on the lake bottom several metres thick. The outflow from the lake, the River Laxá, is rich in animal life and has a good fishable stock of Salmonidae, Arctic Charr and Trout *Salvelinus alpinus* and *Salmo trutta*. One of the three outlets feeding the Laxá can be regulated.

Algal blooms of *Anabaena flos-aquae* occur annually and the production of benthic algae (diatoms, *Cladophora aegrophila* and macrophytes) is very pronounced; populations of benthic Chironomids are likewise among the highest ever recorded.

The lake and its surroundings are one of the most important breeding places for

ducks in northern Europe, with some 16 species, both European and North American, including Scaup *Aythya marila*, Tufted Duck *A. fuligula*, Pochard *A. ferina*, Gadwall *Anas strepera* and Scoter *Melanitta nigra*. The entire European population of Barrow's Goldeneye *Bucephala islandica* (about 1,000 pairs) nests and partly winters in this area. Of special interest are the 100 or so pairs of Harlequin Duck *Histrionicus histrionicus* which nest along the Laxá River. About 250 pairs of Slavonian Grebe *Podiceps auritus* and several thousand of Red-necked Phalaropes *Phalaropus lobatus* use Mývatn as a breeding ground. Finally, it is an important moulting area for up to 6,000 Whooper Swans *Cygnus cygnus* and many duck species, especially Wigeon *Anas penelope*, males of which gather from a wide area.

**Legal status** Protected since 1974 by an Act of Parliament, which is stated in the most recent UN List (1980) to give nature reserve status to an area of no less than 600,000 ha; earlier the status was often compared with that of a National Park, though strictly speaking this conflicted with the fact people were still living and farming in the area. However, the inclusion of an area of 20,000 ha in the Ramsar Convention list gives valuable added protection.

**Tenure** The lake is owned by the local farmers, who presumably also own much of the surrounding land and also the land bordering the Laxá River.

**Management practices** None reported.

**Threats** A project to make the lake into a reservoir, to supply hydro-electric installations, was cancelled after several of the power-plants had actually been built. Their existence still constitutes a possible threat as does a proposal for a diatomite processing factory. Pressure from tourism and recreational activities is increasing.

**Scientific research** Limnological and fish-biology studies have been carried out since 1904 and a research station has been established in the vicinity. In recent years meteorological, hydrological, physical and chemical investigations have predominated, although one of the principal ornithological studies was made as recently as 1971.

#### **Principal reference material**

Stefansson, U. 1970. Chemical observations in Lake Mývatn. *Nátturufraedingurinn* 40: 187–196.

Gudmundsson, F. 1971. Straunendur (*Histrionicus histrionicus*) á Islandi. *Nátturufraedingurinn* 41: 1–28 and 64–98. (In Icelandic, with English summary).

Gardarsson, A. 1976. National report for Iceland. In M. Smart (ed.) *Proc. Internat. Conf. on Conservation of Wetlands and Waterfowl, Heiligenhafen, Fed. Rep. of Germany, 1974*, p. 106. IWRB, Slimbridge.

Jonasson, Peter M. (ed.) 1976. Results of recent scientific investigations at Lake Mývatn. *Oikos*, suppl. vol. 17.

## **27. THJÓRSÁRVER**

**Criteria for inclusion** 1a,b,c,d,e; 2a,b,c; 3a,b; 4a.

**Geographical location** 64°35'N 19°15'W. Headwaters of the Thjórsá river at the southern and eastern foot of the glaciated Hofsjökull peak, in the uninhabited centre of Iceland.



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**Area** c.15,000 ha.

**Altitude** 500 – 700 m above sea level.

**Water depth** Shallow.

**Wetland types** 12, 13, 14, 22, 23.

**Ecology** A semi-tundra area with numerous streams, brooks and pools in the upper valley of the Thjórsá river. The gently sloping valley has many peculiar ecological and landscape features, which have been well studied in recent years. In particular, it is the main breeding area of the Pink-footed Goose *Anser brachyrhynchus*. About two-thirds of the combined Icelandic and Greenland breeding population (11,000 pairs in 1970 and 1971 but down to 8,000 in 1974) nest here.

**Legal status** No legislation for the protection of the area has been enacted.

**Tenure** No information; presumably state-owned.

**Management practices** None so far. The area is still difficult of access and seldom visited.

**Threats** The hydro-electric development plan involving the construction of a storage reservoir in the Thjórsárver would result in the permanent inundation of the major part of the wetland area and thus the destruction of the main breeding area of *Anser brachyrhynchus*. Following strong national and international protests, the Icelandic Government has given support to biological research in the area since 1970 and the decision on the reservoir project has been postponed until investigations of ecosystems of this unique wetland have been concluded, which is likely to be well into the 1980s or later.

**Scientific research** In addition to the support given by the Icelandic Government, financial aid for research has also been provided by the Wildfowlers' Association of Great Britain and Ireland. Research aims include a general biological survey, evaluation of the site both as an unusual ecosystem and, in particular in relation to goose production, assessing to what extent and by what means the loss of habitat, if the site is flooded, might be compensated for elsewhere. Little progress had been made towards the last-mentioned objective, due to the difficulty of reconciling the viewpoints of engineers and biologists, when the matter was last reviewed (IWRB Bulletin 43/43, July/December 1977), but the survey and evaluation of *Anser brachyrhynchus* productivity are being maintained.

**Principal reference material**

Kerbes, R. H., Ogilvie, M. A. and Boyd, H. 1971. Pink-footed Geese of Iceland and Greenland: a population review based on an aerial nesting survey of Thjórsárver in June 1970. *Wildfowl* 22: 5–17.

Gardarsson, A. 1976. National report for Iceland. *Proc. Internat. Conf. on Conservation of Wetlands and Waterfowl, Heiligenhafen, Fed. Rep. of Germany, 1974*, p. 107. IWRB, Slimbridge.

**28. THINGVALLAVATN**

**Criteria for inclusion** 2a,c; 3a,c; 4a.

**Geographical location** 64°10'N 21°05'W. Due east of and 32 km from Reykjavik (or 50 km by road).

**Area** 84,000 ha.

**Altitude** 100.5 m.

**Water depth** Maximum 114 m; mean 34.1 m.

**Wetland type** 15, 19.

**Ecology** The largest lake in Iceland, in a basin of tectonic origin composed of volcanic basalt rocks and surrounded by areas which are still volcanically active. Its waters are oligotrophic and originate from springs. The inflowing spring water is cold (3° – 4°C) and the lake temperature never exceeds 12°C. The shores are very steep and mostly rocky, the main outlet in the south-eastern corner of the lake, the river Sog, flowing some 20 km to the head of a fjord near the town of Hveragerdhi. Stratification of the lake is unusual and the retention time for the lake water is c.270 days. Primary production is largely dependent on the diatoms *Melosira islandica* and *M. italica*. The Arctic Charr *Salvelinus alpinus* is now the main fish species, the formerly important Trout *Salmo trutta* having declined following the construction of a hydro-electric installation. The lake is a Project AQUA site.

**Legal status** The 4,000 ha Thingvellir National Park borders the northern shore of the lake, giving it some measure of protection, although until fairly recently shooting was still permitted in winter, haymaking in early summer, etc.

**Tenure** Partly state-owned and partly owned by local farmers.

**Management practices** The power plant was established in 1962 and has resulted in a certain amount of fluctuation in water level, but effective management has ensured that the lake remains one of the best for fishing in the country, the yield of charr being about 5 kg/ha/yr. Considerable attention is also given to providing recreational facilities.

**Threats** Hydro-electricity generation and the recreational pressures which tend to be excessive for the reason that about half the population of Iceland lives in the vicinity, remain the chief threats to the productivity and integrity of the lake.

**Scientific research** Intensive research has been in progress for several years, on such subjects as the primary and secondary production of the plankton, benthos and fish.

#### **Principal reference material**

Ostenfeld, C. H. & Wesenberg-Lund C. H. 1906. A regular fortnightly exploration of the plankton of two Icelandic lakes, Thingvallavatn and Mývatn. *Proc. Roy. Soc. Edinburgh*, Session 1904–1905, 25(12): 1092–1167.

Adalsteinsson, H. 1975. Icelandic fresh waters. *Votlendi. Rit. Landverndar* (Reykjavik) 4: 56–60.

# IRAN

## SUMMARY OF WETLAND SITUATION

Despite much rugged terrain and a climate of great extremes, Iran is one of the most important wintering areas for waterfowl breeding in the east of the European part of the Soviet Union and in western Siberia. The interior plateau, with its vast semi-arid and arid areas including the salt deserts and pans in the Dasht-e-Kavir and Dasht-e-Lut, is surrounded on practically all sides by formidable mountain ranges. The Zagros Mountains stretch from the Province of Azarbaijan in the north-west corner of the country, in a south-easterly direction parallel to the Iraq border towards the Persian Gulf and thence eastwards to Baluchistan. The Azarbaijan sector comprises high tablelands (with peaks rising to 4,500 m) and lowland basins containing several lakes, of which the highly saline Oroomiyeh is the biggest. The Elborz mountains, branching eastwards along the southern shore of the Caspian Sea, the water level of which is about 30 m below that of the world's oceans, include the 5,601 m volcanic cone of Demavand, the highest peak in the country. A wall of lower mountains (c.2,600 – 4,000 m) runs parallel with the borders of Afghanistan and Pakistan.

Winters are severe in the higher parts of the country, especially Azarbaijan; by contrast summer temperatures in most of the interior and especially in the south-east are among the highest recorded in the world. The Caspian lowland climate varies from hot and humid summers to relatively mild winters. Most of Iran has very little rainfall, the exceptions being the Caspian lowlands and Khuzestan in the south-west, where rainfall during winter is abundant and inundation of large areas of semi-arid country and of the mudflats in the vicinity of the Gulf can occur. The most important wintering areas for waterfowl border the Caspian, notably at Bandar-e-Anzali/Mordab and the bay of Gorgan with the Miankaleh peninsula which encloses it, but including also the reservoirs (ab-bandans) constructed for irrigation purposes. In Azarbaijan wintering flocks of geese (mainly Greylag *Anser anser* and White-fronted *A. albifrons*) occur in the valley of the River Aras (Araxes) on the USSR border. Not far to the south, Lake Rezaiyeh and the saltswamps along the border offer open water in winter for wintering ducks and coots, whilst the lake is an important breeding area for the Greater Flamingo *Phoenicopterus ruber* and White Pelican *Pelecanus onocrotalus*. Very high concentrations of waterfowl occur in Khuzestan, especially 50 km north-west of Bandar-e-Shahpur in the Shadegan marshes and their overflow, after the winter rains, when large areas of semi-arid land and mudflats near the Gulf are inundated. Shadegan is little more than 100 km east of the Hawr Al Hammar in Iraq, where huge numbers of waterfowl spend the cold season, and considerable exchange of waterfowl between the two sites is likely.

To the east there are several more areas of importance for breeding and wintering waterfowl, in the Province of Fars, the most interesting being the Neyriz basin, with lakes Bakhtegan and Tashk, and the marshland complex of Dasht-i-Arjan and Lake Perishan, nearer to Shiraz, declared an International Reserve in 1971 on the occasion of the Ramsar Conference.

In eastern Iran the wetlands of Seistan in the Helmand Basin, on the Afghan

border, can be very important for waterfowl in some years, when the rains have been good. They comprise a mixture of fresh and brackish lakes and marshes, fed by the overflow of four large rivers rising in the Hindu Kush. Flood control in Afghanistan and more particularly the construction of the Kajaki Dam on the Helmand River have considerably affected the Seistan wetland but the Hamun-i-Puzak, on the Afghan side of the border but extending into Iran, which is chiefly fed by the Khash Rud flowing from the mountains 400 km to the north-east, offered excellent conditions for waterfowl in 1976: over 450,000 birds were counted during an aerial survey on both sides of the border.

The Game and Fish Department of Iran, a governmental organisation created in 1967, superseding the Game Council of Iran (set up 11 years earlier) and succeeded in turn by the Department of Environment, embarked in the 1960s and 1970s on an ambitious conservation programme comprising the establishing of a network of protected areas of great ecological interest, which by 1971 totalled over a million hectares and by 1976 numbered between 55 and 60. The activities of the Ornithology Unit, a branch of the Department's Division of Parks and Wildlife, included surveys of wetlands throughout the country, annual midwinter census of Anatidae and a programme for ringing ducks, flamingos, pelicans and cranes. As a consequence, Iran in the mid-1970s was well in the forefront of waterfowl conservation in the whole of Asia, setting an example also for many countries in Europe. This was indeed fitting for a country which had not only been the host of the International Conference on the Conservation of Wetlands and Waterfowl held at Ramsar, close to the Caspian seashore, on 30 January to 3 February 1971, but was also the first country to sign the resulting Convention on 25 August 1972, and the sixth to ratify it – on 23 June 1975. Eighteen of the 34 wetlands listed below (marked with an asterisk), were designated as wetlands of international importance for the purposes of the Convention, their total area being quoted as 1,357,500 hectares. A detailed description of each of them follows the checklist.

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- Firouz, E. 1971. *The Wetlands and Waterfowl of Iran*. Tehran, Game and Fish Department of Iran (Kayhan Press). 47 pp.

### WETLANDS OF INTERNATIONAL IMPORTANCE

\*Nominated for inclusion in the Ramsar Convention list

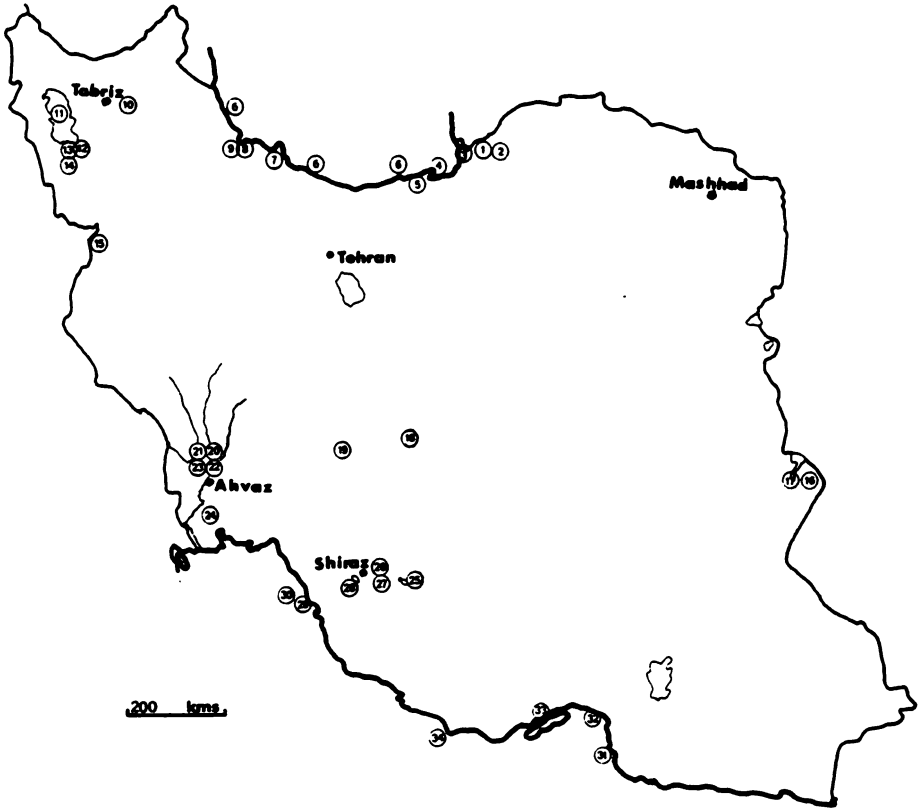
	Locality	Latitude	Longitude	Size	Wetland criteria/ Conservation status
*1.	Alagol, Ulmagol & Ajigol (lakes)	37°21'–25'N	54°35'–40'E	1,000; 200; 200 ha	1a,b; 2a; 4a,b Ramsar Convention site
2.	Lake Bibishervan and Lake Eymar	37°09'N	54°51'E	300; 250 ha	1a,b; 2a; 4a Unprotected
3.	Gomishan lagoons and plains	37°15'N	53°55'E	5,000 ha	1a,b; 2a; 4a Unprotected

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	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
*4.	Miankaleh peninsula and Gorgan bay (incl. Lapoo-Zagmar Ab-bandans)	36°50'–57'N	53°17'–54°00'E	100,000 ha (Ramsar Convention site comprising 40,000 ha)	1a,b,c,d,e; 2a; 3a,b,c; 4a 68,8000 ha protected (Wildlife Refuge and Biosphere Reserve)
5.	Larim Sara, Seyed Mahalle and Zarin Kola	36°44'N	53°00'E	1,600 ha	1a,b,c,d,e; 4a Unprotected
6.	South Caspian shore	37°48'–c.36°50'N	49°01'–c.56°50'E	650 km shoreline	1a,b,e; 2c; 3c 60 km protected (Wildlife Refuge)
*7.	Amirkelayeh lake	37°17'N	50°12'E	1,230 ha	1a,b; 2a; 3c; 4a Protected
*8.	Bandar Farahnaz lagoon	37°25'N	49°29'E	500 ha	1a,b,c,d,e; 2a; 3c; 4a Ramsar Convention site
*9.	Anzali-Mordab	37°25'N	49°25'E	15,000 ha	1a,b,c,d,e; 2a; 3a,b,c; 4a,b,c 3,875 ha protected
*10.	Lake Gori	37°55'N	46°42'E	120 ha	1c,d,e; 2a; 3a,c; 4a Ramsar Convention site
*11.	Lake Oroomiyeh	37°09'–38°17'N	45°05'–57'E	462,600 ha (483,000 ha Ramsar Convention site)	1a,b,c,d,e; 2a,b; 3a,b,c; 4a,b Protected (NP and Biosphere Reserve)
*12.	Lake Kobi	36°57'N	45°52'E	1,200 ha	1a,b,c,d,e; 2a; 4a Ramsar Convention site
13.	Ghara Gheslaq Marshes	36°55'N	45°41'E	400 ha	1a,c,d; 2a; 4a Unprotected
*14.	Shur Gol, Yadegarlu & Dorgeh Sangi (lakes)	37°00'N	45°30'E	2,000; 350; 150 ha	1a,c,d; 2a; 4a,b Ramsar Convention site
15.	Lake Zaribar	35°32'N	46°07'E	1,150 ha	1c,d,e; 2a; 4a Unprotected
*16.	South end of Hamun-I-Puzak	31°20'N	61°45'E	c.10,000 ha	1a,b,c,d,e; 2a,b; 4a,c Protected (part of 180,000 ha Wildlife Refuge)
*17.	Hamun-I-Sabari and Hamun-I-Hirmand	31°20'N	61°20'E	c.50,000 ha	1a,b,c,d,e; 2a,b; 3b; 4a,c Protected (part of 180,000 ha Wildlife Refuge)
*18.	Batlaq-e Gavkhuni and Marshes of lower Zaindeh Rud	32°15'N	52°45'E	c.43,000	1a,d,e; 2a,b; 4a Ramsar Convention site

	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
19.	Gandoman and Cheghakhor Marshes	31°50'N	51°06'E	1,250 ha 800 ha	1b; 2a; 4a Unprotected
20.	Karun River Marshes	31°45'N	48°54'E	2,500 ha	1a,b,c,e; 2a; 4a Unprotected
21.	Dez River Marshes	31°50'N	48°38'E	8,000 ha	1c,d,e 3,837 ha protected (part of 15,873 ha Wildlife Refuge)
22.	Bamdej Marshes	31°45'N	48°36'E	12,000 ha	1a,b,c,d,e; 2a; 4a Unprotected
23.	Karkheh River	31°45'N	47°55'E	3,500 ha	1c,d,e 1,538 ha protected (part of 13,027 ha Wildlife Refuge)
*24.	Shadegan Marshes and tidal mudflats of Khor-al Amaya and Khor Musa	30°30'N	48°30'–45'E	400,000 ha	1a,b,c,d,e; 2a,b; 3a,b,c; 4a 290,000 ha protected (Wildlife Refuge)
*25.	Neyriz Lakes and Kamjan Marshes	29°16'–47'N	53°00'– 54°12'E	108,000 ha	1a,b,c,d,e; 2a,b,c; 3b,d; 4a Protected (part of 327,820 ha Wildlife Refuge)
26.	Zarghan, Lapuyee and Dasht-i Baiza Marshes	29°50'N	52°40'E	max. 10,000 ha	1a,b; 2a; 4a Unprotected
27.	Lake Maharlu and Soltanabad Marshes	29°30'N	52°40'E	21,600 ha 700 ha	1a,b,c,e; 2a; 3a,c; 4a Unprotected
*28.	Dasht-i Arjan and Lake Perishan	29°30'–45'N	52°00'–12'E	2,400 ha 4,200 ha (Ramsar Convention site comprising both areas)	1a,b,c,d,e; 2a,b,c; 3a,b,c; 4a,b Protected (part of Arjan International Reserve 65,750 ha, now National Park)
29.	Delta of Halileh Rud	29°10'N	50°47'E	10,000 ha	1a,b,c,d,e; 2a; 4a Protected
30.	Khark and Kharku Islands	29°19'N	50°21'E	450 ha	1c,e; 2a; 3a; 4a Protected
*31.	Deltas of Rud-i Gaz and Rud-i Hara	26°15'N	57°10'E	15,000 ha	1a,b,c,d,e; 2a,b; 4a,b Ramsar Convention site
*32.	Deltas of Rud-i Shur, Rud-i Shirin & Rud-i Minab	27°00'N	56°45'E	20,000 ha	1a,b,c,d,e; 2a,b; 4a,b Ramsar Convention site
*33.	Khuran Straits	26°45'N	55°40'E	100,000 ha	1a,b,d,e; 2a,b; 3a; 4a Partly protected (by the Hara NP and Biosphere Reserve)
34.	Sheedvar Island	26°48'N	53°24'E	160 ha	1a,c,d,e; 2a,b; 4a Protected

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## DETAILS OF LISTED AREAS

### 1. ALAGOL, ULMAGOL and AJIGOL (Lakes)

**Criteria for inclusion** 1a,b; 2a; 4a,b.

**Geographical location** Alagol: 37°21'N, 54°35'E; Ulmagol: 37°25'N, 54°38'E; Ajigol: 37°24'N, 54°40'E. Turkoman steppes, between 60 and 100 km north-north-east of Gorgan.

**Area** Alagol c.1,000 ha; Ulmagol c.200 ha; Ajigol c.200 ha.

**Altitude** 5 m.

**Water depth** Maximum 2 m: average, variable.

**Wetland types** 17, 18.

**Ecology** The Alagol is an astatic, slightly saline lake formed by seepage, springs, rainfall and local run-off, flooding in winter but in dry summers drying out completely. When full it overflows westwards. The lake bottom consists of mud and sand and the water is largely oligotrophic, supporting little aquatic vegetation

except for some rushes and sedge *Juncus* and *Carex* spp., and grasses, mainly in the north-east, and a small amount of reeds *Phragmites communis*. The lake was virtually dry in the winters 1970/71 and 1971/72, deeply flooded in late winter 1972 and still flooded in mid-winter 1974. Breeding birds include Great Crested Grebe *Podiceps cristatus*, Coot *Fulica atra* and Kentish Plover *Charadrius alexandrinus*; moderate numbers of a wide variety of waterfowl species occur during migration and wintering species include Greater Flamingo *Phoenicopterus ruber*, geese and ducks Anatidae and Coot *Fulica atra*.

The Ulmagol is a small astatic but always freshwater lake forming after rainfall and run-off in autumn and winter, fluctuating considerably and occasionally drying out completely in periods of drought. The bottom consists of mud and fine clay and the water is eutrophic, supporting a sparse vegetation of *Juncus*, duckweed *Lemna*, *Phragmites*, manna *Alhagi* and algae. Rarely, if ever, frozen in winter. *Podiceps cristatus* breeds and on migration a wide variety and fair numbers of *Anas* spp. and other waterfowl pass through. In winter there is a moderate influx of grebes Podicipitidae, Great White Egret *Egretta alba*, swans *Cygnus* spp., various *Anas* spp., Red-crested Pochard *Netta rufina* and diving ducks of the genus *Aythya*, as well as coots and, occasionally, quite big numbers of Smew *Mergus albellus*. The Ajigol is very similar in every respect, except that the vegetation includes some tamarisk *Tamarix*, grasses and salt bush; much of the lake is overgrown with *Phragmites*, particularly at the eastern end, and there is also a considerable amount of submersed vegetation. Breeding birds include Little Grebe *Tachybaptus ruficollis*, as well as the Great Crested Grebe *Podiceps cristatus*, and the White-tailed Plover *Vanellus leucurus*. A good variety of waterfowl occurs on migration and in winter but only *Fulica atra* in large numbers.

**Legal status** Unprotected except that the lakes are now included in the Ramsar Convention list, thus assuring a measure of protection.

**Tenure** State ownership.

**Management practices** Reed-cutting, grazing and wildfowl hunting and also some fishing, still take place.

**Threats** The Alagol is more inaccessible than the others and little disturbed, but the two smaller lakes are subject to considerable disturbance from hunters in winter.

**Scientific research** Wildfowl censuses were carried out in 1969, 1970, 1972, 1973 and 1974.

**Principal reference material**

Firouz, E. 1971. *The Wetlands and Waterfowl of Iran*. Tehran, Game and Fish Dept. of Iran.

**4. MIANKALEH PENINSULA and GORGAN BAY (including Lapoo-Zagmarz Ab-bandans)**

**Criteria for inclusion** 1a,b,c,d,e; 2a; 3a,b,c; 4a.

**Geographical location** 36°50'–57°N 53°17'–54°00'E. South-east corner of the Caspian sea and its seashore. The Lapoo-Zagmarz Ab-bandans are on the inner side of the coastal dunes not far to the east of the Neka rivermouth, at the western end of the wetland. The village of Ashuradeh with its fish-processing factory, at the eastern tip of the Miankaleh peninsula, faces the town of Bandar-e Shah on the



far side of the entrance to the Bay of Gorgan.

**Area** c.100,000 ha.

**Altitude** Miankaleh and Gorgan Bay: 25 m below sea level; Lapoo-Zagmarz Ab-bandans: 18 m below sea level.

**Depth** Maximum in the bay area 2 m and in marsh area 0.50 m: average, variable.

**Wetland types** 3, 5, 6, 11, 12, 18, 24.

**Ecology** The main features of the wetland are the permanent salty (10–12%) bay and the seasonal marshes bordering it, in which the water is fresh to brackish, being derived from numerous small streams, irrigation ditches and run-off. The marshes become flooded in autumn and winter, the water draining slowly into the bay, which is connected to the Caspian sea by a 12 km wide channel. There are a few small settlements along the southern and eastern shores of the bay, which has a sand and mud bottom and is oligotrophic, whereas the extensive marshes are eutrophic. The vegetation consists mainly of glasswort *Salicornia*, sedge *Carex* and rush *Juncus* spp., *Tamarix*, grasses and a few small *Phragmites* reedbeds. Green and blue-green algae are found in the bay. Along the Miankaleh peninsula there is a strip of vegetated sand dunes and some pomegranate *Punica* scrub. The cultivation bordering the bay on the south is for wheat and cotton.

Breeding birds, in years when there has been plenty of rain in early summer, include many heron Ardeidae species. The Pratincole *Glareola pratincola* nests in large colonies and along the shores Kentish Plovers *Charadrius alexandrinus* and Little Terns *Sterna albifrons* are the characteristic breeding species. The wetland is extremely important for a wide variety of waterfowl and other birds during the migrations and in the winter, including Dalmatian Pelican *Pelecanus crispus*, Greater Flamingo *Phoenicopterus ruber* and many species of Ardeidae and Anatidae, including various swans and geese, notably the Lesser White-fronted Goose *Anser erythropus*.

The Lapoo-Zagmarz Ab-bandans consist of a group of muddy-bottomed fresh-water lakes and marshes, fed by irrigation canals, rainfall and run-off. Flooding takes place in autumn and winter and the water level fluctuates considerably but is to some extent controlled, the water flowing sluggishly eastwards into the marshes at the western end of the Gorgan Bay. *Phragmites* reedbeds are the dominant feature of the vegetation but there are stands or scrubby areas of reedmace *Typha*, willow *Salix*, currants *Ribes*, berries *Rubus* and pomegranate *Punica* and an abundant submersed vegetation. Besides the Ardeidae and a few Anatidae nesting in the pond area, there is a large colony of Whiskered Tern *Chlidonias hybrida*. It is also important for migrating and wintering species, especially Red-crested Pochard *Netta rufina* and Coot *Fulica atra*; more occasional visitors are swans *Cygnus* spp. and White-headed Duck *Oxyura leucocephala*.

**Legal status** A Miankaleh Protected Region of 97,200 ha was established in 1970, with Wildlife Refuge status for the 81,180 ha Gorgan bay, Miankaleh peninsula and associated marshes. The latest UN List quotes the size of that part of the area which was declared a Biosphere Reserve in 1976 as 68,800 ha. The Lapoo marshes and Zagmarz Ab-bandans are not included in the Protected Region but an area of 40,000 ha has been nominated for the Ramar Convention list.

**Tenure** State ownership.

**Management practices** Considerable areas are open to livestock grazing and some reed-cutting and fishing take place within the protected zone, but a major pro-

gramme for wildfowl management was drawn up in 1974, though it is uncertain to what extent if any it has ever been implemented. The unprotected Lapoo-Zagmarz Ab-bandans were certainly subject to heavy hunting pressure.

**Threats** Irrigation schemes further inland may tend to diminish the fresh water supply to the bay area. A nuclear power station planned for construction 10 km to the west of reserve could be a source of pollution.

**Scientific research** Limnological and hydrobiological studies have been carried out by SHILOT (Northern Fisheries Organization). Bird-migration studies and wildfowl censusing have been regularly undertaken under the auspices of the Department of the Environment (former Game and Fisheries department).

**Principal reference material**

Nielsen, B. P. and Speyez, H. J. 1967. Some observations of birds in northern Iran. *Dansk Ornithologisk Forenings Tidsskrift* 61: 30-39.

Feeny, P. P., Arnold, R. W. and Bailey, R. S. 1968. Autumn migration in the South Caspian Region. *Ibis* 110: 35-86.

Harrison, J. 1972. South of the Caspian Sea. *World of Birds* (January).

## 7. AMIRKELAYEH (lake)

**Criteria for inclusion** 1a,b; 2a; 3c; 4a.

**Geographical location** 37°17'N 50°12'E. Towards the eastern end of the Gilan Province and very close to the Caspian shore, 15 km north of the township of Langarud and 60 km east of Rasht.

**Area** 1,230 ha.

**Altitude** 20 m below sea level.

**Water depth** Maximum 6 m; average 3 - 4 m.

**Wetland types** 18, 25.

**Ecology** A freshwater lake and marshland fed by springs, run-off from adjacent irrigated lands and rainfall. Flooding occurs in autumn and winter, but the fluctuations in water level are slight, although some overspill into the Caspian to the north occurs at highest flood levels. The bottom is muddy. The lake is eutrophic, the vegetation dominated by reeds *Phragmites*, with some reedmace *Typha* and willows *Salix* and a very rich submersed plant-life. There are several small settlements in the area and adjacent ricefields.

As a breeding place for waterfowl, this wetland is noted for its heron Ardeidae, duck Anatidae and rail Rallidae populations. The first two are greatly augmented by migrants and in winter huge numbers of Coot *Fulica atra* tend to be present, together with very significant numbers of Red-crested Pochard *Netta rufina* and *Aythya* spp. and smaller numbers of swans *Cygnus* spp. and Ardeidae.

**Legal status** The Amirkelayeh Protected Region (1,230 ha) was established in 1971 and rates as a Wildlife Refuge. It has been included in the Ramsar Conventon list.

**Tenure** State ownership.

**Management practices** The current situation is unknown but this wetland was for

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many years kept as a strict nature sanctuary, no exploitation being allowed nor any attempt made to control water levels.

**Threats** None reported.

**Scientific research** Waterfowl surveys by the Dept. of Environment.

### Principal reference material

Firouz, E. 1971. *The Wetlands and Waterfowl of Iran*. Tehran, Game and Fish Department of Iran.

Ferguson, D. A. 1972. Waterfowl Wintering, Resting and Breeding Areas of the South West Caspian Lowlands. *Wildfowl* 23: 5-24.

Harrison, J. 1972. South of the Caspian Sea. *World of Birds* (January).

## 8. BANDAR FARAHNAZ LAGOON

**Criteria for inclusion** 1a,b,c,d,e; 2a; 3c; 4a.

**Geographical location** 37°25'N 49°29'E. The lagoon is linked with two of the westernmost streams of the Safid Rud delta, very close to the shores of the Caspian and about 15 km north-north-west of the major town of Rasht.

**Area** c.500 ha (c.140 ha marshland).

**Altitude** 25 m below sea level.

**Water depth** Maximum 2 m; average 1 m.

**Wetland types** 7, 9, 12.

**Ecology** A shallow freshwater coastal lagoon and swamp, fed by the surplus water of two streams, offshoots of Safid Rud, which are used for irrigation, and also by seepages and rainfall. There is some flooding in winter but the fluctuations in water level are generally slight. The wetland drains northwards through a narrow channel into the Caspian. The bottom is a mixture of sand and mud and the waters basically oligotrophic, except towards the marshy western extremity, where reeds *Phragmites* and *Typha* form the principal vegetation, as opposed to the rushy areas of *Juncus* spp. characteristic of the east and south. Scrub and dune vegetation takes over to the north and north-west and there are grasslands along the Safid Rud, which are subject to flooding. These are bordered on the south and south-east by patches of alder *Alnus* woodland and cultivation, together with some small fishing settlements.

The wetland is a breeding area for Cormorant *Phalacrocorax carbo* and several species of herons Ardeidae. A good variety of waterfowl in moderate numbers passes through on migration but its greatest importance is as a wintering area for grebes Podicipitidae, Dalmatian Pelican *Pelecanus crispus*, Greater Flamingo *Phoenicopterus ruber*, Ardeidae, various Anatidae including Greylag Goose *Anser anser* and Shelduck *Tadorna tadorna*, gulls *Laridae* and some waders *Limicolae*.

**Legal status** Unprotected except that the whole area is now included in the Ramsar Convention list.

**Tenure** State ownership.

**Management practices** Grazing of livestock, reed-cutting, fishing and wildfowl hunting (the last two and several other activities also for sport and recreation) are still actively pursued.

**Threats** Disturbance of the area is increasing. There is serious hunting pressure and over-grazing.

**Scientific research** Waterfowl surveys have been undertaken by the Department of Environment.

**Principal reference material**

Ferguson, D. A. 1972. Waterfowl Wintering, Resting and Breeding Areas of the South-West Caspian Lowlands. *Wildfowl* 23: 5–24.

**9. ANZALI-MORDAB complex**

**Criteria for inclusion** 1a,b,c,d,e; 2a; 3a,b,c; 4a,b.

**Geographical location** 37°25'N 49°25'E. South and south-west of Bandar-e Anzali, near the south-western shore of the Caspian. Two of the ancillary features of the wetland are the Siahkesheem Marsh and the Selke Ab-bandans.

**Area** Anzali-Mordab 10,990 ha; Siahkesheem Marsh 3,650 ha; and Selke Ab-bandans 360 ha, totalling 15,000 ha.

**Altitude** 25 m below sea level.

**Water depth** Maximum 3 m; average 1.5 m.

**Wetland types** 12, 18, 24, 25.

**Ecology** The Anzali-Mordab comprises a large shallow eutrophic, freshwater coastal lagoon and marshes fed by several rivers and streams, including one or two tributaries of the Safid Rud, run-off and rainfall, and liable to flooding in autumn and winter although the actual fluctuations of water level are only moderate. The drainage flow is into the Caspian, just east of Bandar-e Pahlavi, the lagoon bottom is muddy and many settlements border the wetland area. The vegetation includes reeds *Phragmites* and *Typha*, duckweed *Lemna*, bistort *Polygonum*, the pondweeds *Potamogeton* and *Elodea*, milfoil *Myriophyllum*, hornwort *Ceratophyllum*, willow *Salix*, alder *Alnus*, the rushes *Scirpus* and *Cyperus* and the arrowhead *Sagittaria*. *Phragmites* reedbeds are very extensive in the south and east. Features of the surrounding land are some cultivation (rice), sand dunes, many ab-bandans (water reservoirs) and forest patches to the south. The population of breeding waterfowl comprises Great Crested Grebe *Podiceps cristatus*, several species of herons and rails, Ardeidae and Rallidae, and a very large colony of Whiskered Tern *Chlidonias hybrida*, but practically no ducks *Anatidae*. However, the wetland is of great importance to the latter and also to grebes, herons and coots *Fulica atra* during the migration seasons.

The associated Siahkesheem eutrophic freshwater marsh to the south-west gets its water from the Bohambar, Chakoor, Siahdarveshan, Nargestan and other rivers, irrigation canals and rainfall. Flooding takes place in autumn and winter and affects the pastures of some of the small settlements nearby, the water draining north-eastwards into the Anzali-Mordab and thence to the Caspian. The vegetation is similar to that of the main area except that *Ceratophyllum*, *Alnus* and *Scirpus* are not reported and additional species are water chestnut *Trapa*, sedge *Carex* and rush *Juncus* species. Waterfowl which nest here include the Pygmy Cormorant *Phalacrocorax pygmaeus*, several grebes Podicipitidae, herons Ardeidae, a few duck *Anatidae* and *Fulica atra*. In winter, it is rated as an extremely important refuge for surface-feeding and some diving ducks, and for swans; a

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number of herons and coots also winter and many more herons and ducks pass through on migration.

The remaining feature of the wetland complex, the Selke ab-bandans, comprise semi-natural flood plain and eutrophic marsh used for water storage, dikes having been constructed for that purpose along the northern edge. They have a flooded herbaceous vegetation and algal growth in summer, but there are also some *Phragmites* reedbeds and other emergent macrophytes on the north and *Juncus* rushes and damp grassland on the south of the ab-bandans. Huge numbers of surface-feeding and diving ducks, swans and geese, visit them in winter and they are particularly important as a feeding and roosting area for birds from the heavily disturbed Anzali-Mordab lagoon to the north.

**Legal status** The Anzali-Mordab itself is not protected but two reserves or Protected Regions were established, in 1967 and 1970 respectively, the first covering the greater part (3,515 ha) of the Siahkesheem Marsh, the other the whole (360 ha) of the Selke Ab-bandans. The whole area is included in the Ramsar Convention list.

**Tenure** State ownership.

**Management practices** Anzali-Mordab is commercially exploited for fish and waterfowl, livestock grazing and reed-cutting are also practised and there is a considerable traffic of boats. In the Siahkesheem Marsh some reed-cutting, grazing and hunting take place on the unprotected flood plains and ab-bandans of the periphery and similarly on the Selke Ab-bandans there is some grazing and reed-cutting although hunting of the wildfowl is forbidden.

**Threats** The gradual lowering of the water level of the Caspian is likely to have an adverse effect on this wetland. *Phragmites* reedbeds are gradually spreading over open water areas.

**Scientific research** Numerous limnological and hydrological studies have been undertaken by SHILOT (Northern Fisheries Organization). Waterfowl surveys have been carried out by the Department of Environment.

### Principal reference material

Savage, C. W. D. 1963. Wildfowling in Northern Iran. *Wildfowl Trust 14th Annual Report 1961-62*: 30-46.

Nielsen, B. P. and Speyer, H. J. 1967. Some observations of Birds in Northern Iran. *Dansk Ornithologisk Forenings Tidsskrift* 61: 30-39.

Nielsen, B. P. 1969. Further Spring Observations on the Birds of Gilan, Northern Iran. *Dansk Ornithologisk Forenings Tidsskrift* 63: 50-73.

Ferguson, D. A. 1972. Waterfowl Wintering, Resting and Breeding Areas of the South-West Caspian Lowlands. *Wildfowl* 23: 5-24.

## 10. LAKE GORI

**Criteria for inclusion** 1c,d,e; 2a; 3a,c; 4a.

**Geographical location** 37°55'N 46°42'E Eastern Azarbaijan, 40 km ESE of Tabriz.

**Area** 120 ha.

**Altitude** 1,950 m.

**Water depth** Maximum 5 m; average 2 – 3 m.

**Wetland type** 18.

**Ecology** An astatic, fresh to brackish, eutrophic lake receiving its water from rainfall, run-off, springs, seepages and small streams but mainly during and after the spring snow melt. There is little fluctuation in the level but the overflow feeds a small stream on the north-east. The bottom consists of a mud deposit on shale and rocks. The surrounding area is semi-arid, steppic country, with one small settlement and some wheat cultivation on the west and damp grassland on the south-west. The main Tabriz-Tehran road passes along the south side. There are extensive areas of *Phragmites* reedbeds, rush *Juncus* and sedges *Carex* and *Scirpus*, and an abundant underwater vegetation. The lake is always completely frozen and under deep snow cover in mid-winter. In the breeding season there are large colonies of Black-necked Grebe *Podiceps nigricollis* and other grebe species, Coot *Fulica atra* and a variety of ducks including White-headed Duck *Oxyura leucocephala*. A wide variety of waterfowl in small numbers visits the wetland during migration but none during winter when it normally freezes over.

**Legal status** Unprotected except that the lake is now included in the Ramsar Convention list.

**Tenure** State ownership.

**Management practices** Sport fishing, grazing, reed-cutting and wildfowl hunting persist and there is some recreational use of the lake by people from Tabriz.

**Threats** The recreational pressure could become excessive.

**Scientific research** Wildfowl censuses have been undertaken.

#### **Principal reference material**

Gyllin, R. 1970. Bilder från en persisk fågelsjö. *Fauna och Flora* 3: 113–117.

### **11. LAKE OROOMIYEH**

**Criteria for inclusion** 1a,b,c,d,e; 2a,b; 3a,b,c; 4a,b.

**Geographical location** 37°09'–38°17'N 45°05'–57°E. About 70 km south-west of Tabriz.

**Area** 463,600 ha.

**Altitude** 1,280 m.

**Water depth** Maximum 8 m; average 5 m.

**Wetland types** 9, 10, 17.

**Ecology** A natural astatic, eutrophic and extremely saline lake (salinity varies from 8% to 28%). There are some brackish marshes along the shores and the lake is fed by water from rainfall, run-off, numerous streams and rivers, springs and seepage. The water level fluctuates by about 1 – 2 metres and the bottom consists of mud or silt, often covered by salt crystals. There are small human settlements at various points on the shores. Much of the surrounding area is semi-arid, summers hot, winters extremely cold.

The lake supports an abundant growth of the algae *Enteromorpha intestinalis* and there is a very rich algal bloom and build up of brine-shrimp *Artemia* in the summer. The marshes have typical salt marsh plant communities with rushes

*Juncus* sp., some *Phragmites* reedbeds and occasional stands of *Tamarix*, where rivers and streams enter the lake. There are rolling wheatlands to the west and the south, semi-arid steppe and hills to the north and east. 56 islands in the lake are uninhabited but were formerly used for grazing livestock, Quyun Dagh or Kabudan, the largest, having an area of 3,135 ha.

Oroomiyeh is an extremely important breeding area for great numbers of birds including Greater Flamingo *Phoenicopterus ruber*, Shelduck *Tadorna tadorna*, Ruddy Shelduck *T. ferruginea*, Herring Gull *Larus argentatus*, and Slender-billed Gull *L. genei*; there are also large colonies of Spoonbill *Platalea leucorodia* and White Pelican *Pelecanus onocrotalus*. Its importance as a staging post on migration for a wide variety of waterfowl, notably of heron, duck, plover and sandpiper families, Ardeidae, Anatidae, Charadriidae and Scolopacidae, is also very considerable and, in winter, large numbers of Shelduck *Tadorna tadorna* and smaller numbers of other Anatidae and of flamingos *Phoenicopterus ruber* are present.

**Legal status** The former Lake Rezaiyeh was given protection, with National Park status, in 1967 and declared a Biosphere Reserve under UNESCO's Man and the Biosphere (MAB) programme in 1976. Its size has been variously quoted, possibly depending on the allowance if any made for the marshy spots on the otherwise arid shores and for the 56 islands (several are submerged at times of high water); it ranges from 483,000 ha (Ramsar Convention List, where it has now been given the name of Oroomiyeh) to 463,600 (UN List) or 462,600 (MAB).

**Tenure** State ownership.

**Management practices** In principal the whole lake and 52 of the islands are included in the reserve and constitute a sanctuary, the nesting colonies of waterfowl being fully protected. There is, however, a tug and lighter service, mainly for the transport of cattle between five small 'ports', but very little in the way of recreational activities along the shoreline.

**Threats** An increase of recreational use of the shores and lake waters could become a danger in the future and its growth needs to be carefully planned and controlled. The same applies to possible pollution emanating from the towns of Tabriz and Rezaiyeh.

**Scientific research** Studies have been made of the pelicans and flamingos and wildfowl censuses have been carried out by the Department of Environment, Tehran.

#### **Principal reference material**

Savage, C. W. D. 1964. Lake Rezaiyeh: a specialised summer habitat for Shelduck and Flamingos. *The Wildfowl Trust 15th Annual Report 1962-3*: 108-113.

## **12. LAKE KOBI**

**Criteria for inclusion** 1a,b,c,d,e; 2a; 4a.

**Geographical location** 36°57'N 45°52'E. About 75 km south-east of Lake Oroomiyeh, between the towns of Mahabad and Miandowab, but nearer (c.25 km west of) the latter.

**Area** 1,200 ha.

**Altitude** 1,240 m.

**Water depth** Maximum 1.5 m; average very variable.

**Wetland type** 18.

**Ecology** A shallow, eutrophic, fresh to brackish, astatic lake and associated marshland, receiving its water from rainfall, run-off, several springs, seepage and temporary watercourses fed by snow-melt. The lake overflows to the north when full, has a muddy bottom and freezes over regularly in winter. There is an abundant growth of submersed vegetation; the sedge-marsh is extensive and *Phragmites* reedbeds occur in the south and in the marshes to the north-west, together with some grassland. The whole area is surrounded by rolling hilly steppe, with scattered settlements and cultivation both to the north and south.

Quite a variety of waterfowl nest in this wetland, including Night Heron *Nycticorax nycticorax*, Glossy Ibis *Plegadis falcinellus*, Ferruginous Duck *Aythya nyroca*, White-headed Duck *Oxyura leucocephala*, Coot *Fulica atra*, Avocet *Recurvirostra avosetta*, Collared Pratincole *Glareola pratincola* and Common Tern *Sterna hirundo*. The importance of the site is perhaps highest during the migration seasons, when it is used by very large numbers of dabbling and diving ducks, especially *Anas* and *Aythya* spp. and coot.

**Legal status** Unprotected except that it has been included in the Ramsar Convention list.

**Tenure** State ownership.

**Management practices** Grazing of livestock and some hunting of wildfowl still take place but the wetland generally is relatively undisturbed.

**Threats** None at present reported.

**Scientific research** Wildfowl censuses have been undertaken.

**Principal reference material**

None listed.

**14. SHUR GOL, YADEGARLU and DORGEH SANGI (lakes)**

**Criteria for inclusion** 1a,c,d; 2a; 4a,b.

**Geographical location** 37°00'N 45°30'E. Slightly to the north and substantially to the west of an area listed as No. 12, in the plains south of Lake Rezaiyeh and about 35 km north-west of Mahabad.

**Area** Shur Gol 2,000 ha; Yadegarlu 350 ha; and Dorgeh Sangi 150 ha, total 2,500 ha.

**Altitude** 1,290 m.

**Water depth** Maximum 1 m; average very variable.

**Wetland type** 18.

**Ecology** The Shur Gol and associated Hassanlu Marshes consist of a shallow, brackish to salty lake and marshland formed by rainfall, run-off, springs, seepages and several small streams. Flooding occurs in autumn and winter, but drainage is virtually closed and the complex dries out completely only in very dry years. Its character is eutrophic and there are extensive stands of sedge *Carex* spp., particularly in the south-west and north-east, a mixture of grasses and an abundant underwater vegetation. The bottom is muddy or silted. The surrounding country includes wheat cultivation on the rolling hills and plains to the north and more intensive agriculture in the vicinity of the villages in the south. This section of the



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wetland freezes in winter but rarely completely. It dried out completely in late summer of 1971. It is of importance as a nesting-place for duck Anatidae, notably Ruddy Shelduck *Tadorna ferruginea* and Marbled Teal *Anas angustirostris*, Coot *Fulica atra* and various waders Limicolae and terns Sterninae. *Anas* and *Aythya* spp. among the ducks and *Fulica atra* are the most numerous of the large variety of waterfowl visiting the area on migration and small numbers of Anatidae winter, including Smew *Mergus albellus*.

The much smaller Yadegarlu is a shallow fresh-water lake with peripheral marshes fed by run-off, rainfall, springs, seepages and small streams. Its size fluctuates and in winter it freezes over. It is eutrophic and supports a vegetation of grasses and sedges, and abundant underwater growth although almost drying out in late summer. Generally conditions are excellent for breeding waterfowl, which include Great Crested Grebe *Podiceps cristatus*, White Stork *Ciconia ciconia*, some ducks and coot *Fulica atra*. During migration Greylag Goose *Anser anser*, *Anas* spp., *Fulica atra* and various Limicolae visit the area. In winter small numbers of *Anas* spp., *Aythya* spp., *Mergus albellus* and, occasionally, Bewick's Swan *Cygnus columbianus bewickii* are present.

The smallest component of the wetland, Dorgeh Sangi, is a shallow fresh-water lake and marsh, fed by small springs in the south, seepages, rainfall and run-off. Its size fluctuates considerably and it overflows to the west, where and also in the south there are a few villages and patches of cultivation. The bottom is muddy and the water eutrophic, but there is surprisingly little vegetation, mainly grasses and sedges, with some underwater vegetation and also bare mud when the water level is low. The lake is usually almost completely frozen in mid-winter and reduced to a third of its maximum size in late summer. Conditions are nevertheless excellent in spring and autumn for waterfowl, nesting species including Black-necked Grebe *Podiceps nigricollis* and *Fulica atra*. The lake and marsh are also of great value to a good variety of migrating waterfowl, notably *Anas* spp. and Limicolae, and when not frozen over in winter supports large numbers of Anatidae and more occasionally Bewick's Swans *Cygnus columbianus bewickii*.

**Legal status** Unprotected except for its inclusion in the Ramsar Convention list.

**Tenure** State ownership.

**Management practices** Some grazing, reed-cutting and wildfowl hunting persist.

**Threats** Over-grazing and excessive wildfowl hunting are a recurring threat, as is possible urbanization, and need to be controlled under an appropriate reserve status.

**Scientific research** Waterfowl surveys have been undertaken by the Department of Environment.

**Principal reference material**

None quoted.

## 16. SOUTH END OF HAMUN-I-PUZAK

**Criteria for inclusion** 1a,b,c,d,e; 2a,b; 4a,c.

**Geographical location** 31°20'N 61°45'E. On the Iran/Afghan border, in Seistan province, 40 km north-east of Zabol and in the vicinity of the villages of Takht-e Shah, Mahmoodi and Shaugali. By far the largest section of the wetland is in Afghanistan with only fingers of the marsh extending into Iran.

**Area** c.10,000 ha.

**Altitude** 475 m.

**Water depth** Maximum 1.5 m; average 0.75 m.

**Wetland types** 12, 18.

**Ecology** A fresh to brackish lake and marshes depending largely on the Helmand, Khash, and Khuspas rivers, since there is very little local run-off. Flooding usually occurs in late winter or spring but the water level is variable and the area may dry out completely in drought years. There is no overflow except in very wet years. The bottom consists of alluvial silts. The eutrophic lake has extensive reedbeds of *Phragmites* and *Typha*, various sedges *Carex* spp. and *Tamarix*. Submersed vegetation becomes abundant during prolonged periods of flooding. This is the most permanent area of marsh in the Iranian section of the Seistan lowlands but is dependent on the water level in the Afghan portion of the Hamun-i-Puzak and in the 1971 drought dried out completely. It is a nesting area of great importance to waterfowl in wet years and also used by many species, notably surface feeding ducks *Anas* spp. and waders Limicolae, as a staging post on migration, and also by large numbers of *Anas* spp., again, and also of herons Ardeidae and Coot *Fulica atra* as winter-quarters.

**Legal status** The whole of the wetland falls within the 180,000 ha Wildlife Refuge section of the vast Hamun Protected Region (329,000 ha) established in 1967. It is included in the Ramsar Convention list.

**Tenure** State ownership.

**Management practices** Reed cutting, fishing and some grazing continue. Some illegal hunting has been reported.

**Threats** Irrigation schemes along the Helmand River in Iran, being dependent upon flooding on the Afghan side of the border, may adversely affect the situation in the marshlands in years of low rainfall.

**Scientific research** Waterfowl census work has been carried out and several special studies by the Technical Division of the Department of Environment.

**Principal reference material**

Firouz, E. *et al.* 1970. The Wildlife Parks and Protected Regions of Iran. *Biol. Conservation* 3(1): 37-45.

Firouz, E. 1971. *The Wetlands and Waterfowl of Iran*. Tehran, Game and Fish Department (Kayhan Press). 47 pp.

## 17. HAMUN-I SABARI and HAMUN-I-HIRMAND

**Criteria for inclusion** 1a,b,c,d,e; 2a,b; 3b; 4a,c.

**Geographical location** 31°20'N 61°20'E Seistan lowlands, 35 km north-west of Zabol, thence up to the border with Afghanistan, in which a substantial part of the northern end of the Hamun-i-Hirmand (there known as Helmand) is situated. The Hamun-i Sabari and Baring Dakegaz marshes extend southwards from the lake.

**Area** c.50,000 ha.

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**Altitude** 475 m.

**Water depth** Maximum 1.5 m; average 0.5 m or less.

**Wetland types** 12, 18, 23.

**Ecology** A shallow, fresh to brackish lake, receiving its water from the Harut and Helmand rivers and only a little from local run-off. The amount of flooding is variable and usually in late winter or spring; occasionally the area dries out completely. Drainage is essentially closed but any overflow, if the water level gets exceptionally high, moves southwards into the Rud-i-Helmand, in effect reversing that river so that it temporarily flows upstream. The lake bottom consists of alluvial silts. The surrounding area is remote and arid with some tiny settlements and irrigated cultivation to the south and east.

In general, the marshland is eutrophic and there are extensive areas of *Phragmites* and *Typha* reeds, sedges *Carex* spp. and *Tamarix*, supplemented by a flourishing underwater vegetation if the flood period is sufficiently prolonged. A wet year also results in waterfowl breeding in large numbers. Otherwise the wetland is of high importance for migrating *Anas* sp. and Limicolae and even more so for wintering White Pelicans *Pelecanus onocrotalus*, herons, geese and ducks, particularly surface-feeding *Anas* species and Greylag Goose *Anser anser*. The wetland dried up completely in the 1971 drought but was deeply flooded again by the spring of 1972 and again in the winters of 1972/73 and 1973/74.

**Legal status** The Hamun Protected Region, established in 1967, covers 329,000 ha, of which 180,000 ha are classified as Wildlife Refuge. This in turn includes the 50,000 ha of this wetland and the 10,000 ha of the neighbouring Hamun-i-Puzak (Iranian sector), site listed as No. 16. Both these sites are included in the Ramsar Convention list.

**Tenure** State ownership.

**Management practices** A little grazing and reed-cutting takes place but the area is sparsely populated. All hunting has been forbidden within Hamun Protected Region.

**Threats** Due to irrigation schemes on the Helmand River, both in Afghanistan and Iran, the supply of water has been reduced: the wetlands have as a consequence been flooded only in wet years and dry out completely in periods of drought.

**Scientific research** Waterfowl censuses and other special studies have been undertaken by the Department of Environment.

**Principal reference material**

Firouz, E. 1971. *The Wetlands and Waterfowl of Iran*. Tehran, Game and Fish Department of Iran (Kayhan Press). 47 pp.

**18. BATLAQ-E GAVKHUNI (Gavkhuni saltmarsh) and MARSHEs of the LOWER ZAINDEH RUD**

**Criteria for inclusion** 1a,d,e; 2a,b; 4a.

**Geographical location** 32°15'N 52°45'E. Gavkhuni saltmarsh or lake is situated 120 km east-south-east of Eşfahan city, marking the termination of the Zaindeh river. The Zaindeh Rud marshes can extend up the river for over 50 km in a wet year.

**Area** Batlaq-e Gavkhuni: variable but rarely exceeds 12,000 ha; Zaindeh Rud marshes: up to 30,000 ha, average 10,000 ha. Maximum, therefore, c.43,000 ha.

**Altitude** 1,475 m.

**Water depth** Maximum 1 m; average not assessed, the wetland often dries out completely.

**Wetland types** 12, 17, 23, 25.

**Ecology** The Gavkhuni saltmarsh comprises the enclosed basin of a shallow, salt water lake and marsh fed by the Zaindeh Rud and rainfall run-off. The water level fluctuates considerably, flooding occurring in winter and spring. The lake bottom is composed of sand and silt and the water is oligotrophic, vegetation being limited to some *Tamarix* and *Phragmites* at the mouth of the Zaindeh Rud and otherwise a low cover of halophile species. There are also expanses of bare salt- and mud-flats.

The marshes along the lower Zaindeh Rud are a complex of fresh-water swamps and flood plain, fed not only by the river but also several irrigation canals, numerous small streams, rainfall and run-off. Flooding occurs in early winter and drying up in early spring, the flow being eastwards into the Batlaq-e Gavkhuni. The ground consists of rich alluvial soil, silt and mud and only a little natural marsh is left, the main flooding taking place on poor steppe and land cultivated for wheat and rice. The wetland is eutrophic, with some *Phragmites* and *Typha* reedbeds along the main water channels. Much of it is virtually inaccessible in winter, although it may freeze over.

The importance of both areas as nesting places is probably only slight but they are of great importance to wintering and migrating waterfowl, especially *Anas* and *Tadorna* spp., Cranes *Grus grus* and Coots *Fulica atra*.

**Legal status** Unprotected except that the entire area is included in the Ramsar Convention list.

**Tenure** State ownership.

**Management practices** Parts of the flood plain are used for agriculture, grazing of livestock and wildfowl hunting. The saltlake itself is relatively inaccessible and undisturbed, although in about 1000 ha of the saltmarsh, at the mouth of the Zaindeh, brushwood is cut for fuel and there is some grazing and hunting.

**Threats** Pollution is liable to spread down the Zaindeh Rud from Eşfahan.

**Scientific research** Waterfowl surveys have been undertaken by the Department of Environment.

**Principal reference material**

Firouz, E. 1971. *The Wetlands and Waterfowl of Iran*. Tehran, Game and Fish Department of Iran (Kayhan Press). 47 pp.

**24. SHADEGAN MARSHES and tidal mudflats of KHOR-AL AMAYA and KHOR MUSA**

**Criteria for inclusion** 1a,b,c,d,e; 2a,b; 3a,b,c; 4a.

**Geographical location** 30°30'N 48°30'–45'E. About 45 km to the north and north-east of Abadan, Khuzestan.

**Area** c.400,000 ha.

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**Altitude** 4 m.

**Water depth** Maximum 1 m; average very variable.

**Wetland types** 3, 7, 8, 9, 12, 18, 23, 25.

**Ecology** A vast area of shallow coastal, fresh to salt water, eutrophic marshes, fed by overflow channels from the Karun river, seepages, irrigation canals and, to a small extent, by local rainfall and run-off. The water level reaches its peak after spring flooding and drains away into the Persian Gulf. The bottom is muddy. Vegetation includes *Typha* and *Phragmites* reeds, various aquatic plants in the fresh-water marsh in the north, glasswort *Salicornia* and other saltmarsh species in the central area. The extensive tidal mudflats are in the south; and barren saline, dried out flats border the wetland on the east, north and north-west. The settlements, rice-paddies and date palm groves are in the north-east. The marshes at the northern end of the area mostly dry out in summer. The coastal flats in the south still await proper investigation.

This wetland is extremely important as a breeding ground for numerous waterfowl species, among the more notable of which are Marbled Teal *Anas angustirostris*, Ferruginous Duck *Aythya nyroca*, Purple Heron *Ardea purpurea*, Slender-billed Gull *Larus genei* and various terns Sterninae. During the migration it is of particular importance to *Anas* spp., Ardeidae and Limicolae, huge concentrations of which (again including *Anas angustirostris* and also large numbers of Greylag Goose *Anser anser*) stay to winter, together with many gulls Laridae and large flocks of Greater Flamingo *Phoenicopterus ruber* (mainly on the southern coastal mudflats).

**Legal status** 290,000 ha were incorporated in the Shadegan Protected Region established in 1973. The whole area is included in the Ramsar Convention list.

**Tenure** State ownership except for small areas of rice-paddies (totalling 400 ha), which are privately owned.

**Management practices** No hunting is allowed in the Protected Region. Reed-cutting and grazing as well as fishing continue in all sectors.

**Threats** Decreasing water supply due to the irrigation schemes which are part of the agricultural development programme in the north.

**Scientific research** Waterfowl surveys by the Department of Environment.

**Principal reference material**

Scott, D. A. and Carp, E. 1971. A survey in Khuzestan, Iran. In *Proc. Internat. Conf. on the Conservation of Wetlands and Waterfowl, Ramsar, Iran, 1971*: pp. 291-298. Slimbridge, IWRB.

**25. NEYRIZ LAKES (BAKHTEGAN and TASHK) and KAMJAN MARSHES**

**Criteria for inclusion** 1a,b,c,d,e; 2a,b,c; 3b,c; 4a.

**Geographical location** 29°16'–47'N 53°00'–54°12'E. The Neyriz Basin extends from 80 to 160 km east of Shiraz in the Province of Fars. The associated Kamjan Marshes are in the Kor river valley west and upstream of the Neyriz lakes, i.e. about 45 km north-east of Shiraz and to the south and south-west of the ancient site of Persepolis.

**Area** The Neyriz lakes at their greatest extent cover 98,000 ha, the Kamjan

Marshes c.10,000 ha, hence the total of 108,000 ha quoted in the Ramsar Convention list.

**Altitude** 1,550 m.

**Water depth** Maximum 2 m; average 50 cm but very variable and often falling to nil.

**Wetland types** 12, 17, 23.

**Ecology** A vast complex of shallow inland salt lakes and fresh to brackish marshes, which is of considerable limnological and ornithological interest. There is wide variety in salinity since some of the marshes are almost completely fresh-water. The wetland is fed by the river Kor and its tributaries (rising in the Zagros Mtns to the north and east of Shiraz), many springs, perennial streams and rainfall runoff. In very wet winters Lake Tashk and Lake Bakhtegan become interconnected at both of their extremities but normally they may be described as two closed drainage basins situated in arid country. The amount of flooding is extremely variable, depending on rainfall, but has been reduced in recent years by the construction of the Dorudsan Dam on the upper Kor river, 95 km north of Shiraz. The entire complex was dry in the summer of 1971, with the exception of a small lake near Gomun (Gumoo) at the north-western end of Lake Tashk, but deeply flooded in the wet winters of 1971/72 and 1972/73. There are permanent marshes round the Gomun springs, also near Sahlabad on the south-eastern shore of Lake Bakhtegan and near where the river Kor enters the lakes at Doshok. The main lakes are oligotrophic, the marshes eutrophic, the former supporting a vegetational fringe of *Tamarix*, seablite *Suaeda*, *Cressa* and glasswort *Salicornia*. Submersed vegetation includes various Algae, the 'stonewort' *Chara*, *Ruppia* and *Althenia*. The vegetation of sites grouped together as the Kamjan Marshes and of other fresh-water areas is typically composed of sedge *Carex*, reed *Phragmites*, the goosefoot family Chenopodiaceae and grasses. The lake bottoms are covered by alluvial mud, sapropel, silt and some sand. Most of the surrounding country consists of arid steppic hills and flats except for some cultivation along the Kor valley.

The Neyriz wetland is an extremely important breeding area for a wide variety of waterfowl, notably shelducks *Tadorna* spp., Marbled Teal *Anas angustirostris*, Baillon's Crake *Porzana pusilla*, Black-winged Stilt *Himantopus himantopus*, Avocet *Recurvirostra avosetta*, White-tailed Lapwing *Vanellus leucurus* and Common Tern *Sterna hirundo*. During their migration many waders Limicolae and other waterfowl are dependent upon it and it is also a very important wintering area for *Anas* spp., especially Pintail *Anas acuta* and *A. angustirostris*, Ruddy Shelduck *Tadorna ferruginea*, grey geese *Anser* spp., Greater Flamingo *Phoenicopterus ruber* and Common Crane *Grus grus*.

**Legal status** The 108,000 ha Lake Bakhtegan, Lake Tashk and the marshes are incorporated in the very much larger Bakhtegan Protected Region (327,820 ha), which was established in 1968 and has been accorded Wildlife Reserve status in the UN List (1980). The wetlands themselves have been included in the Ramsar Convention list.

**Tenure** State ownership.

**Management practices** Apart from some livestock grazing on the margins the lakes are free from exploitation or disturbance. Some grazing and hunting continues in the Kamjan Marshes and the floodplain of the lower Kor river.

**Threats** The reduction in the flow of the Kor resulting from damming and irrigation projects in the upper reaches of the river may affect the Neyriz wetlands considerably. Pollution of the waters running into the lakes must be guarded against and kept under the strictest control.

**Scientific research** The principal limnological studies were carried out by Professor Dr. H. Löffler, partly under the auspices of the International Biological Programme. Waterfowl studies and census work have been undertaken by the Department of Environment, Tehran.

**Principal reference material**

Löffler, H. 1959. Beiträge zur Kenntnis der Iranischen Binnengewässer. I Der Nirizsee und sein Einzugsgebiet. *Internat. Rev. Hydrobiol.* 44.

Cornwallis, L. 1968. Some notes on the wetlands of the Niriz Basin in S.W. Iran. In *Proc. Techn. Meeting on Wetland Conservation, Turkey 1967*. Morges, IUCN Publ. New Series No. 12: 152-160.

Löffler, H. 1968. The Hydrobiology of Lake Niriz, Iran. In *Proc. Techn. Meeting on Wetland Conservation, Turkey, 1967*. Morges, IUCN Publ. New Series 12: 141-151.

Cornwallis, L. 1969. A Report on the Wetlands and Waterfowl of Fars, S.W. Iran. Cyclostyled report deposited with Iran Dept. of Environment.

## 28. DASHT-I ARJAN and LAKE PERISHAN

**Criteria for inclusion** 1a,b,c,d,e; 2a,b,c; 3a,b,c; 4a,b.

**Geographical location** Dasht-i Arjan 29°35'N 52°00'E; Perishan lake 29°30'N 51°50'E. About 60 km west of Shiraz and 15 to 25 km south-east of Kazerun, Province of Fars.

**Area** Dasht-i Arjan 2,400 ha; Lake Perishan 4,200 ha.

**Altitude** Dasht-i Arjan 1,950 m; L. Perishan 825 m.

**Water depth** Maximum Arjan 2 m, Perishan 3 m; average Arjan not estimated, often nil, Perishan 1.5 m.

**Wetland types** 17, 18, 23.

**Ecology** The two wetlands are unconnected, but as they are both within the great Arjan National Park International Reserve, are treated as an entity. The whole area has an extremely interesting flora and fauna, large mammals including the bear, wolf and leopard, being a notable feature.

The Dasht-i Arjan (normally only about 400 ha in extent but extending to 2,400 ha in wet years) is a shallow inland fresh-water marsh and lake, at a high elevation and surrounded by dry limestone mountains; it is fed by winter rainfall, snowmelt, through run-off and some small watercourses, and by large springs at Chesmeh Salmon on the north-west. The flow is south-easterly to swallow-holes within the enclosed basin and the bottom consists of alluvial mud. The lake and marshes are eutrophic and support a vegetation of *Phragmites* and *Typha* reeds, rushes *Juncus* and aquatic plants. The level section of its surroundings is dominated in wet years by sedges *Carex* sp. etc., but is usually covered with terrestrial grasses or remains as bare dry mud-flat. Some wheat is grown on the west to north-west section where the large village of Dasht-i Arjan is situated and the flats were extensively grazed

by cattle owned by nomadic tribesmen until quite recently. The area is of great importance, but only in very wet years, as a breeding-place for waterfowl, notably Dalmatian Pelican *Pelecanus crispus*, Marbled Teal *Anas angustirostris*, Ferruginous Duck *Aythya nyroca*, Spoonbill *Platalea leucorodia*, Glossy Ibis *Plegadis falcinellus*, Baillon's Crake *Porzana pusilla* and Coot *Fulica atra*. Moderate numbers of many species of waterfowl visit the area on migration and fairly large numbers of surface-feeding duck *Anas* spp., Ruddy Shelduck *Tadorna ferruginea*, Greylag Goose *Anser anser* and Crane *Grus grus* may winter. This is one of many wetlands in the region which dried out almost completely in the summer of 1971.

Lake Perishan is a larger shallow saltlake, bordered by brackish marshes, at a much lower level. Its salinity is very variable and in very wet years the bays are almost fresh. It is fed by numerous springs along the north shore and to the east, also by rainfall and some temporary watercourses, and the water level varies greatly. The lake was almost completely dry in the summer of 1971, but deeply inundated in the wet winter of 1971/72. The wetland has a closed drainage and the bottom is muddy. The lake is oligotrophic, the marshes and bays eutrophic. Extensive reedbeds of *Phragmites* and *Typha* and patches of sedge occur where salinity is low, but the vegetation of most of the shoreline consists of Chenopodiaceous halophytes, as well as *Tamarix* and sedges. There is a wheat farming area to the south and west and scattered settlements, with orchards and gardens, on the west. This wetland like the Dasht-i Arjan provides a nesting place for *Pelecanus crispus*, *Anas angustirostris*, *Platalea leucorodia* and *Fulica atra* (but with the addition of a big mixed heronry and some colonies of terns Sterninae) and is likewise used by waterfowl on migration. Its chief importance, however, is as a wintering area for many species, including grebes Podicipitidae, *Pelecanus* spp. herons Ardeidae, Greater Flamingo *Phoenicopterus ruber*, *Anas* spp., White-headed Duck *Oxyura leucocephala*, Greylag Goose *Anser anser*, Crane *Grus grus* and great numbers of *Fulica atra*.

**Legal status** Both wetlands and a large surrounding zone are incorporated in the Arjan National Park International Reserve (65,750 ha) established in 1973 and also designated as a Biosphere Reserve under UNESCO's MAB Programme in 1976. The two lakes are included in the Ramsar Convention list.

**Tenure** State ownership.

**Management practices** Grazing, reed-cutting and fishing, but only slight hunting pressure were reported until 1973, when the wetlands became totally protected.

**Scientific research** The ecology of the area has been thoroughly studied by the Department of Environment, which also undertook annual census of the waterfowl from 1969 onwards.

**Principal reference material**

Cornwallis, L. 1969. A Report on the Wetlands and Waterfowl of Fars, S.W. Iran. Cyclostyled report deposited with Iran Department of Environment.

Firouz, E. 1971. *The Wetlands and Waterfowl of Iran*. Tehran, Game and Fish Department of Iran (Kayhan Press). 47 pp.

### 31. DELTAS OF RUD-I-GAZ and RUD-I HARA

**Criteria for inclusion** 1a,b,c,d,e; 2a,b; 4a,b.



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**Geographical location** 26°15'N 57°10'E. Eastern side of the Straits of Hormoz, c.120 km south-east of Bandar Abbas.

**Area** 15,000 ha.

**Altitude** Sea level.

**Water depth** Not estimated.

**Wetland types** 3, 5, 11, 12.

**Ecology** A mixture of tidal mudflats, mangroves and saltmarsh. The water of the Rud-i-Gaz and Rud-i Hara deltas and of the several other intermittent streams in this area are fresh to brackish, the flow sluggish and the bottom made up of alluvial deposits, silt, mud and sand. The inshore zone is very shallow with sand bars, spits, islets, mangrove swamps and some saltmarsh.

There is some typical saltmarsh and sand-dune vegetation and also some areas of mangrove *Avicennia* sp. and algae, but the mud-flats lack any seaweed cover and the low-lying hinterland to the east is very arid and sparsely vegetated. Its precise importance as a waterfowl breeding area and staging post for migrants has not been investigated but may be quite high to judge from listed area 33 below. As a wintering ground it is very attractive to Cormorant *Phalacrocorax carbo*, several species of heron Ardeidae, Spoonbill *Platalea leucorodia*, Dalmatian Pelican *Pelecanus crispus*, gulls Laridae and Limicoline species such as Oystercatcher *Haematopus ostralegus*, Redshank *Tringa totanus*, Bar-tailed Godwit *Limosa lapponica* and Curlew *Numenius arquata*.

**Legal status** Unprotected except that the whole area is now included in the Ramsar Convention list.

**Tenure** State ownership.

**Management practices** The area is remote and sparsely populated but fishing and some cutting of brushwood take place.

**Threats** None reported.

**Scientific research** Waterfowl census work has been carried out.

**Principal reference material**

No information.

### 32. DELTAS of the RUD-I SHUR, RUD-I SHIRIN and RUD-I MINAB

**Criteria for inclusion** 1a,b,c,d,e; 2a,b; 4a,b.

**Geographical location** 27°00'N 56°45'E. Coastal area between 25 and 80 km east of Bandar Abbas, along the northern shore of the Straits of Hormoz.

**Area** 20,000 ha.

**Altitude** Sea level.

**Water depth** Not estimated.

**Wetland types** 3, 5, 11, 12.

**Ecology** Tidal mud-flats, mangroves and saltmarsh. The water is mostly saline or brackish but of the intermittent streams entering the tidal area from the north, the waters of the Rud-i Shirin and Rud-i Minab are both fresh, although that of the

Rud-i Shur is somewhat brackish. The flood period of all three is in winter and early spring. The inshore zone is very shallow and plentifully endowed with sand bars and spits, the bottom consisting of alluvial deposits, silt, mud and sand, with a certain amount of algal growth. There are scattered clumps of mangrove *Avicennia* sp. in the creeks and rivermouths, and some not very extensive saltmarsh and dunes, both with typical vegetation. Otherwise the mud-flats are mainly bare and the plains stretching inland to the north very arid and sparsely vegetated. Further south the hinterland consists of fairly level steppe with little in the way of vegetation except for some *Acacia* and date palms *Phoenix dactylifera* on its northern margin. The human population is generally scanty.

As with listed area 32 the importance of this wetland to waterfowl as a breeding place and staging post on migration has not yet been properly investigated but, from what is known of the not far distant listed area 33, may be considerable. It is certainly an extremely important wintering area for Cormorant *Phalacrocorax carbo*, various herons Ardeidae, Greater Flamingo *Phoenicopterus ruber*, waders such as Oystercatcher *Haematopus ostralegus*, Bar-tailed Godwit *Limosa lapponica* and Curlew *Numenius arquata*, and gulls Laridae.

**Legal status** Unprotected except that the deltas are now included in the Ramsar Convention list.

**Tenure** State ownership.

**Management practices** Activities in the area include fishing and the cutting of brushwood for fuel.

**Threats** None reported.

**Scientific research** None apart from wildfowl censusing.

**Principal reference material**

No information.

### 33. KHURAN STRAITS

**Criteria for inclusion** 1a,b,d,e; 2a,b; 3a; 4a.

**Geographical location** 26°45'N 55°40'E The Straits (once known as the Clarence Straits) are situated between the Iranian mainland, in the neighbourhood of the Mehran and Kul/Rasul (Gol) deltas, and Qeshm Island, over a distance from 10 to 125 km west-south-west of Bandar Abbas.

**Area** c.100,000 ha.

**Altitude** Sea level.

**Water depth** Not estimated.

**Wetland types** 1, 2, 3, 5, 8, 9, 11, 12.

**Ecology** A vast area of sandy coasts, inter-tidal mudflats and mangrove *Avicennia* swamps, with numerous small islands, creeks and estuaries (those of the Mehran and Kul rivers being much the most important). Apart from the mangroves, red and brown algae (Rhodophyceae and Phaeophyceae) constitute the typical vegetation of the shallows. A few small settlements are scattered along the shorelines.

The area is an important breeding place of Ardeidae, notably Great White Egret *Egretta alba*, Western Reef Heron *E. gularis*, Indian Pond Heron *Ardeola grayii* and Goliath Heron *Ardea goliath*. Two other species of particular interest

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which nest are the Crab Plover *Dromas ardeola* and Great Stone Plover *Esacus magnirostris recurvirostris*. The numerous species of true plovers Charadriidae are also a feature of the passage migration. In winter the area is of special importance to Ardeidae, Charadriidae and Scolopacidae including, in addition to species already mentioned, the Grey Heron *Ardea cinerea*, Redshank *Tringa totanus*, Terek Sandpiper *T. cinereus*, Bar-tailed Godwit *Limosa lapponica* and Curlew *Numenius arquata*. Wintering flocks of Dalmatian Pelican *Pelecanus crispus*, Spoonbill *Platalea leucorodia* and Greater Flamingo *Phoenicopterus ruber* have also been recorded.

**Legal status** The wetland (particularly the Mehran delta area) is partly protected by the Hara Protected Region (65,750 ha) established on the mainland opposite Queshm island in 1972. Later this was given National Park status and enlarged to 82,360 ha and, in 1976, it was designated as a Biosphere Reserve under UNESCO's MAB Programme with an area further increased to 85,686 ha. It is incorporated in the 100,000 ha wetland included in the Ramsar Convention list.

**Tenure** State ownership.

**Management practices** The area within the Biosphere Reserve is fully protected, although some illegal cutting of mangroves has been reported. Fishing and boat traffic still continues in the Straits.

**Threats** In the unprotected areas cutting of bush for fuel and charcoal burning may have some adverse effects. The wetlands could also suffer from the pollution to which the Persian Gulf is increasingly prone.

**Scientific research** Waterfowl censuses have been carried out in this area. The marine research station established on Hormoz Island, off the eastern end of the Straits, may well have undertaken work in the wetland.

### **Principal reference material**

None listed, although many of the previously mentioned general works under the authorship of E. Firouz and published by the Department of Environment in the period 1970-77 are relevant.

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## SUMMARY OF WETLAND SITUATION

The two great rivers, Tigris and Euphrates, traverse the country from north to south and unite near Al Qurnah about 60 km north-west of Basra. From there the river is known as the Shatt al Arab and it reaches the Persian/Arabian Gulf approximately 100 km south-east of Basra near Al Faw (Fao). Before uniting, the Tigris and Euphrates flow through a vast complex of marshes, possibly the largest of its kind in the world, covering about 20,000 sq. km, so big in fact that it would be inconvenient to quote sizes in hectares. Most of the rest of Iraq is desert or semi-arid country and, in the past, its agriculture has been dependent on the annual spring flooding along the lower courses of the two rivers which spreads silt over the fields. In recent years dam-building in the upper reaches of the rivers and the creation of huge storage basins in depressions west and north-west of Baghdad has brought the annual flooding (which tended to vary in volume) largely under control. The most important storages are Lakes Tharthar, Habbaniya and Rezzaza.

In general the aim of the irrigation projects is to double the area that can be put under cultivation. Such ambitious schemes for river control and irrigation will probably lower the water level in the marshes considerably. At the beginning of the 1970s the depth of the marshes during the flood season averaged about 1.0 – 1.5 m and the maximum was 2.0 to 3.5 m.

The principal marshes at high water level are Shaniyah and Meshkab Basin (1,625 sq. km), Qartaizat, Hitala and Shukus (1,200 sq. km), Dalmaj (1,600 sq. km), Ummal Baqir and Awdah (1,500 sq. km), Hawizah (3,000 sq. km) and Qalat Salih – Qurnah (3,000 sq. km). The dominant vegetation in these shallow lakes and marshes consists of the two most important emergent species, the reeds *Phragmites communis* and *Typha angustifolia*. The numerous submerged aquatic species include *Vallisneria* sp., pondweed *Potamogeton* sp., water milfoil *Myriophyllum* sp., hornwort *Ceratophyllum* sp., stonewort *Chara* sp., naiad *Najas* sp. and water fern *Salvinia* sp. The floating vegetation includes the water lilies *Nymphaea* sp. and *Nuphar* sp., water soldier *Pistia stratiotes* and *Lemna* sp. In the past considerable amounts of nutrients reached the shallow lakes and marshes with the silt-laden floodwater and as a result they are rich in fish, especially Cyprinids. The annual commercial production has been estimated at 30,000 metric tons, 70% of which consists of Cyprinids (Al Hamed 1966).

The marshes, shallow lakes and even flooded fields abound in waterfowl at all seasons but especially in winter and during the migrations. Unfortunately, information on the breeding status of such birds is extremely scarce, partly because of the difficulties of access to much of the marshland. The biggest waterfowl concentrations probably occur on the Hawr al Hammar, between Basra and An Nasiriyah, an area covering 5,200 sq. km at high water level and approximately 3,500 sq. km during periods of low water. This is the largest eutrophic lake in the country although generally shallow, with a maximum depth of 1.8 m. Its littoral zone dries out during periods of low water and banks appear in many places, providing excellent feeding and roosting areas for probably hundreds of thousands of waterfowl in autumn, winter and spring. Species include a great variety of Anatidae,

but mostly Mallard *Anas platyrynchos*, Teal *A. crecca*, Gadwall *A. strepera*, Wigeon *A. penelope*, Pintail *A. acuta*, Shoveler *A. clypeata* and Pochard *Aythya ferina*. Other prominent species are the pelicans *Pelecanus* spp., Little Egret *Egretta garzetta*, Great White Egret *Egretta alba*, Grey Heron *Ardea cinerea*, Greater Flamingo *Phoenicopterus ruber* and Coot *Fulica atra*, while waders and gulls are present in great variety and large numbers. Some parts of the Hawr al Hammar have recently been drained to facilitate oil exploration and a canal to connect the south side of the marshes directly with Basra may by now have been completed and could have the effect of permanently lowering the water level.

The Hawr as Suwaiqiyah 25 km north of Al Kut is known as a traditional wintering area for large numbers of Greylag Goose *Anser anser*, White-fronted Goose *A. albifrons*, four species of ducks *Anas platyrhynchos*, *A. crecca*, *A. acuta*, *A. penelope*, and also *Phoenicopterus ruber*.

The Mileh Tharthar and the Hawr al Habbaniyah, west and north-west of Baghdad, are deep and oligotrophic and probably have lost much of their importance for waterfowl since their water storage and flood relief functions were enlarged some years ago. Habbaniyah now has an inlet and outlet canal connecting it with the Euphrates and a third canal which carries any excess water 50 km to the south to the Bahr al Milh and Abu Dibis (Rezzaza) lakes, west of Karbala. The latter seem to be favourable wintering areas for Cormorant *Phalacrocorax carbo*, Spoonbill *Platalea leucorodia*, Greater Flamingo *Phoenicopterus ruber*, several species of Anatidae and *Fulica atra* (Carp 1975). A fourth area deserving mention, although in the absence of recent information no sites are listed below, comprises the Diyala River valley and the valleys of the Great and Lesser Zab Rivers, as well as the Tigris, in the Kirkuk-Mosul region of northern Iraq. These are known at one time to have offered good waterfowl habitat but may have lost their importance as a result of drainage for agricultural purposes.

Finally, it is worth remembering that the great marshes to the north of the Hawr al Hammar, between Basra, Al 'Amarah and An Nasiriyah, are the home of 100,000 Madan ('Marsh Arabs'). Their ancient culture has probably changed little since Sumerian times and is of great ethnological interest. The remarkable architecture of their reed-houses and their skilfully built canoes are as fine examples of their kind as anywhere in the world.

Scientific investigation of the marshes and their ecosystems is still in its early stages but a field research station was established by the Basra Museum of Natural History in 1975 and is situated between Basra and Al Qurnah. It is to be hoped that its work will contribute towards the effective conservation of Iraq's unique ecosystems, particularly the huge wetland tracts, which is so desirable.

Recent data on wintering waterfowl were collected by the joint IWRB/University of Basra expedition in January 1979. 55 sites were visited at which 875,000 waterfowl of 81 species were observed, including 4,000 Pelicans *Pelecanus* sp., over 3,000 Greater Flamingos *Phoenicopterus ruber*, 2,400 geese, 140,000 ducks, 230,000 Coots *Fulica atra*, 20,000 waders and 15,000 gulls and terns. It was emphasized that these were only minimum numbers, as counts were confined either to places reachable by car or made on a limited number of boat-trips. Actual numbers may well amount to several million but could only be reliably estimated on the basis of a comprehensive aerial survey. Detailed notes on the waterfowl and conservation proposals were communicated by IWRB to the University of Basra and the Bulletin of Basra Natural History Museum will publish a complete review, now in preparation, of the wetland avifauna.

The list of Wetlands of International Importance, which follows, must be regarded as tentative in the absence of more complete data. No attempt is made to

specify criteria for selection though in fact most of the areas listed would qualify on the basis of their importance for migrating waterfowl.

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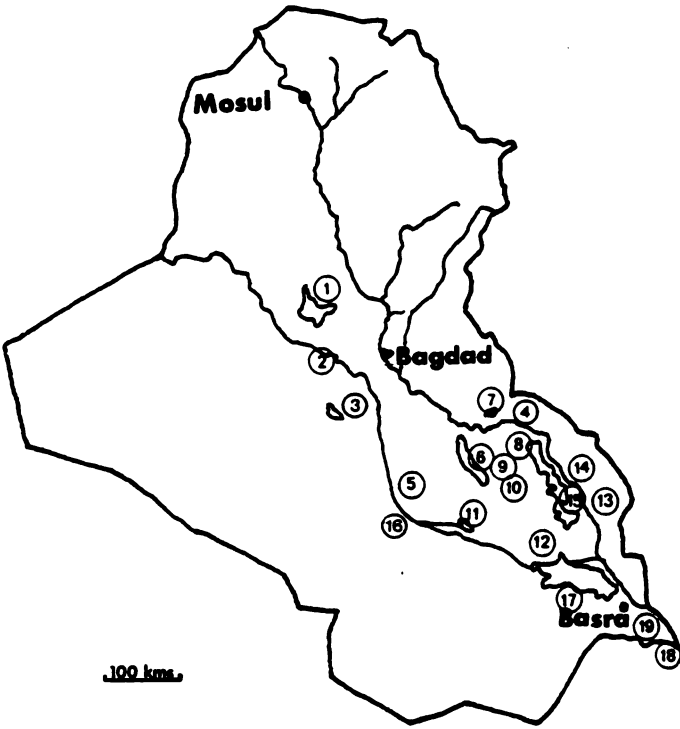
### WETLANDS OF INTERNATIONAL IMPORTANCE

	Locality	Latitude	Longitude	Size
<b>A. Flood control and storage lakes:</b>				
1.	Lake Tharthar	33°55'N	43°16'E	2,300 sq. km
2.	Lake Habbaniyah	33°16'N	43°30'E	430 sq. km
3.	Lake Rezzaza (Hawr Abu Dibis and Hawr al Milh)	32°38'N	43°44'E	1,500 sq. km
<b>B. Marsh complexes and shallow lakes</b>				
4.	Marshes of Shaikh Saiyid (Hawr Al Ahwar, Hawr Al Abbara, Hawr Al Abulwarid, Hawr Al Ugar & Hawr Shaikh Saiyid)	32°33'N	46°15'E	20 sq. km
5.	Hawr Ibn Najm	32°10'N	44°35'E	100 sq. km
6.	Hawr Dalmaj	32°20'N	45°30'E	1,000 sq. km
7.	Hawr as Suwayqiyah	32°42'N	45°55'E	500 sq. km
8.	Hawr as Sadiyah	32°10'N	46°38'E	1,400 sq. km
9.	Hawr Um Al Baram & Hawr Al Abjiya	32°25'N	46°03'E	100 sq. km

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	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>
10.	Marshes of Al Hayy (Hawr Maraiba & Hawr Al Hachcham)	32°10'N	46°02'E	80 sq. km
11.	Hawr Lafta	31°21'N	45°31'E	200 sq. km
12.	Hawr Chamuqa and surrounding marshes	31°22'N	46°25'E	325 sq. km
13.	Hawr al Hawizah and surrounding marshes	32°30'N	47°35'E	2,500 sq. km
14.	Hawr Chubaisah and surrounding marshes	31°56'N	47°20'E	275 sq. km
15.	Hawr Al Awdah	31°33'N	46°51'E	75 sq. km
16.	Euphrates marshes around Hawr Dima, Hawr Ub al Binni, Hawr az Zikri and Hawr Birkat	31°00'–30'N	44°42'–45°18'E	3,000 sq. km
17.	Hawr Al Hammar	30°46'N	47°05'E	5,200 sq. km
C. Coastal areas				
18.	Mudflats near Al Faw (Fao)	29°55'N	48°26'–32'E	No estimate
19.	Khor Zubair and Khor Abd-Allah	30°12'N	47°54'E	200 sq. km

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# IRELAND

## SUMMARY OF WETLAND SITUATION

Ireland with its mild winters provides an ideal wintering area for huge numbers of waterfowl. Many suitable habitats exist all round the coast and also a distance of well over 70 km up the Shannon Estuary on the west. Adverse factors, on the other hand, include the fact that, because the economy of the country is largely based on agriculture, efforts to improve marginal farming areas have resulted in the disappearance of a number of good inland wetlands. This applies particularly to the former 'turlough' area in Counties Galway and Mayo. Another threat is the amount of peat extracted from the bogs since the energy crisis started in 1973/74.

Virtually the only winter quarters of two distinctive populations of wildgeese are in Ireland. The Greenland race of the White-fronted Goose *Anser ablifrons flavirostris* winters mainly on the Wexford Slobs in the south-east and along the Little Brosna River (in the centre of the country west-south-west of Dublin), whilst the Greenland population of *Branta bernicla hrota*, the pale-breasted race of Brent Goose, has its winter quarters in various sites from the Rogerstown and Malahide estuaries and North Bull Island, to the north of Dublin, south and west round the coast to Tacumshin Lake, Castlemaine Harbour, Tralee Bay and Cummeen Strand in Sligo Bay. Both the Whooper and Bewick's Swans *Cygnus cygnus* and *C. columbianus bewickii* winter on the River Shannon and Rahasane turlough; the Whooper, only, on Lough Oughter, Birra Lough and Lough Swilly; Bewick's, only, on the Wexford Slobs. Finally, large numbers of waders are found wintering in Dundalk Bay, North Bull Island, Wexford Harbour and Slobs, Cork Harbour and Ballymacoda estuary 12 km to the east of it, and the Shannon Estuary.

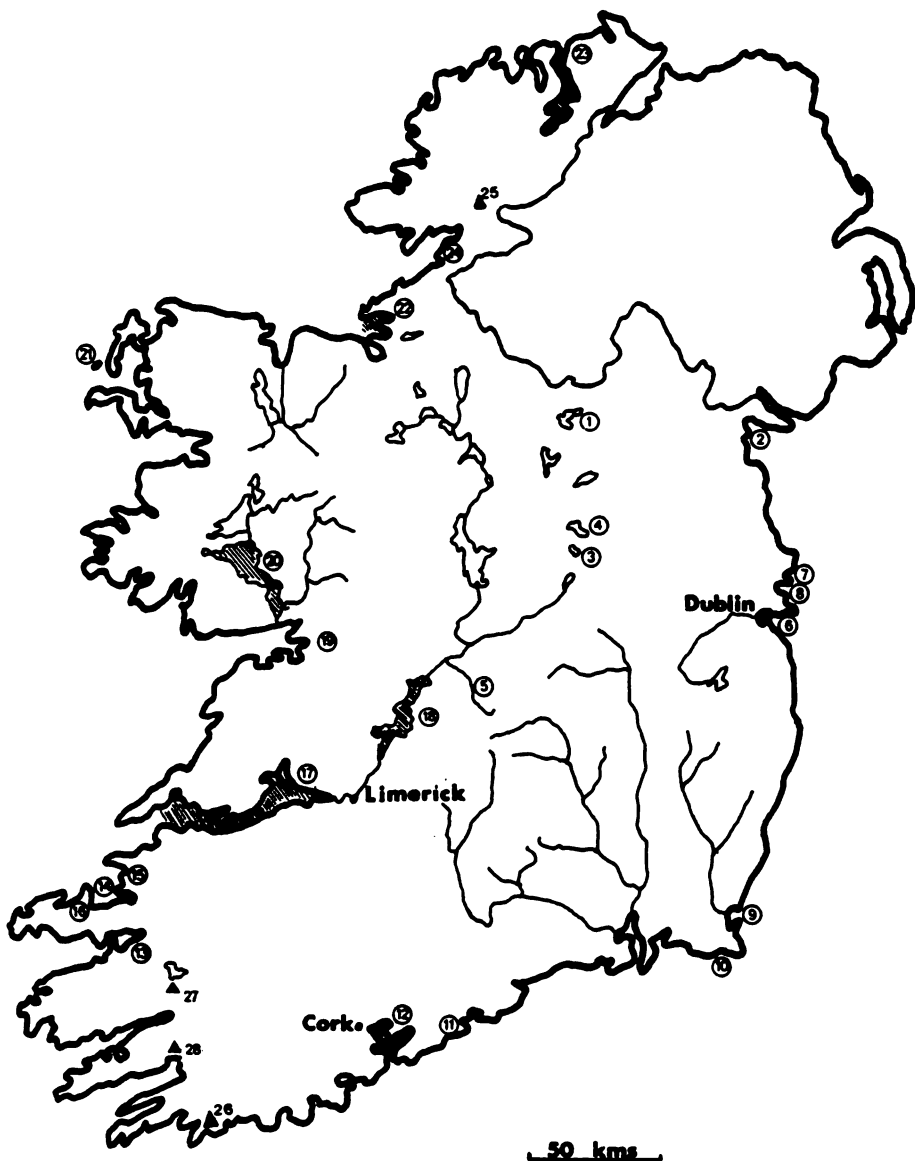
The numbers of ducks of surface-feeding species nesting in Ireland have decreased in recent years, whilst both resident and wintering diving ducks are increasing. New legislation on Forest and Wildlife, giving greater powers for the protection of waterfowl habitats, was enacted in the early 1970s. The detailed information which follows on the Irish wetlands of national and international importance was compiled with the assistance of the Forest and Wildlife Service of the Department of Lands in Dublin in 1974.

## WETLANDS OF INTERNATIONAL IMPORTANCE

	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
1.	Lough Oughter	54°00'N	7°29'W	1,012 ha	1a; 3a,c; 4a,b No shooting
2.	Dundalk Bay	54°00'N	6°20'W	4,717 ha	1a,b; 2a; 3c Parital no-shooting
3.	Lough Owel	53°34'N	7°24'W	1,008 ha	1a,d,e; 2a; 3a; 4a,b Unprotected
4.	Lough Derravaragh	53°39'N	7°23'W	1,285 ha	1a; 2a; 4a Unprotected
5.	Little Brosna River	53°07'–09'N	8°00'–06'W	1,400 ha	1a; 2a; 3a Unprotected

<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
6. North Bull Island	53°22'N	6°12'W	607 ha	1a,b; 2a,b; 3a,b,c; 4a Protected
7. Rogerstown Estuary	53°30'N	6°12'W	368 ha	1a,c No shooting
8. Malahide Estuary	53°27'N	6°12'W	606 ha	1a,b,c,e; 3a Unprotected
9. Wexford Harbour and Slob	52°19'N	6°24'W	c.4,400 ha	1a; 3a,b,c; 4a Partly protected
10. Tacumshin Lake and Whitehole	52°11'N	6°29'W	464 ha	1a,c,e; 2a; 3a,c; 4a Unprotected
11. Ballymacoda Estuary	51°54'N	7°54'W	602 ha	1b,e; 2a Unprotected
12. Cork Harbour	51°50'N	8°17'W	5,950 ha	1a,b; 2a; 3a,c; 4a Unprotected
13. Castlemaine Harbour	52°07'N	9°55'W	9,874 ha	1a,c,e; 2a; 3c; 4a Unprotected
14. Tralee Bay and Barrow Harbour	52°16'N	9°48'W	3,290 ha	1a,c,e; 2a; 3c; 4a Unprotected
15. Akeragh Lough	52°22'N	9°50'W	231 ha	1a; 2a,b; 3c; 4a Unprotected
16. Lough Gill	52°15'N	10°03'W	1,807 ha	1a; 2a; 3c; 4a Unprotected
17. Shannon Estuary	52°25'–49'N	8°38'–9°57'W	c.34,000 ha	1a,b,c,e; 2a; 3c Unprotected
18. River Shannon	53°05'–17'N	8°02'–12'W	4,350 ha	1a Unprotected
19. Rahasane Turlough	53°13'N	8°47'W	257 ha	1a,c,d,e; 2a,b; 3a,c; 4a Unprotected
20. Lough Corrib	53°16'–33'N	9°03'–31'W	18,240 ha	1a,e; 2a; 3c Unprotected
21. Inishkea Islands	54°07'N	10°13'W	328 ha	1a,e; 2a; 3b; 4a,b No shooting
22. Cummeen Strand, Sligo Bay	54°07'N	8°32'W	1,865 ha	1a; 2a; 4a,b Unprotected
23. Lough Swilly	55°07'N	7°32'W	17,400 ha	1a; 2a; 4a No shooting in some areas
24. Birralough	54°34'N	8°11'W	365 ha	1a; 2a; 4a Unprotected
<b>Other wetlands of international importance, mainly for their limnological/hydrobiological values</b>				
25. Lough Eske	54°50'N	8°03'W	450 ha	1c,e; 4a,b Unprotected
26. Lough Hyne	51°30'N	9°18'W	225 ha	1d,e; 2b,c; 3a,b,c; 4a Unprotected
27. Lough Crincaum	51°59'N	9°32'W	c.1 ha	1c; 2c Unprotected
28. Lough Nagarriva	51°47'N	9°31'W	c.1.5 ha	1c; 2c Unprotected

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## DETAILS OF LISTED AREAS

### 1. LOUGH OUGHTER

**Criteria for inclusion** 1a;3a,c;4a,b

**Geographical location** 54°00'N 7°29'W about 7km to the west of Cavan Town and including a number of adjacent lakes in the vicinity of Milltown to the north and Ricehill to the south.

**Area** 1,012 ha.

**Altitude** 50 m.

**Water depth** No information.

**Wetland type** 18.

**Ecology** Lough Oughter is in the upper part of the River Erne drainage system and consists of a maze of islands and peninsulas formed by the submergence of drumlins. The southern part is well wooded and the seclusion of the area provides ideal habitats for birds. The dominant vegetation consists of *Phragmites* reedbeds and scrubby stands of alder *Alnus*. Wildfowl counts were carried out in December 1971 and the number of wintering Whooper Swans (563) was found to be of international importance.

**Legal status** The wetland area has been subject to an annual no-shooting Order under the Game Preservation Act 1930.

**Tenure** State ownership.

**Management practices** No information.

**Threats** None reported.

**Scientific research** None.

**Principal reference material** None.

## 2. DUNDALK BAY

**Criteria for inclusion** 1a,b;2a;3c

**Geographical location** 54°00'N 6°20'W Immediately to the east of the town of Dundalk (Dun Dealgan), in the extreme north-east of the Republic, and extending from Bellurgan point at the north-west end of Ballymascanlon Bay south to Annagassan.

**Area** 4,717 ha (seaward limit taken as edge of mudflats as marked in the Half-inch to 1 Mile or 1:3,168,000 Ordnance Survey map).

**Altitude** Sea level.

**Water depth** Varies with tide (max. 5.1 m, min. 4.2 m at high water).

**Wetland type** 3.

**Ecology** Saltmarsh and mudflat extending some 16 km from Ballymascanlon Bay to Annagassan. The saltmarsh is dissected by many drainage channels. The area is dominated by enormous expanses of rice grass *Spartina townsendii* which still seems to be spreading. Other communities are to be found only in the higher levels of the saltmarsh, a zone which is often very narrow as a result of reclamation. Only a very little *Salicornia* is present. The main vegetation types comprise:

Puccinellietum maritimae (common saltmarsh grass)

Juncetum gerardii (salt mud rush)

Salicornetum europaeae (glasswort)

Zosterion (common grass-wrack)

Spartinetum townsendii (rice grass)

Wildfowl censuses were carried out in January, February, July, August and September 1974 over the whole area. Counts had earlier been made in Ballmas-

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canlan Bay in November, January and February 1970/71 and 1971/72, on South Marsh and Ballymascanlan in March and October 1973 and on Lurgangreen monthly in 1972/73. The results indicated wader numbers of international importance of the following order at the seasons specified:

Oystercatcher *Haematopus ostralegus* 26,000 autumn  
Golden Plover *Pluvialis apricaria* 13,000 autumn  
Dunlin *Calidris alpina* 15,000 mid-winter  
Knot *Calidrus canutus* 8,000 mid-winter  
Curlew *Numenius arquata* 4,500 mid-winter  
Bar-tailed Godwit *Limosa lapponica* 6,000 late autumn

Up to 48,000 waders have been counted on occasion in the area, which is as many as have been noted at any one time in the entire Shannon Estuary.

**Legal status** An annual no-shooting Order under the Game Preservation Act 1930 has been applied to Ballymascanlan Bay in the north-east of the area, but the remainder is unprotected.

**Tenure** State ownership.

**Management practices** Cattle are still grazed in the upper zones of the saltmarsh.

**Threats** There is some evidence of pollution, probably from Dundalk Town. The growth of *Spartina* may well be bringing about a reduction in the feeding area of the waders.

**Scientific research** None.

**Principal reference material** None.

### 3. LOUGH OWEL

**Criteria for inclusion** 1a,d,e;2a;3a;4a,b

**Geographical location** 53°34'N 7°24'W Four kilometres north of Mullingar, County Westmeath.

**Area** 1,008 ha

**Altitude** 99.4m

**Water depth** Maximum 23 m

**Wetland type** 18

**Ecology** Lough Owel is a shallow clear water lake on limestone, with marl deposits on the bottom. Marginal vegetation is not well developed but beds of reed *Phragmites communis*, fen sedge *Cladium mariscus* and bottle sedge *Carex rostrata* occur on the western side. There is also some wet grassland and alder *Alnus* carr. Wildfowl counts were carried out in November 1971, January and February 1972 and monthly through the winters of 1972/73 and 1973/4, species recorded including Shoveler *Anas clypeata* (maximum of 2,000 rating as internationally important) and Mallard *Anas platyrhynchos* (max. 2,500) Tufted Duck *Aythya fuligula* (2,000) and Pochard *Aythya ferina* (2,000).

Fish species include Brown Trout *Salmo trutta* and certainly at one time the Arctic Charr *Salvelinus alpinus*, though this species may now have died out.

**Legal status** Unprotected.

**Tenure** State ownership.

**Management practices** The lough is used to supply water to Mullingar, but this does not at present lead to much fluctuation in water levels. It is also an important trout fishery managed by the Inland Fisheries Trust Inc.

**Threats** None reported.

**Scientific research** Limnological and biological information from this lough are used as baseline data in comparative studies.

**Principal reference material** None quoted, but several papers on the trout fishery are known to have been published.

#### 4. LOUGH DERRAVARAGH

**Criteria for inclusion** 1a;2a;4a

**Geographical location** 53°39'N 7°23'W Thirteen kilometres north of Mullingar, County Westmeath.

**Area** 1,285 ha.

**Altitude** 63.4 m.

**Water depth** Maximum 23 m.

**Wetland type** 18.

**Ecology** Lough Derravaragh is part of the River Inny drainage system and is a clear water limestone trout lake. At its north-west end it is backed by raised bog but the long south-eastern arm runs between resistant siliceous limestone outcrops, which slope steeply into the lake. The outcrops are covered by oak woodland. As a result of drainage, extensive areas of the lake bed are exposed at the western end forming a mosaic of land and water very attractive to waterfowl.

Wildfowl counts were carried out in November 1970, January, February and November 1971, January and February 1972, monthly through the winter of 1972/73 and in October and November 1973. The dominant species, with peak numbers in autumn (the birds dispersing rapidly from November onwards), proved to be Pochard *Aythya ferina* (maximum of 5,600, which rates as of international importance) and Tufted Duck *Aythya fuligula* (maximum varying between 1,200 and 2,800).

**Legal status** Unprotected.

**Tenure** State ownership.

**Management practices** Drainage works, undertaken for unspecified reasons, have recently lowered the water level. The lough is managed as a trout fishery.

**Threats** Eutrophication due to water draining into it from Lough Sheelin in the north, via the Inny river. Intensive pig-farming in the Lough Sheelin catchment has been responsible for this process.

**Scientific research** Studies of the trout and Chironomid populations of the lough have been undertaken.

**Principal reference materials** Not quoted.

**5. LITTLE BROSNA RIVER****Criteria for inclusion** 1a;2a;3a**Geographical location** 53°07'–09'N 8°00'–06'W. From New Bridge, about 8 km north-west of Birr, County Offaly, to the confluence of the Little Brosna and Shannon; and including Big Island and Friars Island in the Shannon itself.**Area** 1,400 ha.**Altitude** 35 m.**Water depth** No estimate; the river is subject to seasonal flooding.**Wetland type** 12.

**Ecology** The main feature of the wetland is its 'callows', the meadows on gleyed alluvial soils which are flooded with water from the river during winter. The extent of flooding is variable and uncontrolled: it begins in early autumn but extensive areas may remain uncovered late into November; patches of surface water may remain well into the summer. Thus the callows are floodplains as opposed to perennial marshy turloughs. The meadow vegetation is a sward of sedges *Carex hirta* and *nigra*, sweet grass *Glyceria* spp., meadow grass *Poa pratensis* and creeping bent *Agrostis stolonifera*. On wetter areas the reed sweet grass *Glyceria maximum*, *Juncus* spp. and mare's tail *Hippuris vulgaris* dominate. Water plantain *Alisma plantago-aquatica* occurs in some of the surface drains. The past history of this area is not documented, but there are indications that the course of the river has been somewhat straightened and that the area through which it flows was not long ago much wetter than it tends to be today, when the vegetation varies from a sedge-rich, close-cropped grassland over most of the area through rushy grassland dominated by *Glyceria maxima* to emergent aquatic vegetation in the ditches. When not in flood the river has very steep banks with little marginal vegetation.

Wildfowl counts carried out in November, January and February 1970/71 and 1971/74 and monthly from the air and ground in 1972/3 and 1973/74 gave the following indications:

a) Waterfowl present in internationally important numbers:

Wigeon *Anas penelope* max. 11,500 (March 1974)

Greenland White-fronted Goose *Anser albifrons flavirostris* max. 500 (1974)

Duck numbers fluctuate considerably depending on the extent of flooding of the callows and shooting pressure. Wigeon numbers may go as low as 750 (January 1972), but in 1972/3 they peaked at 5,000 in March and in 1973/74 at 11,500, also in March when the water level had dropped after extensive flooding. The last figure represents much the largest concentration of this species recorded in the Republic and over 1% of the North West European Flyway population. The Greenland White-fronted Goose population is Ireland's second largest (after that in the Wexford Slob).

b) Other waterfowl, present in nationally significant numbers:-

Pintail *Anas acuta* max. 250 February

Shoveler *Anas clypeata* max. 540 February

Lapwing *Vanellus vanellus* max. 15,000 February

Golden Plover *Pluvialis apricaria* max. 3,000 February

Black-tailed Godwit *Limos limosa* max. 2,000 February

**Legal status** Unprotected.

**Tenure** Multiple private ownership.

**Management practices** The callows are grazed by cattle during the summer and the area is under heavy shooting pressure in the winter. A system of surface drains prevents permanent water-logging of the ground surface. To maintain the area as it is now, grazing during summer months must continue, together with careful management of the drainage system to prevent permanent water-logging or conversely drying out. This may well imply some active management of the Little Brosna River itself, including the sections upstream and downstream of the callows.

**Threats** There are proposals for draining the whole wetland and plans for this have been prepared. The effect would be to curtail drastically if not eliminate the areas of wet meadow used as feeding-grounds by waterfowl.

**Scientific research** No information.

**Principal reference materials** None quoted.

## 6. NORTH BULL ISLAND

**Criteria for inclusion** 1a,b; 2a,b; 3a,b,c; 4a

**Geographical location** 53°22'N 6°12'W On the north side of Dublin Bay, separated by a creek from the mainland and flanked on east and south by open water and tidal mudflats, from the Sutton and Howth peninsula to the Bull or North Wall of Dublin harbour.

**Area** 607 ha.

**Altitude** Sea level to c.2 m.

**Water depth** The rise and fall of the tide ranges from 3.2 to 4.6 m.

**Wetland types** 1, 3, 10, 11.

**Ecology** The North Bull island lies within the boundaries of Dublin City and consists of a long sand bar built up since 1768 by natural processes, as a result of the construction of the 'Great South Wall' in the harbour. Between the island and the mainland is a wide marshy creek, which, together with the adjacent mudflats, supports large numbers of wildfowl and waders at certain times of the year. The highest densities of waterfowl ever noted in Ireland or indeed the British Isles as a whole, has on occasion been recorded here. The mudflats are rich in Algae (32 species recorded) and there are also several areas of narrow-leaved eel-grass *Zostera angustifolia*, beaked tassel pondweed *Ruppia maritima* and glasswort *Salicornia* spp. The inner side of the island is bordered by saltmarsh, in which some 330 invertebrate species have been recorded (Healy, c. 1975).

North Bull island has the further distinction that its origin and development are well documented (Harris 1974). Due to its proximity to Dublin it is an important educational site for field studies and, for this purpose, the most intensively used wetland in Ireland. Its dune system also has an important recreational role. Changes in its ecology have, however, recently been observed, caused by the construction of a solid causeway between island and mainland, and by seepage of eutrophication effluent from the Dublin Corporation dump, which has led to an algal bloom.

Waterfowl counts undertaken every winter during the period 1966/67 to 1973/74 produced the following results:



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### a) Waterfowl present in internationally important numbers:

Pale-breasted Brent Goose *Branta bernicla hrota* max. 460 (1966/67); 1,400 (1973/74) indicating the increase in numbers over the 8 year period from the low level of 1966/67.

Waders Limicolae: max. 25,000, which makes this wetland the third most important wader haunt in Ireland.

### b) Other waterfowl, present in nationally significant numbers:

Wigeon *Anas penelope* max. 4,000 (November)

Pintail *Anas acuta* max. 450

Shoveler *Anas clypeata* max. 350

Shelduck *Tadorna tadorna* max. 900

Numbers of Pintail and Shoveler were noted as on the increase.

**Legal status** Bird Sanctuary under Wild Bird Protection Act (1930); no shooting Order made annually under the Game Preservation Act (1930).

**Tenure** State ownership.

**Management practices** The no-shooting order is effectively enforced; much of the dune grassland bordering the wetland is managed as a golf course.

### Threats

a) Use of part of the saltmarsh as a domestic refuse tip by the Dublin Corporation and resulting danger of toxic seepage and eutrophication by effluents of the creek waters; dump could adversely affect any extension of the waterfowl feeding grounds and the duneland saltmarsh complex.

b) The suggestion that dumped refuse might be surfaced and converted into a road would, if implemented (especially in circumstances where the dump were extended further along the long-axis of the island), seriously jeopardize the future of feeding grounds and dune system by facilitating disturbance, damage to vegetation by walkers and recreational developments.

c) The 'Dublin Bay Plan' put forward by Dublin Port and Docks Board, which would expose the island to all the problems of a wildlife sanctuary in close proximity to an industrial estate, particularly if the latter included the proposed oil refinery and attendant petrochemical plant.

Meanwhile, as mentioned above, the building of a causeway between the island and the mainland has altered water current movements and patterns of silt deposition and, unless or until a new equilibrium is reached, the possibility of adverse effects on waterfowl feeding grounds cannot be ruled out.

**Scientific research** Studies of the evolution of the island, the saltmarsh communities, pollution in relation to marine algae and invertebrates, and the effects of changes in siltation, are among the many that have been undertaken.

### Principal reference material

O'Reilly, H. and Pantin, G. 1957. Some observations on the saltmarsh formation in Co. Dublin. *Proc. R. Ir. Acad.* 58: 89-127.

Harris, C. R. 1974. The evolution of North Bull Island, Dublin Bay. *Sci. Proc. R. Dub. Soc.* A5(14): 237-252.

Healy, B. c. 1975. Fauna of the salt-marsh, North Bull Island, Dublin. *Proc. R. Ir. Acad.*

## 7. ROGERSTOWN ESTUARY

**Criteria for inclusion** 1a,c

**Geographical location** 53°30'N 6°12'W About 16 km north-north-east of Dublin. The most important part of the wetland is to the west of the railway which traverses it.

**Area** 368 ha.

**Altitude** Sea level.

**Water depth** The rise and fall of the tide ranges between about 3.2 and 4.6 m.

**Wetland type** 8.

**Ecology** An estuary at the mouth of a small river which runs for most of its length through farm land used primarily for cattle grazing and thus carries little industrial effluent. A sand-spit narrows the estuary mouth. The intertidal mudflats appear to be subject to only slow accretion, supporting extensive beds of Common Mussel *Mytilus edulis* and narrow-leaved eel-grass *Zostera angustifolia*. There is a narrow fringe of saltmarsh grassland round the estuary, broadening in the vicinity of the sand-spit and at the estuary head, inland from which there is some wet pasture containing several maritime plant species. Stands of rice grass *Spartina townsendii* are widely distributed and spreading.

Ornithologically, the area is mainly of importance for the Pale-breasted Brent Geese, *Branta bernicla hrota*, which move between the Rogerstown and Malahide (site 8) estuaries and North Bull Island (site 6). Its numbers, based on monthly counts during the winter of 1970/71, 1971/72, 1972/73 and 1973/74 up till December, reach a maximum of about 475 and flocks are present from December until March or April. The Pintail *Anas acuta* is the only other waterfowl species reaching locally significant numbers, up to about 150 having been recorded.

**Legal status** An annual no-shooting Order under the Game Preservation Act (1930).

**Tenure** State ownership.

**Management practices** The saltmarsh grassland at the inner end of the estuary is currently grazed by cattle, sheep and horses. The dune grassland at the seaward end is used as a golf course. A small amount of shooting is apparently continuing within the estuary.

### Threats

a) A Dublin County Council domestic refuse dump in an erstwhile saltmarsh area; its expansion may well be proposed and it is already spoiling the shores with unsightly debris and possibly giving rise to toxic seepage. As previously indicated, there is not much industrial waste entering the river upstream, but perhaps enough sewage and agricultural chemicals to cause some eutrophication and potentially alter bottom conditions in the estuary.

b) *Spartina townsendii*, a hybrid species between the common and American species of cord grass *maritima* and *alterniflora* has become established, is spreading and if it further invades waterfowl feeding grounds must have an adverse effect.

c) Pleasure craft: boat mooring over areas of intertidal mudflats could be a problem if it becomes excessive.

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**Scientific research** No information.

**Principal reference material** None quoted.

## 8. MALAHIDE ESTUARY

**Criteria for inclusion** 1a,b,c,e;3a

**Geographical location** 53°27'N 6°12'W About 2 km south of site No. 7 and hence 14 km north-north-east of Dublin. Differs from No. 7 in so far as it is the area to the east or seaward side of the railway which is of greater interest.

**Area** 606 ha.

**Altitude** Sea level.

**Water depth** Tidal range is between 3.2 and 4.6 m.

**Wetland types** 8, 11.

**Ecology** Malahide estuary is surrounded by rich agricultural land and is more or less cut off from the sea, except for a narrow channel, by an extensive and well developed sand-dune system. There are varied deposits of mud, sand and shingle. The head of the estuary is fringed by fields of permanent grassland in which sea plantain *Plantago maritima*, sea aster *Aster tripolium* and sea club-rush *Scirpus maritimus* grow in depressions. Tassel pondweeds *Ruppia* spp. have been recorded on the mudflats. Only small areas of saltmarsh occur, but there are extensive stands of rice grass *Spartina* at the north-eastern end of the estuary.

The winter waterfowl counts carried out in the period 1969/70 to 1973/74, showed that a maximum of about 400 Pale-breasted Brent Geese *Branta bernicla hrota* visit this estuary and that there is a considerable movement of the birds, between it and North Bull Island to the south and Rogerstown Estuary to the north.

**Legal status** Unprotected.

**Tenure** State ownership.

**Management practices** None, but efforts to eliminate or check the spread of *Spartina* (see next section) are urgently needed.

**Threats** The rice grass *Spartina townsendii* is spreading quickly and encroaching on waterfowl feeding grounds.

**Scientific research** Phytosociological studies have been undertaken.

**Principal reference material** None quoted.

## 9. WEXFORD HARBOUR AND SLOBS

**Criteria for inclusion** 1a,3a,b,c;4a

**Geographical location** 52°19'N 6°24'W The inner harbour is immediately to the north and west of the city of Wexford, the main harbour to the east and the slobbs partly occupy and also border the main harbour. The full extent of the wetland from Ferrycarrig and Castlebridge on the inner harbour to Rosslare Point and Raven Point on either side of the entrance to the outer harbour is about 13 km.

**Area** c.4,400 ha.

**Altitude** Whole area below mean sea level.

**Water depth** Wexford Harbour: max. 10m.

**Wetland type** 8, 25.

**Ecology** Wexford Harbour is a mud-filled arm of the sea into which the River Slaney flows. The 'sloblands' to the north and south of the harbour are areas of alluvial mud now reclaimed, drained and under cultivation or grazing. Extensive areas of wheatfield and pasture are separated by drainage ditches, which empty into larger drainage channels. The water level can be controlled to provide irrigation in summer. Within the slob, plant communities, other than controlled pasture-swards and arable crops, are restricted to the ditches and their margins. Elsewhere there are areas of sand-dune and saltmarsh bordering the harbour-edge, particularly in the vicinity of Raven and Rosslare Points, the Rosslare dune communities being unusual in that they contain patches of dune scrub of which introduced sea buckthorn *Hippophae rhamnoides* is a notable ingredient.

The main plant communities in the sloblands are:

- (1) On drained land re-seeded grassland dominated by rye grasses *Lolium perenne* and *multiflorum*, cat's tail *Phleum pratense* and white clover *Trifolium repens*, plus fields of wheat and barley.
- (2) In the small undrained area of the North Slob, old pastures of mixed common and creeping bent *Agrostis tenuis* and *stolonifera*, scented vernal grass *Anthoxanthum odoratus* and Yorkshire fog *Holcus lanatus*.
- (3) Communities of aquatic and emergent plants in the drainage channels and the small areas of sea-wrack and saltmarsh in the harbour itself, the more important being:—
  - (a) Phragmition communis, Scirpetium maritimae, Scirpeto-Phragmitetum (reeds and club-rush).
  - (b) Ruppion maritimae (tassel pondweed).
  - (c) Potamogetalia (pondweeds).
  - (d) Salicornietum europaeae (glasswort).
  - (e) Zosterion (eel-grass).

Wildfowl counts carried out in November, January and February 1969/70 and 1970/71 and monthly each winter from 1971/72 to 1973/74 gave the following figures:

- (a) Waterfowl present in internationally important numbers:—

Greenland White-fronted Goose *Anser albifrons flavirostris* max. 7,000  
 Pintail *Anas acuta* max. 1,120  
 Bewick's Swan *Cygnus columbianus bewickii* max. 317  
 Lapwing *Vanellus vanellus* max. 22,000  
 Golden Plover *Pluvialis apricaria* max. 8,000  
 Other waders Limicolae max. 39,000

The Greenland White-fronts, which feed on the old pasture and in the barley stubble and roost in Wexford harbour at night represent at least 35% of the world population of this yellow-billed race. The Pintails represent approximately 1% of the N. W. European Flyway population of this species. The numbers of Bewick's Swans have increased in recent years.

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(b) Other waterfowl, present in nationally significant numbers:—

Pale-breasted Brent Goose *Branta bernicla hrota* max. 600 (winter 1973/74)

Mallard *Anas platyrhynchos* max; 3,800 (autumn)

Teal *Anas crecca* max. 1,900 (autumn).

Black-tailed Godwit *Limosa limosa* max. 1,600

The numbers of Mallard peak in the autumn and then decline to between 500 and 1,300. The autumn peak is the largest known gathering of this species in the Republic.

**Legal status** Part of the North Slob has been declared a wildfowl refuge, while Rosslare Point, sand bar and beaches, part of which is known as Tern Island, are a private sanctuary.

**Tenure** Slob: Private ownership except for small portion owned by the State.  
Harbour: State ownership.

**Management practices** The northern side of the harbour is mostly arable farmland with some cattle pasture. A system of ditches and drainage channels operates to keep the ground surface dry throughout the year and, conversely, is sometimes used in summer for irrigation purposes. Shooting is prohibited. Control over the use of agricultural chemicals in the area would possibly be desirable. The land use of the southern side of the harbour is more varied and includes provision for a number of holiday chalets and semi-permanent dwellings, and a golf course.

**Threats** The use of fertilisers and pesticides, and even any major change in farming priorities, on the North Slob would adversely affect the character of the goose feeding-grounds, whilst the close proximity of the port of Wexford makes all parts of the area not specifically protected, potentially vulnerable to development.

**Scientific research** There have been important and continuing studies of the ecological preferences of *Anser albifrons flavirostris* and of how changing farming practices have affected their behaviour and distribution.

### Principal reference material

None quoted.

## 10. TACUMSHIN LAKE and WHITEHOLE

**Criteria for inclusion** 1a,c,e;2a;3a;c;4a

**Geographical location** 52°11'N 6°29'W About 15 km due south of Wexford city and adjacent to the southern coast of the county.

**Area** 464 ha.

**Altitude** Sea level.

**Water depth** Ranging from 10 to 100 cm during seasonal summer flooding; deeper in winter.

**Wetland types** 6, 7.

**Ecology** Lake Tacumshin is a lagoon formed behind a sand-spit growing along the coast under the influence of a westerly 'long-shore drift. The spit is attached at its eastern end but the growing tip is unstable and mobile; in 1974 it moved inshore, blocking the channel between Tacumshin lake and the sea. When this

happens the streams emptying into the lake progressively reduce its salinity, the water seeping outwards through the sand-spit and leaching the salt from the spit in the process. In the present phase contact between lake and sea is likely to be made and lost under storm action at relatively frequent intervals, but the continuing growth of the spit westwards suggests that the channel to the sea will eventually become permanently blocked; Tacumshin would then become a fresh-water lake. Meanwhile, the vegetation bordering the lake contains a large number of maritime species, while the spit has an incomplete cover of vigorous marram *Ammophila* with some stands of other colonizing plants such as sea holly *Eryngium maritimum* and *Euphorbia* spp. (spurges). An abundance of tassel pondweed *Ruppia* spp. is the main feature of the Whitehole, but reeds and rushes *Phragmites* and *Scirpus* spp. are generally dominant.

Wildfowl counts carried out in January and February 1970, January 1971 and monthly through the winters of 1971/72 to 1973/74, showed that this is another wetland where internationally important numbers of the Pale-breasted Brent Goose *Branta bernicla hrota* winter, up to 600 having been recorded.

**Legal status** Unprotected.

**Tenure** Multiple private ownership.

**Management practices** Cattle are grazed along the shores. There is a sluice gate at the mouth of Whitehole where it enters the lake.

**Threats** The channel which has been made through the shingle bank, if successful may temporarily lower the summer level of the lake. The proposed Carnsore Point Nuclear Power Station will be less than 7 km away to the east.

**Scientific research** No information.

**Principal reference material**

None quoted.

## 11. BALLYMACODA ESTUARY

**Criteria for inclusion** 1b,e;2a

**Geographical location** 51°54'N 7°54'W About 6.5 km south-south-west of Youghal, County Cork.

**Area** 602 ha

**Altitude** Sea level.

**Water depth** Tidal range 3.3 to 4.1 m

**Wetland type** 8

**Ecology** The estuary shared by the Dissour and Womanagh rivers, comprising a large expanse of marshy fields, saltmarsh and mudflats, downstream from Crompaun bridge.

Waterfowl counts carried out in September 1970, January, March, October and November 1971, March 1972, and monthly during the winters of 1972/73 and 1973/74, showed as many as 22,000 waders Limicolae to be present including internationally significant numbers on occasion of the following species:—

Golden Plover *Pluvialis apricaria* max. 12,000  
Lapwing *Vanellus vanellus* max. 8,000  
Curlew *Numenius arquata* max. 2,000

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Black-tailed Godwit *limosa Limosa* max. 1,000

Dunlin *Calidris alpina* max. 1,000

**Legal status** Unprotected.

**Tenure** State ownership.

**Management practices** Not known.

**Threats** None reported.

**Scientific research** No information.

**Principal reference material**

None quoted.

## 12. CORK HARBOUR

**Criteria for inclusion** 1a,b; 2a; 3a,c; 4a

**Geographical location** 51°50'N 8°17'W The whole of the harbour from Cork city (Tivoli) to East Ferry and south to Whitegate on the eastern side of the harbour mouth.

**Area** 5,950 ha.

**Altitude** Sea level.

**Water depth** The average is less than 10 metres, but over 20 m in the Shipping Channels, with a tidal rise and fall of between 3 and 4 m

**Wetland type** 8.

**Ecology** Cork harbour consists of two large shallow lakes on a limestone base, known as Cobh Harbour and Lough Mahon and separated from each other and from the sea by ridges of Old Red Sandstone running east and west. Deep, narrow channels cutting through the sandstone provide the connections between the sea and the lakes.

The areas important for wildfowl in the harbour are the mudflats at Tivoli, the Douglas estuary, Lough Beg, Whitegate, and the channel from Foaty Island to the Ferry on the east channel into Cobh bay. Most of these areas consist of mudflats, some of them covered by a very luxuriant growth of algae, mainly *Enteromorpha* spp. This has been shown elsewhere in Ireland to lead to a decrease in numbers and diversity of invertebrates which normally occupy this type of habitat. There is also a small amount of saltmarsh vegetation including some rice grass *Spartina townsendii*. The wildfowl counts undertaken in March 1968, over the whole harbour area, the north channel between East Ferry and Cork city in January 1969 and January, October and December 1971, and the Tivoli, Douglas and Rossleague more occasionally, showed Shelduck *Tadorna tadorna* and waders Limicolae to be the main species occurring in internationally important numbers. There are usually over 1,200 Shelduck in January, their numbers increasing up to March with a peak of 2,415 in March 1968. Between 20,000 and 25,000 waders have been counted in mid-winter.

**Legal status** Unprotected.

**Tenure** State ownership.

**Management practices** A treatment plant for human and industrial wastes is badly needed. Industrial development is occurring at various points round the

harbour and in particular an effort is being made to convert Little Island on the north side of Lough Mahon and upstream of much of the waterfowl feeding grounds, into an industrial estate, a chemical plant having been established at the south-west corner of the island.

**Threats** Sewage from the city of Cork is discharged untreated into the River Lee or directly into the harbour, with resulting eutrophication and algal blooms on the foreshore and a decline in the amount of invertebrate food available for Limicolae.

**Scientific research** No information.

**Principal reference material**

None quoted.

### 13. CASTLEMAINE HARBOUR

**Criteria for inclusion** 1a,c,e;2a;3c;4a

**Geographical location** 52°07'N 9°55'W At the head of Dingle Bay, County Kerry, at the southern foot of Slieve Mish mountain which separates it from Tralee, 16 km to the north-east, and extending from Inch Point and Rossbeigh Creek east to Castlemaine town.

**Area** 9,874 ha.

**Altitude** Sea level.

**Water depth** Not quoted but considerable areas are bare at low tide and the tidal rise and fall varies from about 2.6 to 3.4 metres.

**Wetland type** 8.

**Ecology** Within the harbour or estuary of the River Maine a series of interlocking sand-spits have developed, upstream of which areas of saltmarsh have formed. There are also extensive mudflats and the wetland is bordered by poorly drained agricultural land, especially at its eastern end. Large patches of eel-grass *Zostera* spp. occur, especially in the north-west corner sheltered by the Inch peninsula, while within the harbour there is a typical range of saltmarsh plant communities. The hybrid cord grass *Spartina townsendii* has obtained a foothold locally and some reedbeds are found along the two channels of the two rivers flowing in from the east. Thrift *Armeria maritima*, saltmarsh grass *Puccinellia maritima* and glasswort *Salicornia* sp. are the other dominant features of the vegetation.

Wildfowl counts carried out in November 1969, February 1970 and monthly through the winters of 1972/73 and 1973/74, gave the following figures:

Wigeon *Anas penelope* max. 6,800

Pintail *Anas acuta* max. 2,500

Shoveler *Anas clypeata* max. 1,500

Pale-breasted Brent Goose *Branta bernicla hrota* max. 4,000

Wigeon numbers peak in October and decline steadily throughout the winter. Wintering Pintail and Shoveler populations fluctuate considerably. Numbers of each of these species are slightly in excess of 1% of their estimated N. W. European Flyway populations and therefore rate as internationally significant. Brent Geese numbers are highest in the autumn but flocks are continually moving between Castlemaine Harbour and the next listed site, Tralee Bay.

**Legal status** Unprotected.



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**Tenure** State ownership.

**Management practices** Cattle grazing on saltmarsh. A need for some kind of restriction of shooting has been suggested.

**Threats** Heavy shooting pressure.

**Scientific research** No information.

**Principal reference material**

None quoted.

**14. TRALEE BAY and BARROW HARBOUR**

**Criteria for inclusion** 1a,c,e;2a;3c;4a

**Geographical location** 52°16'N 9°48'W The wetland extends from Blennerville about 3 km south-west of Tralee, to Derrymore Island on the south shore of the estuary, Fenit peninsula on the north, and beyond it and protected by it from the open ocean, Barrow Harbour.

**Area** 3,290 ha.

**Altitude** Sea level.

**Water depth** Very variable and entirely tidal, well over half the area being bare at low spring-tide but under up to 6 m of water at high spring-tide.

**Wetland type** 8.

**Ecology** On the north side of the Dingle peninsula, complementary to Castlemaine Harbour on the south. The most important areas are at the eastern end, where saltmarshes and mud flats occur behind a pebble spit on the southern shore, and Barrow Harbour and Carrahane strand in the north-west and south-west corners of the wetland, respectively, developed behind sand bars. Eel-grass *Zostera* sp. occurs on the mudflats and tassel pondweed *Ruppia spiralis* in Barrow Harbour. Large areas are covered in sea rush *Juncus maritimus*, and thrift *Armeria maritima*, rice grass *Spartina townsendii* and fennel-like pondweed *Potamogeton pectinatus* are other dominant species, the last-mentioned in certain freshwater communities of depressions on the so-called Derrymore Island (in fact a peninsula).

Waterfowl counts, carried out in September 1967, January and November 1969, February and November 1970, January and February 1971 and monthly through the winter of 1973/74, indicated that two species winter in internationally significant numbers (Pintail *Anas acuta*, max. 800, and Pale-breasted Brent Goose *Branta bernicla hrota*, max. 2,000). The geese move freely between Tralee Bay and wetland No. 13 Castlemaine Harbour. Wigeon *Anas penelope* have been recorded in numbers of up to 3,500, which is of considerable importance at the national level.

**Legal status** Unprotected.

**Tenure** State ownership.

**Management practices** None, but some restriction of shooting would be very desirable.

**Threats** Heavy shooting pressure.

**Scientific research** No information.

**Principal reference material**

None quoted.

**15. AKERAGH LOUGH****Criteria for inclusion** 1a; 2a,b; 3c; 4a**Geographical location** 52°22'N 9°50'W About 15 km north-north-west of Tralee and a kilometre south of Ballyheige.**Area** 231 ha.**Altitude** 3 m.**Water depth** Average in summer 20–30 cm; seasonally flooded.**Wetland type** 7.**Ecology** A brackish lagoon behind a line of high dunes and bordered on the east or inland by extensive wet meadows. During the summer the lough consists of two ponds connected by ditches. The northern pond receives the sewage of a nearby town and possesses no visible aquatic flora, but the southern pond is very rich in this type of vegetation, the dominants of the main communities being as follows:

- (1) *Juncetum gerardii* (salt mud rish)
- (2) *Scirpetum maritimae* (sea club-rush)
- (3) Magnocaricion; *Iris pseudacoris* – *Carex vulpina* = *otrubae* (yellow flag and false fox sedge)
- (4) *Ruppion maritimae* (beaked tassel pondweed)
- (5) *Potamogetalia* (pondweed)

Waterfowl censuses carried out in September 1967, January and November 1969, February and November 1970, January 1971 and monthly through the winter of 1973/74, indicated that the Teal *Anas crecca* is the most numerous wintering duck, with a maximum count of 3,500; a count of 150 Gadwall *Anas strepera* is also to be rated as of importance at the international level, and the lough also has an international reputation as the site of numerous records of unusual species of duck and waders (particularly vagrants from North America).

**Legal status** Unprotected.**Tenure** Multiple private ownership.**Management practices** The northern part of the lough together with surrounding fields is fenced off. The fields round the southern end are grazed. Shooting-hides have been constructed on islands in the lough.**Threats** There is a sewage inflow at the northern end of the lough, which has killed off all the aquatic vegetation in the immediate vicinity and has led to eutrophication of the rest of the wetland. An increased sewage input would certainly do further damage, so that concern is felt about the proposals for tourist development around the lakeshore.**Scientific research** No information.**Principal reference material**

None quoted.

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16. LOUGH GILL

**Criteria for inclusion** 1a;2a;3c;4a

**Geographical location** 52°15'N 10°03'W Between Tralee Bay and Brandon Bay, County Kerry, at the neck of the peninsula which separates them and less than a kilometre west of the market-town of Castlegregory.

**Area** 1,807 ha.

**Altitude** 4 m.

**Water depth** Maximum 1 m: minimum 30–40 cm (in summer).

**Wetland type** 7.

**Ecology** A shallow lake with aquatic vegetation dominated by stoneworts *Chara* spp. It backs onto a coastal dune system and is underlain by Old Red Sandstone which gives rise to thin peaty, podzolic soils, sufficient to provide for rough pasturage along its inland shores. *Phragmites* reedbeds of varying extent fringe the entire lake, giving way on the seaward shore to dune grassland developed on blown sand. The flattish land between reedbed and dune-system proper has been fenced into a row of fields, some of which have been treated with fertilizers and re-seeded to make improved pasture. Beyond this is a strip of fixed-dune grassland about 300–400 m wide; a jumble of dune crests c. 10–12 m in height and an unbroken grass sward incorporating large patches of senescent marram *Ammophila* and grazed by livestock (cattle and horses). The dune grassland ends abruptly in a 6 m high sandstone cliff which is evidently eroding rapidly under wave action. The outlet from the lake to the sea is a *Scirpus*-fringed stream, man-made and maintained, in which the flow is controlled by sluice gates.

Lough Gill and its adjacent dunes support an apparently flourishing colony of the natterjack toad *Bufo calamita*, the only toad species occurring in Ireland and now restricted to three or four localities. The waterfowl counts carried out in January and September 1967, January 1969, November 1970, January 1971 and monthly in the winter of 1972/73, found 12 or 13 species present on several occasions and as many as 14 species on one occasion. A wintering population of 200 Gadwall *Anas strepera* comes within the definition of 'internationally important'.

**Legal status** Unprotected.

**Tenure** Multiple private ownership.

**Management practices** There is a small amount of cultivation and some pasture and meadowland on the seasonally flooded fields round the lough. The water level is controlled by sluice gates which also serve to prevent the influx of salt water.

**Threats** Excessive shooting is a threat to which the lough is particularly vulnerable because of the easy access to all parts of the shoreline. Since the lake is very shallow any input of sewage effluent would be very damaging. The dune system between lake and sea is being continuously eroded by wave action, which also places the future of the wetland in jeopardy.

**Scientific research** No information.

**Principal reference material**

None quoted.

**17. SHANNON ESTUARY****Criteria for inclusion** 1a,b,c,e;2a;3c**Geographical location** 52°25' – 49°N 8°38'–9°57'W West coast of Ireland between counties Clare, Limerick and Kerry, and from Limerick City down to a line between Loop Head, County Clare, and Kerry Head.**Area** c.34,000 ha.**Altitude** Sea level.**Water depth** Maximum about 15 m.**Wetland type** 8.**Ecology** About 80 km in length and varying in width from 1 to over 15 km, with numerous shallow inlets, the estuary is flanked by reed swamps, saltmarsh, wet meadows and pasture. The swamps consist of beds of common, glaucous and triangular club-rush *Scirpus lacustris*, *tabernaemontani* and *triquetrus*, and of the common reed *Phragmites communis*. Eel-grass *Zostera* sp. occurs on the extensive mudflats. There are also large areas of seaweeds growing in the more rocky sectors near the mouth of the estuary.

The most important areas for waterfowl are Pounasherry Bay, Clonderalaw Bay, the Fergus Estuary and a section of upper Shannon Estuary from Rineanna Point to Cratloe district, all in County Clare, Ballylongford Bay and Tarbert in the north-east corner of County Kerry, and the southern shores of the upper estuary from Foynes Island to Limerick City in County Limerick. According to a ground census of waterfowl in January 1973, aerial counts covering the entire estuary and made between October 1973 and February 1974, and additional counts in the Fergus estuary in November 1972 and March 1973, waterfowl which occur in numbers of international significance are as follows:–

Teal *Anas crecca* max. 4,600Wigeon *Anas penelope* max. 9,900Shelduck *Tadorna tadorna* max. 1,300 (winter)Dunlin *Calidris alpina* max. 30,000Black-tailed Godwit *Limosa limosa* max. 16,400 (spring)

Other Limicolae (waders) max. 49,000

The numbers of teal and wigeon (recorded in December 1973) represent almost 2% of the N.W. European Flyway populations of these species. The estuary also rates as the finest wader haunt in the country, holding almost 30% of the Irish population of Dunlin in midwinter.

Two other species deserve to be noted, namely Pintail *Anas acuta*, of which up to 250 have been recorded, mainly in Clonderalaw Bay, Co. Clare, and Greylag Goose *Anser anser*, of which a maximum of about 100 winter on Aughinish Island near Foynes, Co. Limerick. The variety of species occurring in this great wetland is indicated by the fact that up to sixteen have been recorded in a single count.

**Legal status** Unprotected.**Tenure** State ownership.**Management practices** Unmanaged, except for pastures on periphery.**Threats** The area is scheduled for major industrial development, which includes three oil refineries and an alumina extraction plant.

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**Scientific research** No information.

**Principal reference material**

None quoted.

**18. RIVER SHANNON**

**Criteria for inclusion** 1a,c;2a

**Geographical location** 53°05' – 17'N 8°02'–12'W Shannon valley between Shannon Bridge and Portumna, where it forms the boundary between Counties Galway, Offaly and Tipperary.

**Area** 4,350 ha.

**Altitude** 33–38 m.

**Water depth** No estimate; seasonal flooding.

**Wetland type** 12.

**Ecology** Where, as in this section, the Shannon traverses the Central Irish Plain, it is a broad slow-flowing river, surrounded by extensive bogs and poorly drained agricultural land. However, most of the flood-plain consists of meadows and pastures, frequently flooded in winter. Even in the summer some areas have standing water. The vegetation of the flooded areas attracts large numbers of waterfowl. The margins of the river are densely fringed with reeds, backed in some places by sedge swamps, behind which, in turn, rushy pastures or meadow with *Filipendula/Festuca* grassland are found on higher less frequently flooded areas. The main plant communities present are:

- (1) Phragmition communis:– Glycerietum maximae–Scirpeto–Phragmitetum (rush and reed-beds, including some reed sweet grass)
- (2) Magnocaricion: Caricetum inflato-vesicariae (sedges)
- (3) Glycerieto–Sparganion: Heliosciadium (=Apium) – Veronica (sweet grass, bur-reed, marsh-wort, brooklime community)
- (4) Calthion palustris: Senecioni–Juncetum acutiflori (marsh marigold, marsh ragwort, sharp-flowered rush)
- (5) Filipendula–Festuca (meadowsweet-fescue grassland)

Wildfowl counts, carried out from the ground in January 1969 and from the air monthly in the winters of 1972/73 and 1973/74, showed wild swans, both Whooper *Cygnus cygnus* and Bewick's *Cygnus columbianus bewickii*, to be present in internationally important numbers, the highest recorded being 430 altogether (the two species could not be unfaillingly distinguished from the air).

**Legal status** Unprotected.

**Tenure** Multiple private ownership.

**Management practices** Land bordering the river is often used as pasture for livestock. Restriction of shooting has been suggested as a desirable measure.

**Threats** Quite heavy shooting pressure. The most serious threat is the plan for draining the land bordering the river, which would greatly decrease or eliminate the area of wet meadow used by birds for feeding.

**Scientific research** No information.

**Principal reference material.**

None quoted.

**19. RAHASANE TURLOUGH****Criteria for inclusion** 1a,c,d,e; 2a,b; 3a,c;4a**Geographical location** 53°13'N 8°47'W Floodland of the Dunkellin River 3 km south-south-west of Craughwell, County Galway.**Area** 257 ha.**Altitude** 20 m.**Water depth** Not estimated; the turlough is seasonally flooded.**Wetland types** 12, 23.

**Ecology** Rahasane turlough is the last remaining large-scale example in Ireland of a karstic lake. It is a seasonal water-body flooded during the winter months by ground-water which bubbles up through swallow-holes in its limestone floor when the water table rises in the autumn (and occasionally at other times), augmented by river water when the Dunkellin River is flooded and overflows its banks. As a result a 3 km long, 0.8 km wide lake can appear literally overnight in the turlough and vanish again as it drains away through both swallow-holes and river. Unlike its immediate environs, the floor of the turlough is coated to a variable depth (several metres in places but precise details unknown) with a fine grained base-rich alluvial silt, incorporating strata of water-snail shells. Five distinct plant communities occur within the wetland, their distribution relating to the length of time that different parts of the turlough remain flooded each year:—

- (1) In Dunkellin River channel; dominants: pondweed *Potamogeton* spp. and water-plantain *Alisma plantago-aquatica*.
- (2) In permanent standing water; dominant: stoneworts *Chara* spp., which form an almost pure community.
- (3) Semi-permanent standing water; dominants: reed sweet grass *Glyceria* spp. and floating marsh-wort *Apium inundatum*.
- (4) In regularly flooded marginal zones; dominant: cat's-tail/silverweed *Phleum palustre*/*Potentilla anserina* sward, grazed down to 2–3 cms by sheep, cattle, horses, goats and rabbits.
- (5) In occasionally flooded areas: sedges *Carex* spp., fescue *Festuca rubra*, rye grass *Lolium perenne* and daisy *Bellis perennis* dominate this species-rich community.

Communities (1) and (2) cover 15–20% of the turlough, (3) occupies another 15–20% and (4) the vast majority of the remaining 60–70%.

The limestone pavement surrounding the turlough supports patches of dense scrub, principally of hazel *Corylus*, hawthorn *Crataegus* and blackthorn *Prunus spinosa*. The scrub provides the habitat for one of Ireland's most localized indigenous butterflies, the brown hairstreak *Thecla betulae*: Rahasane is one of its three known Irish stations. The turlough is also the single known locality in Ireland, or in fact in the British Isles, where a species of the freshwater fairy-shrimp genus *Tanyastix* occurs.

Monthly waterfowl counts from November 1969 to February 1970, in January and November 1971, in January and February 1972 and monthly through the winters of 1972/73 and 1973/74, indicated three species as occurring in numbers of

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international importance, namely the Whooper and Bewick's Swan *Cygnus cygnus* and *Cygnus columbianus bewickii* (about 200 of each) and the Wigeon *Anas penelope* (about 5,000) – maximum in each case –; the numbers of these and of other species (of which the Shoveler *Anas clypeata* has been noted in numbers up to 300) fluctuate considerably, low numbers usually coinciding with periods in which the water table is high.

**Legal status** Unprotected.

**Tenure** Multiple private ownership.

**Management practices** Common-land, grazed by cattle, horses, sheep and goats during the summer. No control is exercised over water levels. To maintain the area in its current condition the grazing pressure must be retained and any drainage plans for the Dunkellin River catchment carefully scrutinized to ensure continuance of the annual fluctuations in ground-water level.

**Threats** Drainage plans. Elimination of the turlough, besides removing a valuable wildfowl habitat, would destroy the last remaining turlough of any size in Ireland together with its unique invertebrate communities.

**Scientific research** An extensive ecological survey involving personnel from the Brathay Field Centre, An Foras Forbartha and the Department of Lands (Dublin) and the Natural History Museum (London), has been undertaken.

### **Principal reference material**

Not listed but believed to be extensive.

## 20. LOUGH CORRIB

**Criteria for inclusion** 1a,e; 2a; 3c

**Geographical location** 53°16'–33°N 9°03'–31°W Extends from 4 km north of Galway City c. 60 km north-west to the foot of the Maamturk Mountains and south-eastern hills of Joyce's Country.

**Area** 18,240 ha.

**Altitude** 8–9 m.

**Water depth** Maximum 46 m.

**Wetland type** 18.

**Ecology** A large fresh-water lake on carboniferous limestone which gives way, in the north-west corner, to silurian schist and gneiss. In consequence, much of the lough is bordered by limestone pavement or thin fen-peat overlying the limestone (but replaced by peaty gleys on the silurian rocks). At the lower south-eastern end is an extensive area of fen, which supports occasional small stands of willow *Salix* / alder *Alnus* carr; but over much of this area these shrubs are "weeded out" by local thatchers who maintain the fen as a source of black bog-rush *Schoenus nigricans*, for use in their trade. Wet ditches at the lough edge abound with bladderwort *Utricularia*, while shallow waters on the limestone pavements are similarly dominated by stoneworts *Chara* spp. Other plants of the fringing marshes include blunt-flowered rush *Juncus subnodulosus*, fern sedge *Cladium mariscus* and bulrush *Typha latifolia*. The land round the lake is predominantly cattle

pasture on the limestone, but the eastern shore has increasing numbers of summer chalets.

Little information is available about the fauna and flora of the lough itself, except that its fish species also include the Arctic Charr *Salvelinus alpinus* and a glacial relict species *Mysis relicta*. The lough is also the main arrival point of migrant Pochard *Aythya ferina* in autumn. Maximum numbers (c. 22,000) were recorded in October 1974 and rate as internationally important. Numbers decline during the winter.

**Legal status** Unprotected.

**Tenure** State ownership.

**Management practices** The extensive bog-rush *Schoenus* fen at the lower end of the lough is managed for the supply of a local thatching industry dependent upon this plant. Also under management is the important trout fishery, and the water level is regulated.

**Threats** None reported but as noted under Ecology, above, increasing numbers of holiday homes are being built along the eastern shore and could result in a pollution problem.

**Scientific research** Studies of the Brown Trout *Salmo trutta fario* have been undertaken.

**Principal reference material**

None quoted.

## 21. INISHKEA ISLANDS

**Criteria for inclusion** 1a,e; 2a; 3b; 4a,b

**Geographical location** 54°07'N 10°13'W About 5 km west of the southern end of the Mullet peninsula, north-western County Mayo.

**Area** 328 ha.

**Altitude** Sea-level to 70 m.

**Wetland type** 10.

**Ecology** Inishkea north and south are two low windswept islands each being about 2.5 kilometres long by 1 kilometre wide. They are separated by a channel 30 m across. The islands are two reefs of gneiss with a thin covering of sand, the vegetation restricted to a fescue *Festuca rubra*-creeping bent *Agrostis stolonifera*-ribwort plantain *Plantago lanceolata* sward. Some *Phragmites* grows in Lough Doon on the northern island.

The international importance of this site is that it provides winter-quarters for up to 2,900 Barnacle Geese *Branta leucopsis*, which incidentally represents over 60% of the Irish mid-winter population.

**Legal status** Annual no-shooting Order under The Game Preservation Act (1930).

**Tenure** Multiple private ownership.

**Management practices** Cattle and sheep are grazed on the islands throughout the year.



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**Threats** None reported.

**Scientific research** Studies have been undertaken of the Barnacle Geese populations.

### **Principal reference material**

Cabot, D. and West, B. 1973 Population Dynamics of Barnacle Geese, *Branta leucopsis*, in Ireland. *Proc. R. Irish Acad.* 73, B(24): 415-443.

## 22. CUMMEEN STRAND (SLIGO BAY)

**Criteria for inclusion** 1a; 2a; 4a,b

**Geographical location** 54°17'N 8°32'W Stretching from 2 km to 5 km west-north-west of Sligo Town.

**Area** 1,865 ha.

**Altitude** Sea-level.

**Water depth** Not quoted: intertidal zone with high water ranging between about 3 and 4 m above datum.

**Wetland types** 3, 8.

**Ecology** Cummeen Strand forms part of the River Garavoge estuary and is to a great extent separated from the open sea by Coney Island. No information is available about the vegetation. The extensive and sheltered mudflats provide valuable feeding grounds for waterfowl. Counts carried out in January, February, September and November 1970, January, February and November 1971, January, February and October 1972 and October 1973, showed that one of the species present, the Pale-breasted Goose *Branta bernicla hrota* can attain numbers rated as internationally important, a maximum of 2,250 having been recorded in October, the month in which there is generally a large arrival of these geese. Numbers decline over the next two or three months and by January only about 200 wintering Brents are normally still present.

**Legal status** Unprotected.

**Tenure** State ownership.

**Management practices** None reported.

**Scientific research** No information.

### **Principal reference material**

None quoted.

## 23. LOUGH SWILLY

**Criteria for inclusion** 1a; 2a; 4a

**Geographical location** 55°07'N 7°32'W From the head of the lough near Letterkenny, County Donegal, to its mouth, very nearly due north between Fanad and Dunaff Heads, is over 40 km as the crow flies. At its nearest point (Blanket Nook) it is only 10.4 km west of Londonderry.

**Area** 17,400 ha.

**Altitude** Sea-level.

**Water depth** Maximum over 20 m; average c.10 m.

**Wetland types** 8 (17,100 ha); 25 (300 ha).

**Ecology** Lough Swilly is a sea lough, which is in effect an extension of the River Swilly estuary, the whole being approximately 50 km long by water from north to south and 4 km broad at its mid-point. It possesses extensive intertidal mudflats and shingle banks particularly at its head, where the most important areas for wildfowl are the Lannan and Swilly estuaries; but the man-made lagoons known as Blanket Nook and Inch Lough on the south-east of the lough are perhaps even more so.

Blanket Nook is a small brackish inlet which has been cut off by the building of a dike across its entrance to Lough Swilly. It has a moderately developed aquatic flora and is bordered by wet fields and saltmarsh. The main vegetation types are:

- (1) *Ruppion maritima* (beaked tassel pondweed)
- (2) *Charatalia* (stonewort)
- (3) *Juncetum gerardii* (salt mud rush)
- (4) Grassland dominated by *Agrostis stolonifera* (creeping bent)

Inch Lough was formed by blocking off the two ends of a channel between Inch Island and the mainland by dikes. The resulting lake is slightly brackish. The water is clear with a very well developed aquatic vegetation. There are also large marginal reedbeds backed by fields which are flooded during the winter. The main vegetation types are:

- (1) *Charatalia* (stonewort)
- (2) *Potamogeton pectinatus-Ruppia* association (pondweeds)
- (3) *Scirpetum maritimi* (sea club-rush)
- (4) *Scirpeto-Phragmitetum* (club-rush and reedbed)
- (5) *Alnion glutinosae* (alder)
- (6) Grassland dominated by *Agrostis stolonifera* (creeping bent)

The assessment of the area's importance for wildfowl is based on counts in January 1969 of the whole area, plus counts at Inch Lough and Blanket Nook in November, January and February 1970/71; monthly counts from November to February at Inch Lough and Blanket Nook in 1971/72 and 1972/73; monthly counts in the Lannan and Swilly estuaries in 1972/73 and 1973/74; and an almost complete count of wildfowl and waders in December 1973. The results indicated the presence of Whooper Swans *Cygnus cygnus* in internationally significant numbers (maxima of 550 in Blanket Nook and 700 in Inch Lough), the peak occurring in November and the swans apparently commuting quite regularly between the two sites. A similar movement has been noted with the quite substantial numbers of Greylag Goose *Anser anser* (maximum 250), between Lough Swilly and the River Foyle near Carrigans, 30 km downstream from Strabane. In the Swilly area as a whole, 12 species of duck, 3 species of goose and 3 species of swan occur annually and can be seen on most days throughout the winter.

**Legal status** Blanket Nook is protected by an annual no-shooting Order under the Game Preservation Act (1930).

**Tenure** State ownership (17,100 ha). Multiple private ownership (300 ha comprising Blanket Nook and part of Inch Lough).

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**Management practices** Grazing of the saltmarsh and the marshy fields associated with the two lagoons. Water levels in the lagoons are controlled by sluice gates.

**Threats** Heavy shooting pressure in some areas such as Inch Lough. Eutrophication of Blanket Nook by fertilizer run-off from the surrounding agricultural land.

**Scientific research** No information.

**Principal reference material**

None quoted.

**24. BIRRALOUGH**

**Criteria for inclusion** 1a; 2a; 4a

**Geographical location** 54°34'N 8°11'W Near the coast about 8 km north of Ballyshannon, County Donegal.

**Area** 365 ha.

**Altitude** 4 m.

**Water depth** No estimate given.

**Wetland type** 18.

**Ecology** A shallow freshwater lough separated from the sea by sand dunes. It is bordered by extensive marginal reedbeds and surrounded by marshy fields.

Wildfowl counts, carried out in January 1967 and 1968, January, February and November 1970, January 1971, February, October and November 1972, February 1973 and 1974, indicated an internationally important wintering population of Whooper Swan *Cygnus cygnus* (maximum of over 200).

**Legal status** Unprotected.

**Tenure** Multiple private ownership.

**Management practices** No information.

**Threats** None reported.

**Scientific research** No information.

**Principal reference material**

None quoted.

**28. LOUGH HYNE**

**Criteria for inclusion** 1d,e; 2b,c; 3a,b,c; 4a

**Geographical location** 51°30'N 9°18'W On the coast 7 km south-south-east of Skibbereen, County Cork.

**Area** 225 ha.

**Altitude** Sea level.

**Water depth** Maximum 35 m; mean c. 10 m

**Wetland type 5**

**Ecology** The particular scientific interest of this small sea lough, also known as Lough Ine, lies in its almost landlocked form, only a very narrow and comparatively steep entrance linking it to the sea. This has the effect of limiting the tidal rise and fall to 85 cm. The rapid outflow and inflow of water (60 m per minute) results in most unusual marine conditions. Many species are much larger than elsewhere in the vicinity, for example *Parerythropodium libernicuri* related to cup coral *Caryophyllia* species. There are also some excellent examples of littoral zonation readily available for study.

**Legal status** Unprotected.

**Tenure** State ownership, though most of the foreshore is privately owned, certain sections jointly by the University College of Cork and Bristol University.

**Management practices** Some fishing takes place.

**Threats** Hotel and holiday home construction may become a disturbing factor, especially since one of the islands in the lough was purchased by a private owner.

**Scientific research** Commenced in 1930 and has been continued ever since under the aegis of the University of Cork and Bristol University, which established a marine laboratory and run regular courses in marine biology.

**Principal reference material**

Rees, T. V. 1935. The marine algae of Lough Ine. *J. Ecol.* 23(1): 70–133.

Humphries, C. F. 1953. A species of polyzoa *Cabera borizi* Andonin, new to Ireland. *INJ* II(3).

Bassindale, R. *et al.* 1957. The ecology of the Lough Ine rapids. *J. Ecol.* VI(45): 879–900.

Ebling, F.J. *et al.* 1962. The ecology of Lough Ine. *J. Anim. Ecol.* XII(31): 457–470.

# ISRAEL

## SUMMARY OF WETLAND SITUATION

Between 1920 and 1940, practically all of the six groups of swamps in Israel, which still covered about 18,000 ha at the beginning of this century were drained. By 1948, only the Hula swamp and its neighbouring lake, comprising about 6,000 ha, still remained, pending the occupation of the Beth-Saida valley in 1967. In the early 1950s plans to drain the whole of the Hula swamp, which had always been the most important and ecologically the most diversified in the country, were executed except that, fortunately, 310 ha were saved and now form the Hula Swamp Nature Reserve established in 1956.

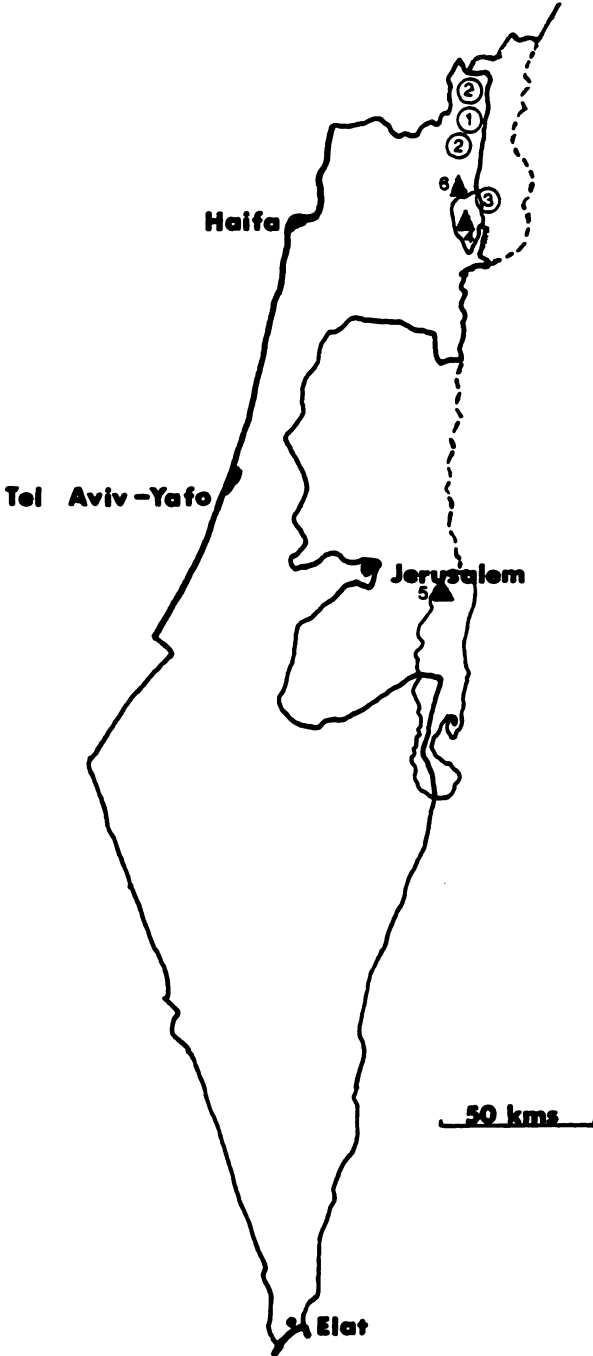
The Reserve, which can be considered as an entity with the fishponds created in and scattered widely through the former wetland, is the main concentration area for huge flocks of duck in winter and during migration. The numbers of duck in the fishponds markedly increased after hunting was prohibited in 1970, thanks mainly to the elimination of disturbance. Thus the estimated wintering population of Teal *Anas crecca* increased from 6,700 in 1965 to around 40,000 by 1971; Mallard *Anas platyrhynchos* increased from several hundreds to over 11,000 by 1972; and Pochard *Aythya ferina* from several hundreds to 15,000 by 1974. Of the ducks occurring in Israel only *Anas platyrhynchos*, Ferruginous Duck *Aythya nyroca* and Marbled Teal *Anas angustirostris* (which here as in many parts of the Mediterranean basin is reckoned to be a threatened species) are known to breed in the country.

Several other sites of limnological interest are mentioned in the Project AQUA list. These include Yam Kinneret (also known as Lake Tiberias, the Sea of Galilee or Lake Genaseret), the En-Nur spring (one of the springs of the En-Sheva group), situated on the north-western shore of Kinneret, and the En-Fashkha swamp and associated springs along the north-western shore of the Dead Sea (Yam Hamelah). All of these sites rate as internationally important.

## WETLANDS OF INTERNATIONAL IMPORTANCE

	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
1.	Hula Swamp (Nature Reserve)	33°05'N	35°35'E	310 ha	1a,b,c,d,e; 2a; 3a,b,c; 4a Protected
2.	Fishponds in the Hula Valley	c.33°02'-13'N	35°34'-38'E	1,250 ha	1a,b,c,e; 2a; 3a,b Unprotected
3.	Beth-Saida	32°50'N	35°35'E	1,000 ha	1d; 2a; 3a,b,c; 4a Protected (Nature Reserve)
4.	Yam Kinneret	32°42'-53'N	35°31'-39'E	167,000 ha	2a,c; 3a,b,c; 4c Unprotected
5.	En Fashkha	31°43'N	35°27'E	200 ha	2b,c; 3c Protected (Nature Reserve)
6.	En Nur	32°52'N	35°34'E	c.2 ha	2a,c; 3c Partly protected

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## DETAILS OF LISTED AREAS

### 1 HULA SWAMP (Nature Reserve)

Criteria for inclusion 1a,b,c,d,e; 2a; 3a,b,c; 4a

**Geographical location** 33°05'N 35°35'E At the northern end of the Dead Sea Rift Valley, about 22 km north of Yam Kinneret (Lake Tiberias) and the same distance north-east of Zefat.

**Area** 310 ha.

**Altitude** 66 m.

**Water depth** Maximum 1.2 m; average 0.8 m.

**Wetland types** 18, 21.

**Ecology** The Hula Nature Reserve is the only remaining part of a swamp that formerly extended over about 5,000 ha and which was drained between 1950 and 1960. Extensive work has been carried out since the summer of 1972 to reconstruct the various biotopes that were characteristic of the original swamp, one of the results achieved being the reappearance of lakes totalling over 60 ha in size. The remaining surface area of the reserve consists of c. 100 ha of tall swamp vegetation, mainly *Cyperus papyrus* and *Phragmites communis*; c. 60 ha low swamp vegetation (in the areas which usually dry out in summer) again dominated by reeds and rushes *Typha*, *Scirpus* and *Cyperus* but also several *Polygonum* spp; c. 10 ha of the millets *Panicum repens* and *Paspalum digitatum*; 40 ha of shallow water attractive to Limicolae; a system of clear spring water rivulets covering an area of 10 ha; and finally a canal system accounting for c. 30 ha. *Papyrus* *Cyperus papyrus* probably reaches its northern limit in the reserve, while such northern species as bracken *Pteridium aquilinum* and white water lily *Nymphaea alba* are at the southern extremity of their range. The tropical *Marsilea minuta* and the northern species greater bladder wort *Utricularia vulgaris*, both formerly characteristic of the Hula Swamp, have disappeared.

Thirty different species of birds used to nest, of which only twenty now remain, five of the others having ceased altogether to breed in Israel. There is still a very big mixed nesting colony of herons Ardeidae comprising a few pairs of Little Bittern *Ixobrychus minutus*, large numbers of Night Herons *Nycticorax nycticorax*, Squacco Herons *Ardeola ralloides*, Little Egrets *Egretta garzetta* and Grey Herons *Ardea cinerea*, plus a few pairs of Purple Herons *Ardea purpurea*. There is also a colony of Common Terns *Sterna hirundo* and several limicoline breeding species, notably Spur-wing Plover *Hoplopterus spinosus*. The Reserve is an important staging post for huge numbers of migrating birds, including pelicans *Pelecanus onocrotalus* and *crispus* and upwards of 30 species of Limicolae, as well as herons, ibises and storks Ardeidae and Ciconiidae and about 16 species of duck Anatidae.

**Legal status** Nature Reserve declared under the Law of 1963.

**Tenure** State ownership.

**Management practices** A special canal from the nearby river Jordan supplies the reserve and water levels are maintained by dams and sluices. Sport-fishing is allowed and some recreation facilities are provided.

**Threats** Contamination by toxic chemicals as a result of aerial spraying of adjacent farmlands. Visitor pressure.

**Scientific research** Concentrated on field studies of the aquatic fauna.

**Principal reference material**

Zohary, M. and Orshanski, G. 1947. The vegetation of the Hula Plain. *Palestine J. Bot.* series 4: 90–104.

Zahavi, A. 1957. The breeding birds of the Hula Swamp and Lake. *Ibis* 99: 600–607.

Komarovski, B. 1958. Contribution to the knowledge of the plankton of Lake Hula. *Fishermens Bull.* 15: 20–25. (In Hebrew).

Kugler, J. and Wool, D. 1968. Chironomidae (Diptera) from the Hula Nature Reserve, Israel. *Annales Zool. Fenn.* 5: 76–83.

### 3. BETH-SAIDA

**Criteria for inclusion** 1a; 2a; 3a,b,c;4a.

**Geographical location** 32°50'N 35°35'E North-east shore of Yam Kinneret (Lake Tiberias) between the river Jordan delta and the Daliot watercourse to the south. The town of Tiberias is 20 km across the lake in a south-westerly direction.

**Area** Total c. 1,000 ha, of which about 50 ha is accounted for by the lagoons which adjoin the marshlands.

**Altitude** Approximately 205 m below sea-level.

**Water depth** In winter the lagoons are about 2 m deep, in summer fluctuating around 1 m. Water in streams and channels varies between half and one metre in depth.

**Wetland types** 12, 16, 18.

**Ecology** The Beth-Saida is a natural valley formed by the confluence of five streams flowing down from the Golan Heights. The streams form natural pools and the area has two large and several smaller lagoons, as well as a substantial area of marshland. In the delta of the Jordan River, at the north-western end of the wetland, several small islands were formed in the winter of 1968/69, and the dominant plant community, accounting for 90% of the vegetation, is *Salicetum acmophyllae* (willow) thicket, whilst *Phragmites communis* reedbeds constitute the main component of the tall swamp vegetation. Between them and the drier grasslands is low swamp vegetation, mainly along the banks of the rivulets, in which oleander *Nerium oleander* and the chaste tree *Vitex agnus-castus* are the dominant species. In the waters of the lagoons water-milfoil *Myriophyllum* sp. and one of the bog pondweeds *Potamogeton nodosus* are found. The streams and lagoons are rich in fish and are the main breeding areas of the *Tilapia* spp. populating the nearby lake; no fewer than 17 fish species have been identified.

In winter huge flocks of several species of duck visit the area. Occasional Cormorants *Phalacrocorax carbo* and Greater Flamingos *Phoenicopterus ruber* have been observed and two of the Anatidae the Greylag Goose *Anser anser* and the Ruddy Shelduck *Tadorna ferruginea* are also only occasional winter visitors. The Brown Fish-owl *Ketupa zeylonensis*, which breeds in the cliffs overlooking the Beth-Saida valley, is a noteworthy species, the main population of which ranges from lower Iraq to South East Asia.

**Legal status** Nature Reserve under special contract which is renewed each year.



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**Tenure** No information.

**Management practices** None were mentioned in a 1974 report on the area.

**Threats** Extensive agricultural developments, drainage, diversion of streams, fertilizers, pesticide and other kinds of pollution. The activities of fishermen operating in the adjacent sector of the lake are not in any way controlled.

**Scientific research** No information. A preliminary report (in Hebrew) on the Beth-Saida Valley by Aviva Rabinowitz was published in 1971.

**Principal reference material**

Apart from the publication just mentioned, none have been quoted.

# ITALY

## SUMMARY OF WETLAND SITUATION

In Roman times approximately a tenth of Italy, or almost 3 million hectares, consisted of wetlands. Only 764,000 ha remained by 1865, and just over a century later, in 1972, after a massive drive to eliminate the hazard of malaria and to provide agricultural land, the figure had been further reduced to only 190,000 ha. A Special Committee of the Senate dealing with ecological problems in 1972, recommended that the remaining wetlands in Italy should be preserved and protected as useful and necessary for maintaining an ecological balance in the country as a whole.

Some vast complexes of wetland still exist, particularly along the north-west shores of the Adriatic (Lagune di Marana e Grado, Laguna di Venezia, Delta del Po and the Valli in the Provinces of Ferrara and Ravenna); all of them still have a most interesting flora and fauna and remnants of their formerly characteristic landscapes. Surveys to assess their importance as a habitat for breeding, migrating and wintering waterfowl are continuing but there is little doubt that these wetlands harbour waterfowl which on occasion reach internationally important numbers, especially in severe winters in Central and South East Europe.

Only a few wetland reserves exist along the Tyrrhenian coast (Bolgheri, Orbetello and the National Park of Circeo). The wetlands of Sardinia, of which none are at present adequately protected, are of great importance to migrating and wintering waterfowl, including Greater Flamingos *Phoenicopterus ruber*. In some of the 'stagni' the rare Purple Gallinule *Porphyrio porphyrio* still breeds. It is likely that some of the wetlands in Sicily are important staging posts for migratory waders Limicolae and this should be further investigated.

A number of wetlands of the mountainous regions in Northern and Central Italy, and others situated in Puglia, Sicilia and even on the small island of Pantelleria, rate as internationally important because of their limnological interest.

In general, further efforts to establish and expand an adequate system of wetland reserves and, in particular, reduce excessive hunting pressure, are highly desirable, if one of the most valuable but often forgotten resources of Italy is not to be squandered. A most important step towards the proper conservation of that resource was the ratification by Italy of the Ramsar Convention on 14 December 1976, followed by the nomination to date of no less than 26 sites for the Convention list.

## WETLANDS OF INTERNATIONAL IMPORTANCE

\*Nominated for inclusion in the Ramsar Convention list

	Locality	Latitude	Longitude	Size	Wetland criteria/ Conservation status
1.	Lagune di Marano e Grado complex	45°32'–45°N	12°35'– 13°30'E	c.12,000 ha	1b,e; 2a,c; 3c; 4a Unprotected
1.1.	Laguna di Marano	45°44'N	13°15'E		
1.2.	Laguna di Grado	45°42'N	13°23'E		
1.3.	Valli di Zignago	45°40'N	12°50'E		

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	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criterial Conservation status</i>
1.4.	Foce del Tagliamento	45°35'N	13°08'E		
1.5.	Stagno di Cortellazzo	45°32'N	12°45'E		
* 1.6.	Marano Lagunare-Foci dello Stella	45°45'N	13°08'E	1,400 ha	Ramsar Convention Site
2.	Lagune di Venezia complex	45°13'–34'N	12°10'–40'E	c.50,000 ha	1a,b; 2a,c; 3c; 4a Partly protected (Landscape Reserve)
2.1.	Laguna di Levante	45°30'N	12°30'E		
2.2.	Laguna di Ponente	45°20'N	12°15'E		
3.	Laguna e valli della Delta del Po	44°47'–45°14'N	12°13'–30'E	c.14,000 ha	1b,c; 2a; 3c; 4a Largely unprotected though partly a Landscape Reserve
3.1.	Valli da Pesca di Rovigo	45°04'N	12°13'E		
3.3.	Lagune between Foce dell'Adige and Foce del Po di Goro	44°45'–45°10'N	12°15'–30'E		
4.	Valli of Ferrara and Ravenna provinces	44°32'–34'N	11°49'–12°18'E	c.17,600 ha	Partly protected
4.1.	Valle del Mezzano	44°15'N	11°50'E	No estimate	Unprotected
4.2.	Valle Bertuzzi	44°43'N	12°15'E	c.1,900 ha	1e; 2a; 4a Partly protected (Landscape Reserve)
4.3.	Sacca di Goro	44°45'N	12°18'E	c.4,000 ha	1d; 2a; 3c; 4a Partly protected (Landscape Reserve)
* 4.4.	Punte Alberete/ Valle Mandriole	44°32'N	12°19'E	480 ha	1d,e; 2a; 3a,b,c; 4a,b Partly protected (Landscape Reserve) Ramsar Convention Site
* 4.5.	Valle Campotto e Bassarone- *Valle Santa	44°35'N 44°34'N	11°49'E 11°50'E	1,363 ha 261 ha	1e; 2a; 3c; 4a Partly protected: Ramsar Convention Sites
4.6.	Valli di Comacchio e Vene di Bellocchio	44°29'N	12°16'E	c.10,500 ha	1b,d,e; 2a,b; 3b,c; 4a Partly protected (Landscape/ hydrogeological reserve)
* 4.7.	Sacca di Bellocchio	44°38'N	12°16'E	223 ha	Ramsar Convention Site
5.	Laghi di Lesina e Varano	41°50'–54'N	15°17'–50'E	c.11,000 ha	1a,d,e; 2a Unprotected
6.	Stagni della Capitanate	41°32'–35'N	15°51'–53'E	c.7,200 ha	Partly protected

	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
6.1.	Vasche del Cervaro — Candelaro/ Manfredonia			c.700 ha	1a,b,e; 2a; 3c; 4a
6.2.	Alma Dannata			c.1,000 ha	
6.3.	Carapelle			c.1,000 ha	
• 6.4.	Saline di Margherita di Savoia	41°25'N	16°00'–09'E	c.3,871 ha	Partly protected Ramsar Convention Site
7.	Laghi Pontini	c.41°15'–30'N	12°30'–13°22'E	c.2,792 ha	1e; 2a; 3a,b,c; 4a
7.1.	Lago di Fondi	41°18'N	13°22'E	c.600 ha	Unprotected
• 7.2.	Lago di Paola/ Sabaudia	41°17'N	13°02'E	1,474 ha	Ramsar Convention Site
• 7.3.	Lago di Monaci	41°23'N	12°56'E	94 ha	Ramsar Convention Site
• 7.4.	Lago di Caprolace	41°21'N	12°59'E	229 ha	Ramsar Convention Site
• 7.5.	Lage di Fogliano	41°24'N	12°54'E	395 ha	7.2 to 7.5 also protected by Circeo National Park
8.	Maremma Meridionale	42°22'–41'N	11°00'–25'E	c.5,110 ha	Partly protected
•8.1.	Lago di Burano	42°22'–24'N	11°23'–25'E	c.410 ha	1b,e; 2a; 3a,b,c; 4a,b Protected (Landscape Reserve and WWF Sanctuary) Ramsar Convention Site
• 8.2.	Laguna di Orbetello	42°25'–30'N	11°10'–20'E	c.3,600 ha	1a,b,d,e; 2a; 3b,c; 4a Partly protected Ramsar Convention Site (887 ha)
8.3.	Stagni della Trappola	42°38'–41'N	11°00'–02'E	c.600 ha	2a Included in a National Park project
8.4.	Stagni della Diaccia	42°38'–41'N	11°00'–02'E	c.500 ha	Criteria unspecified Unprotected
9.	Maremma Settentrionale	43°15'–51'N	10°16'–30'E	c.1,612 ha	Criteria unspecified
•9.1.	Stagni di Bolgheri	43°14'N	10°33'E	562 ha	Protected Ramsar Convention Site
9.2.	Lago di Massaciuccoli	43°51'N	10°20'E	c.650 ha	Unprotected
9.3.	Stagni di S. Rossore	43°46'E	10°16'E	c.400 ha	Unprotected
10.	Lago Trasimeno	43°09'N	12°05'E	12,605 ha	1e; 2a,c; 3a,b Unprotected
11.	Stagni di Cagliari	39°11'–16'N	c.9°04'–17'E	5,064 ha	Criteria unspecified Unprotected
•11.1.	Stagno di S. Gilla	39°13'N	c.9°14'E	2,013 ha	Ramsar Convention Site
11.2	Saline di Macchiareddu	39°11'–13'	9°12'–17'E	c.1,350 ha	Site (the two areas combined)

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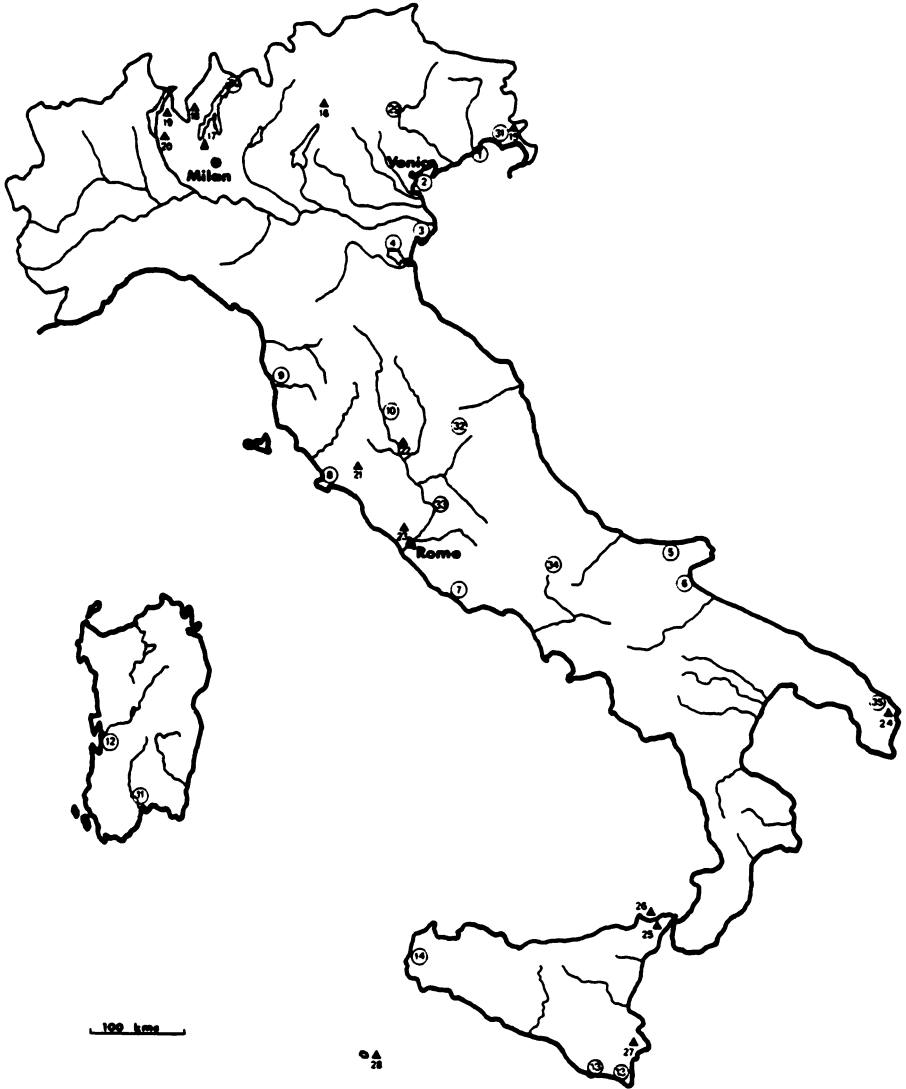
	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criterial Conservation status</i>
11.3.	Stagno di Simbirizzi	39°16'N	c.9°02'E	c.100 ha	
*11.4.	Stagno di Molentargius	39°14'N	c.9°09'E	1,401 ha	Ramsar Convention Site
11.5.	Saline di Quartu	39°13'N	c.9°10'E	200 ha	
12.	Stagni di Oristano	39°46'– 40°02'N	8°21'–39'E	c.8,240 ha	Criteria unspecified
*12.1.	Stagno di Corru S'Ittiri (incl. saltpan, inshore water and S. Giovanni e Merceddi pond)	39°44'N	8°30'E	2,610 ha	Ramsar Convention Site
*12.2.	Stagno di S'Ena Arrubia	39°49'N	8°34'E	300 ha	Ramsar Convention Site
12.3.	Stagno di Palmas Arborea	39°52'N	c.8°39'E	c.50 ha	Unprotected
12.4.	Stagno di S. Giusta	39°51'N	8°31'E	c.900 ha	Unprotected
*12.5.	Stagno di Cabras	39°53'N	c.8°28'E	3,575 ha	Ramsar Convention Site
12.6.	Stagno di Sale Porcus	40°01'N	c.8°21'E	c.200 ha	Unprotected
12.7.	Stagno di Mistras	39°52'N	8°38'E	254 ha	Unprotected
12.8.	Stagni di Putzu Idu	40°02'N	8°23'E	64 ha	Unprotected
*12.9.	Stagno di Pauli Maiori and surroundings	39°52'N	8°37'E	287 ha	Ramsar Convention Site
13.	Stagni del Pachinese	36°42'N	14°15'– 15°07'E	c.500 ha	Criteria unspecified Unprotected
13.1.	Stagno di Vendicari	36°48'N	14°07'E	c.190 ha	Unprotected
13.2.	Pantano Cuba	36°42'N	15°01'E	c.63 ha	Unprotected
13.3.	Biviere di Gela and other coastal lagoons eastwards to Pozzallo region	36°44'– 37°02'N	14°18'–58'E	c.200 ha	Unprotected
14.	Stagnone di Marsala	c.37°45'– 38°01'N	12°27'–32'E	c.3,400 ha	Criteria unspecified Unprotected
14.1.	Stagnone di Marsala				
14.2.	Salina di Marsala				
14.3.	Salina di Trapani				

**Other wetlands of international importance, mainly for their limnological/hydrobiological values**

15.	Lago di Doberdo (Corizia)	45°57'N	13°37'E	60 ha	Protected
16.	Lago di Tovel (Trento)	46°15'N	10°56'E	38 ha	Protected
17.	Lago di Monotorfano (Como)	45°47'N	9°07'E	47 ha	Unprotected
18.	Lago di Lugano (Como)	46°00'N	9°02'–08'E	4,890 ha	Partly protected
19.	Lago Maggiore (Novara and Varese)	45°43'– 46°07'N	8°40'E	21,251 ha	Unprotected

	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
20.	Lago di Mergozzo (Novara)	45°57'N	8°39'E	1,800 ha	Unprotected
21.	Lago di Bolsena (Viterbo)	42°36'N	11°55'E	11,500 ha	Unprotected
22.	Fonti del Clitunno (Perugia)	42°50'N	12°19'E	980 ha	Unprotected
23.	Lafo di Monterosi (Viterbo)	42°12'N	12°18'E	30 ha	Unprotected
24.	Grotta Zinzulusa (Lecce)	40°01'N	18°28'E	140 m long	Partly protected
25.	Lago di Faro (Sicilia, Messina)	38°16'N	15°30'E	26 ha	Unprotected
26.	Lago di Granzirri (Sicilia, Messina)	38°15'N	15°30'E	33 ha	Unprotected
27.	Fiume Ciane (Sicilia, Siracusa)	37°10'N	15°10'E	c.8 km long	Partly protected
28.	Bagno dell'Acqua (Pantelleria)	c.36°50'N	11°57'E	No information	Unprotected
<b>Additional sites entered on the Ramsar Convention list but not yet described in detail nor evaluated</b>					
*29.	Cellarda rush (giunco/Juncus) plantation (Belluno)	46°01'N	11°58'E	99 ha	Ramsar Convention Site
*30.	Lago di Mezzola (Sondrio)	46°13'N	9°26'E	1,086 ha	Ramsar Convention Site
*31.	Cavanata Valley (Friuli/Venezia Giulia)	45°43'N	13°29'E	243 ha	Ramsar Convention Site
*32.	Stagno di Colfiorito (Perugia)	43°01'N	12°53'E	157 ha	Ramsar Convention Site
*33.	Lago di Nazzano (Roma)	42°13'N	12°36'E	265 ha	Ramsar Convention Site
*34.	Lago di Barrea (L'Aquila)	41°47'N	13°58'E	303 ha	Ramsar Convention Site; Abruzzo National Park
*35.	Le Cesine (Lecce)	40°20'N	18°23'E	620 ha	Ramsar Convention Site

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## DETAILS OF LISTED AREAS

### 1. LAGUNE DI MARANO E GRADO complex

**Criteria for inclusion** 1b,e; 2a,c; 3c; 4a

**Geographical location** 45°32'–45°N 12°35'–13°30'E Northern shores of the Adriatic, Udine and Gorizia Provinces, about 40 km south of Udine. In addition to the Laguna di Marano and Laguna di Grado, the Valli di Zignago, Foce (river-

mouth) del Tagliamento and Stagno di Cortelazzo are the other main constituents of the wetland complex.

**Area** c. 12,000 ha.

**Altitude** Sea-level to 3 m.

**Water depth** Maximum 3 m; average: shallow, no more than about 1 m.

**Wetland types** 7, 9.

**Ecology** Large lagoons of brackish to salt water separated from the sea by lines of dunes. Vegetation typical for such areas, dominated by *Salicorneta* (glasswort) and *Ruppia maritima* (tassel pondweed). Great numbers of birds, especially duck Anatidae, Coot *Fulica atra* and waders Limicolae, visit the wetland on migration or winter. The lagoons are a highly productive source of fish.

**Legal status** Unprotected, but permission has to be obtained from the authorities responsible for landscape conservation, before any alterations can be made in certain parts of the wetlands. A 1,400 ha sector of the wetland, comprising the Marano Lagunare and Foci dello Stella, has been included in the Ramsar Convention list.

**Tenure** No information.

**Management practices** Fishing (including commercial exploitation) and shooting, mainly in privately owned hunting reserves, still continue but some limited areas have been transformed into refuges. Additional bird sanctuaries are needed.

**Threats** Drainage, in-filling, tourist developments, including construction of marinas for pleasure boats, and increasing pollution are the most serious dangers.

**Scientific research** No information.

#### Principal reference material

Montalenti, G. 1967. *Relazione sulla protezione delle lagune e degli stagni costieri della Penisola e delle grandi isole*. Quaderni de la Ricerca Scientifica No. 38, Consiglio nazionale delle Ricerche, Roma.

Fornaciari, G. 1968. Aspetti floristici e fitosociologici della laguna di Grado e del suo litorale. *Atti. Acc. Sc., Lett. Arti. Udine*, Serie VII(6).

## 2. LAGUNA DI VENEZIA complex

**Criteria for inclusion** 1a,b; 2a,c; 3c; 4a

**Geographical location** 45°13'–34'N 12°10'–40'E Coastal zone of the north-west Adriatic coast, extending from the Lido di Jesolo to the corner of the Adriatic, north and south of Venice from the west bank of the Piave rivermouth to the vicinity of Chioggia.

**Area** c.50,000 ha.

**Altitude** Sea-level.

**Water depth** No figures quoted but mostly shallow except for shipping channels.

**Wetland types** 6, 7.

**Ecology** A vast complex of shallow basins intersected by long and sometimes



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deep channels. Water from the Adriatic flows through the lagoons in tidal movements of great variation and intensity. The mudflats uncovered at low tide support a rich vegetation including interesting plants like the cord-grass *Spartina stricta* (= *maritima*) – this being the only Mediterranean enclave of this Atlantic species –, and glasswort *Salicornia herbacea* (= *europaea*). The most characteristic plant associations are Limonietum (sea lavender) and Artemisetum (wormwood). Along the shores are a number of pine woods and dunes that are relatively unspoilt (in the Tagliamento, Bosco Nordio and Rosolina-Mare areas). The dominant species are black pine *Pinus nigra*, stone or umbrella pine *P. pinea* and holm oak *Quercus ilex*.

The wetlands have a rich avifauna and are an important wintering area for ducks Anatidae, rails Rallidae and plovers Charadriidae, especially when the winter is severe.

**Legal status** Landscape reserve status gives partial protection. The area is subject to hydrogeological restrictions.

**Tenure** Ownership is divided between the Municipality of Venice, various other Communes and some private persons.

**Management practices** It has been shown that the only thing that can save Venice from destruction is the maintenance intact of the lagoons surrounding it. The struggle against the draining or in-filling of shallow waters in order to create industrial sites seems at last to have had some success and even some of the industries which have been established for 30 years or longer may be moved to other areas in Italy.

**Threats** Meanwhile, threats of various kinds persist, such as pollution, drainage of areas bordering the wetlands, tourist developments along the coast, roads, canals, insufficient protection from very high tides, etc.

**Scientific research** No information except as indicated in the following section.

### Principal reference material

Pignatti, S. 1966. La vegetazione alofila della laguna veneta. *Mem. Ist. Ven. Sci. Lett. Arti* 33: 1–174.

Montalenti, G. 1967. *Relazione sulla protezione delle lagune e degli stagni costieri della Penisola e delle grandi isole*. Quaderni de la Ricerca Scientifica no. 38, Consiglio nazionale delle Ricerche, Roma.

## 3. LAGUNE e VALLI DELLA DELTA DEL PO

**Criteria for inclusion** 1b,e; 2a; 3c; 4a

**Geographical location** 44°47'–45°14'N 12°13'–30'E On the western Adriatic coastal zone in the vicinity of the Adige, Po di Goro and Gnocca rivers. The area includes the Rovigo fishponds as well as all the lagoons between the Adige and Po rivermouths.

**Area** Now estimated at c.14,000 ha, although nearer 17,000 ha when the MAR List was published and before the Sacca degli Scardovari sector had been drained.

**Altitude** Sea level.

**Water depth** Maximum c.2 m; average shallow, probably c.0.5 m.

**Wetland types** 6, 7, 9, 24.

**Ecology** A vast complex of 'valli' (lagoons) which has gradually evolved during the last few thousand years through the continuing expansion of the Po Delta. Although human intervention has greatly influenced the characteristics of the area there has been relatively little land reclamation, compared with the areas south of the Po, and frequent floods and sedimentation have been the main formative influences. The 'valli' have been subject to various kinds of utilization, such as fish-farming or acting as hunting reserves. Their water level is controlled and they are usually protected by walls or dams from too free an inflow of sea-water, salinity often being kept to 20‰ by drawing on the river Po or canals. In general, the 'valli' are very productive and highly attractive to migrating and wintering waterfowl, the Ca'Zuliani to the north of the Po di Pila being the classic example and others including the Ca'Pisani, Moraro and Boccara. Certain types of 'valli', in communication with the sea or periodically flooded by sea water, tend to be of a more natural character and often support thick reedbeds ('bonelli'). In areas where, in summer, bare soil emerges at ebb tide, few plants are able to survive, except for scattered bushes of white willow *Salix alba* and an introduced North American leguminous plant *Amorpha fruticosa*. Deeper lagoons with less reeds, but also in communication with the sea, are called 'sacche'; most of them have sea-walls along their landward margins.

Species of waterfowl which frequent the Po delta in large concentrations during the winter include Pochard *Aythya ferina*, Mallard *Anas platyrhynchos*, Teal *A. crecca*, Pintail *A. acuta*, Shoveler *A. clypeata* and Coot *Fulica atra*. Mallard and Coot also nest in the area as does the Purple Heron *Ardea purpurea*, a few pairs of Osytercatcher *Haematopus ostralegus*, many Kentish Plovers *Charadrius alexandrinus* and colonies of Herring Gull *Larus argentatus*, Common Tern *Sterna hirundo* and Little Tern *S. albifrons*.

**Legal status** Some protection as a landscape reserve and through hydrogeological restrictions. Plans for a Regional Park along the coast are under study but have so far made little progress.

**Tenure** Mainly privately owned.

**Management practices** Water level and quality are under constant control in most 'valli', especially the inland ones. Fisheries or fish-farming are operating in several lagoons and the shooting preserves are of considerable economic value, though in the areas nearer to the sea no fees are charged. In some of the better run preserves food is put out to attract waterfowl and about 10 to 15% of the stock are estimated to be harvested annually. Several of the smaller areas serve as refuges. The general situation has been in existence and remained unchanged for many years, which may indicate that shooting pressure is not too destructive, but the creation of at least one good nature reserve in the delta would seem desirable.

**Threats** The construction of a major power station at Porto Tolle on the Po Grande or main channel and other industrial development are likely to result in severe air pollution and degradation of landscape and vegetation. Plans for another port and large industrial complex at the mouth of the Po di Levante (as an alternative to further industrial developments in site no. 2 Laguna di Venezia) could however lead to the final ruin of the delta as a wetland of international importance.

**Scientific research** Studies of the vegetation and several studies of possible ecological consequences of industrial developments have been undertaken.

**Principal reference material**

Brunelli, G. 1923, Schreiber, B. 1931 and various reports by the World Wildlife Fund (Italian National Appeal) and Italia Nostra, Rome; but no details have been supplied.

**4.2 VALLI BERTUZZI**

**Criteria for inclusion** 1e; 2a; 4a

**Geographical location** 44°43'N 12°15'E In the vicinity of Comachio, 35 km north of Ravenna.

**Area** c.1,900 ha.

**Altitude** Sea-level to 2 m.

**Water depth** Maximum 1 m; average 0.5 m.

**Wetland type** 7.

**Ecology** A brackish lagoon on the Adriatic coast, a remnant of the vast 'valli' once extending from Ferrara to the sea and now the only large natural body of water between the Valli di Comacchio and the Po di Goro. Fairly large beds of shrubby glasswort *Salicornia* (= *Arthrocnemum*) *fruticosum* are found in the surrounding area and along the ancient dunes marking the former sea shore. On small islands there are halophile communities of couch-grass *Agropyron*, golden samphire *Inula crithmoides*, sea aster *Aster tripolium*, etc. and on the higher dunes thickets of holm oak *Quercus ilex*, *Phillyrea* and other typical Mediterranean species. Reedbeds are also found in the shallow, less saline waters of the inner Valle Cantone.

The fish fauna is exploited by traditional fisheries but yield is decreasing since all communications with the sea are closed off. Fresh water from the Volano cannot be used because it is polluted and there is resulting deoxygenation in times of summer drought.

Breeding birds of the lagoon include Mallard *Anas platyrhynchos*, Coot *Fulica atra*, Black-winged Stilt *Himantopus himantopus* (50–100 pairs), Herring Gull *Larus argentatus*, Little Tern *Sterna albifrons* and, in some years, Pratincole *Glareola pratincola*. It is also an important area for wintering and migrating waterfowl such as Great Crested Grebe *Podiceps cristatus*, Little Grebe *Tachybaptus ruficollis*, Grey Heron *Ardea cinerea*, *Anas platyrhynchos*, Teal *A. crecca*, Wigeon *A. penelope*, *Fulica atra* and sundry plovers and sandpipers (Charadriiformes).

**Legal status** Landscape reserve, giving partial protection.

**Tenure** Privately owned by the Società Benifiche Terreni Ferraresi.

**Management practices** Control of water level, commercial fishing. The area is a shooting preserve but shooting pressure is moderate and none was allowed for a period of at least two years in the 1970s, though without any resulting increase in the numbers of wintering waterfowl. What is clearly needed is for at least part of the wetland to be constituted as a wildlife refuge with appropriate management practices. There was a project for including the area in a Regional Park for the coast of Emilia-Romagna, but it is uncertain whether it has been implemented.

**Threats** Pollution from the river Volano. Little exchange of water from the

Adriatic. Shortage of oxygen in the water has led to asphyxiation of fish, decreasing the economic value of the fishery, and may also have adverse effects on the avifauna. However, the risk of further draining of the lagoon is thought to have been averted.

**Scientific research** Studies of the vegetation have been undertaken in the past and more recent studies, by two Companies, have been directed to the Regional Park project, which is sponsored by the Government and by the Regione Emilia-Romagna.

**Principal reference material**

Corbetta, F. 1968 La vegetazione delle 'valli' del litorale ferrarese e ravennate. *Not. Fitosoc.* 5: 67-98.

Toschi, A. and Spagnesi, M. 1971. *Ricerche di Biologia della Selvaggina* (No. 52). Lab. Zool. appl. Caccia, Bologna.

### 4.3 SACCA DI GORO

**Criteria for inclusion** 1d; 2a; 3c; 4a

**Geographical location** c.44°45'N 12°18'E On the north-west Adriatic coast 10-15 km east of Codigoro and between the mouth of the Po di Goro and the Po di Volano estuary.

**Area** About 4,000 ha.

**Altitude** Sea-level.

**Water depth** Maximum 3 m; average 1 m.

**Wetland types** 6, 7, 8, 9, 10, 21.

**Ecology** A bay with almost the characteristics of a lagoon, despite a wide opening to the sea between several small islands, the two largest being Goro and Piallaza. The water is brackish due to the influx of fresh water from the rivermouths of the Po di Goro and Po di Volano. The benthic communities of algae are dominated by the seaweed *Gracilaria confervoides* but Angiosperms are also represented by eel grass *Zostera marina*. In the shallower water and in denser stands along the shores emergent *Phragmites communis* reedbeds occur in many places, those on the northern shore of the bay, in the vicinity of the Po di Goro or Valle di Gorino, being particularly extensive and known locally as 'bonelli'. Elsewhere, plant associations dominated by rushes such as sea club-rush *Scirpus maritimus* and sea rush *Juncus maritimus* also occur.

Animal life is plentiful in this productive estuarine area. Breeding birds include the Purple Heron *Ardea purpurea*, Ferruginous Duck *Aythya nyroca* and the Oystercatcher *Haematopus ostralegus* (very rare and localized in Italy). Many waterfowl occur offshore in winter, such as Tufted Duck *Aythya fuligula*, Scaup *A. marila*, Velvet Scoter *Melanitta fusca* (very unusual in the western Mediterranean) and Goosander *Mergus merganser*.

On the south-west corner of the Sacca di Goro wetlands, near the Po di Volano, remnants amounting to about 150 ha of the large Valli Giralda and Gaffaro, drained several years ago, still exist and are rich in waterfowl. The bay known as the Taglio della Falce ('sickle-shape') is particularly beautiful, with a very old wood of holm oak *Quercus ilex*, the Bosco della Mesola (1,060 ha), bordering its shores and supporting populations of Red Deer *Cervus elaphus* and Fallow Deer

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*Dama dama*. In general, the Sacca di Goro complex, with its variety of habitats, is an important and picturesque example of what the sea shores of northern Italy looked like in the past.

**Legal status** Part of the area (the Taglio della Falce and several inland swamps) has been designated as a Landscape Reserve.

**Tenure** Mainly Government or regional government ownership.

**Management practices** Fishing, reed cutting for commercial purposes, harvesting of seaweed *Gracilaria* beds. Complete protection for the whole area would be highly desirable.

**Threats** Excessive shooting pressure.

**Scientific research** Studies undertaken for the purpose of a project for creating a Regional Park on this section of the coast.

### Principal reference material

Corbetta, F. 1968. La vegetazione delle Valli del litorale ferrarese a ravennate. *Not. Fitosoc.* 5.

Toschi, A. and Spagnesi, M. c. 1971. *Lineamenti di una pianificazione faunistico-venatoria della regione Emilia-Romagna*. Ric. Biol. della selvaggina, Lab. di Zool. applic. Caccia, No. 52, Bologna.

## 4.4 PUNTE ALBERETE E VALLE MANDRIOLE

**Criteria for inclusion** 1d,e; 2a; 3a,b,c; 4a,b

**Geographical location** c. 44°32'N 12°09'E About 10 km north of Ravenna, in the north-western coastlands of the Adriatic.

**Area** 480 ha.

**Altitude** Sea level to 4 m.

**Water depth** Maximum 2 m; average 1 m.

**Wetland types** 12, 15, 18, 21.

**Ecology** Unique example of swampy woodland on the eastern edge of the plains of the river Po. Dominant species are white poplar *Populus alba*, willows *Salix* spp., the ash *Fraxinus oxycarpa* and English elm *Ulmus campestris* (= *procera*), growing mainly on the sandy dunes, which indicate former shore lines. Lower-lying areas are flooded, the water coming mainly from the river Lamone, and occupied by *Phragmites* reedbeds, stands of reedmace *Typha latifolia* and *T. angustifolia*, and plant associations such as Caricetum sedges and Mariscetum (fen sedge *Cladium mariscus*). The more open water has a covering of Laminetum, composed of such species as white water-lily *Nymphaea alba*, bladderwort *Utricularia vulgaris*, frog-bit *Hydrocharis morsus-ranae* and some pondweed *Potamogeton* and stonewort *Chara* sp.

The area has a rich fauna: thus amphibians include the newts *Triturus vulgaris meridionalis* and *T. cristatus carnifex*, the frogs *Rana dalmatina* and *R. latastei* and the pond terrapin *Emys orbicularis*; there are many breeding birds, such as, for instance, a large heronry of Night Heron *Nycticorax nycticorax* (100 pairs), Squacco Heron *Ardeola ralloides* (10–20 pairs), Little Egret *Egretta garzetta* (400 pairs) and Glossy Ibis *Plegadis falcinellus* (1 to 5 pairs, but not every year), Mallard

*Anas platyrhynchos* (200), Garganey *Anas querquedula* and Ferruginous Duck *Aythya nyroca* (at least 2 pairs), Coot *Fulica atra* (about 500 pairs), Penduline Tit *Remiz pendulinus* and Bearded Tit *Panurus biarmicus*. Several rare invertebrates occur such as the beetle *Carabus clathratus antonelli* and the endemic *Iphidrus carrarei*.

The Valle Mandriole is separated from Punte Alberete by the river Lamone, for which it serves as an overflow reservoir ('cassa di colmata'). It is covered to a large extent with Phragmitetum and Typhetum. Small patches of marsh bedstraw *Galium palustre*, sedges *Carex* (especially *C. caespitosa*) and common bulrush *Scirpus lacustris*; *Paspalum distichum* grass and water-plantain *Alisma plantago-aquatica* are also found. The waterways are bordered with bur-reed *Sparganium ramosum* (= *erectum*), fen sedge *Cladium*, arrowhead *Sagittaria*, etc. A number of clearings ('chiari') are kept free of vegetation artificially. The Valle is an important feeding ground for birds nesting at Punte Alberete and could support many aquatic birds in winter as well; but hunting pressure is severe.

**Legal status** Landscape reserve and, partly, bird sanctuary. Included in the Ramsar Convention list.

**Tenure** Most of the area is owned by the Municipality of Ravenna.

**Management practices** Punte Alberete is a bird sanctuary, managed by World Wildlife Fund and other organizations. An observation tower open to the public has been constructed, the water level is controlled, canals and small pools kept open, and food put out for the birds in winter. In the Valle Mandriole, on the other hand, shooting takes place and can exert heavy pressure on the waterfowl. Other practices include opening of waterways, reed-cutting and fishing. Sanctuary status for this part of the wetland would be desirable.

**Threats** None reported, other than periodically excessive shooting pressure in the Valle Mandriole sector.

**Scientific research** Investigations by the Laboratorio di Zoologia applicata alla Caccia, Bologna; by the Istituto Botanico di Bologna; and recently by a team working for Tecneco and Italeco, in connection with the project for a regional park in Emilia-Romagna.

#### Principal reference material

Stinchi, E., Toschi, A. and Corbetta, F. 1968. *Le Punte Alberete e la Valle del Lamone*. Quaderni de 'La Ricerca Scientifica', C.N.R., Roma, No. 48.

### 4.5 VALLE DI CAMPOTTO e VALLE SANTA

**Criteria for inclusion** 1e; 2a; 3c; 4a.

**Geographical location** 44°34'N 11°50'E To the east of Portomaggiore, 27 km south-east of Ferrara and the same distance from the Adriatic sea; c. 36 km north-west of Ravenna.

**Area** 1,363 ha and 261 ha: total 1,624 ha.

**Altitude** Sea-level to 3 m.

**Water depth** Maximum: 2 m; average 1 m.

**Wetland types** 12, 15, 18.

**Ecology** These 'valli' comprise two neighbouring freshwater reservoirs, serving Ravenna and its industries and acting also as overflow basins for torrent-like watercourses, especially the river Reno. They are the last remnants of the formerly much bigger swamps of the south-eastern Po floodplains which were reclaimed in the 19th century. They are now in effect eutrophic lakes, supporting extensive reedbeds interspersed with channels and stretches of open water of largely artificial origin, often covered by white water-lilies *Nymphaea alba* and colonised by typical submersed plant associations. A low level of pollution allows the waters to be extremely productive and they are much used for commercial and sport fishing of Pike *Esox lucius*, Tench *Tinca tinca* etc. The Pond Terrapin *Emys orbicularis* is still common, the Otter *Lutra lutra* probably extinct.

Great numbers of waterfowl (Podicipitidae, Ardeidae, Anatidae, Rallidae, Charadriidae and Scolopacidae) congregate here in winter. Breeding species include a number of relatively scarce species such as the Bittern *Botaurus stellaris*, Squacco Heron *Ardeola ralloides* (increasing), Little Egret *Egretta garzetta*, Purple Heron *Ardea purpurea* and Glossy Ibis *Plegadis falcinellus* (irregularly). There are several hundred nesting pairs of Great Crested Grebes *Podiceps cristatus*, Mallard *Anas platyrhynchos*, Garganey *A. querquedula*, Coots *Fulica atra*, a large colony of Whiskered Tern *Chlidonias hybrida* (reputedly the only one in Italy) and also Black Tern *C. nigra*.

**Legal status** The two sectors have been entered separately in the Ramsar Convention list and partly protected, certain hydro-geological 'constraints' (vincoli) being applied. The Valle Santa is a bird and fish sanctuary under the control of the World Wildlife Fund (Italian National Appeal).

**Tenure** Private ownership (Società Bonifiche Renane).

**Management practices** The water level is kept generally low to attract birds, although at times the area is flooded by the river Reno. Some reed cutting and clearing of channels still take place. Campotto is a private hunting reserve but subject to moderately low shooting pressure. The bird and fish populations of the Santa sanctuary, controlled by WWF, are prolific.

**Threats** Believed to be negligible at the present time.

**Scientific research** Ornithological and hydrological studies are being carried out (on behalf of the regional government) by Tecneco and Italeco.

#### **Principal reference material**

No specific publications quoted, but the area is briefly described in:

Toschi, A. 1968. *Interesse faunistico e paesistico delle Valli dolci e salmastre delli Emilia orientale*. Studi Romagnoli XIX, 12 pp.

## **4.6 VALLI DI COMACCHIO e VENE DI BELLOCCHIO**

**Criteria for inclusion** 1b,d,e; 2a,b; 3b,c; 4a

**Geographical location** 44°29' – 38°N 12°16'E About 14 km due north of Ravenna.

**Area** c.10,500 ha.

**Altitude** Sea-level to 2 m.

**Water depth** Maximum 2.5 m; average varying between 0.5 and 1.5 m.

**Wetland types** 6, 7.

**Ecology** The area comprises the Valli di Comacchio (residual), the Vene di Bellocchio, with the adjacent estuary of the river Reno, and other partially flooded areas. The Valli di Comacchio (9,500 ha) are what remains of the very large coastal and inland complex of lagoons and marshes which existed before 1850. Since the mid-1950s some 25,000 ha have been drained including, most recently, the Valli del Mezzano, and are already under cultivation. The surviving valli (Fossa di Porto, Campo and Lido di Magnavacca) constitute a deep water lagoon in which the water level and inflow from both the sea and river Reno are fully controlled. The traditional and far-famed eel-fishery is now in decline and fish-farming has been introduced. The southern part of the lagoons is shallower, with sand or shell banks and small islands (remains of old shorelines) and also some fresh water bodies of limited size, in which glasswort *Salicornia* and *Phragmites* reedbeds are found.

The Vene di Bellocchio are a complex of salt marshes bordering the Adriatic, with several parallel basins separated from the Valli di Comaccio by a narrow strip of land traversed by the Chioggia-Ravenna road. The northern end of the marshes is completely degraded and the only uncontaminated area is the Orsi-Mangelli 'preserve', partly covered by woods of stone pine *Pinus pinea*. The submerged vegetation consists mainly of the Characeous algae, *Lamprothamnium papulosum* (Vene Bellocchio, Valle Lide di Magnavacca), and of tassel pondweed *Ruppia spiralis* (V. Fossa di Porto), often together. Halophytic plants include pure strands of shrubby glasswort *Salicornia* (= *Arthrocnemum*) *fruticosa*, as well as associations in which *Salicornia herbacea* (= *europaea*) or seablite *Suaeda maritima*, saltwort *Salsola soda* or couch-grass/golden samphire *Agropyron elongatum/Inula crithmoides* may be the dominant species.

There is a rich avifauna in the Valli and common breeding birds include Mallard *Anas platyrhynchos*, Garganey *A. querquedula*, Black-winged Stilt *Himantopus himantopus*, Avocet *Recurvirostra avosetta*, Little Tern *Sterna albifrons* and Bearded Tit *Panurus biarmicus*. Other species breeding in small numbers are Ferruginous Duck *Aythya nyroca*, Shelduck *Tadorna tadorna*, Redshank *Tringa totanus*, Gull-billed Tern *Gelochelidon nilotica* and Common Tern *Sterna hirundo*. Wintering Anatidae are present in large numbers in most years, especially Pochard *Aythya ferina*, but also *Anas platyrhynchos*, Wigeon *A. penelope*, Teal *A. crecca*, etc. It is believed that the Otter *Lutra lutra* may still exist in the Orsi-Mangelli preserve.

**Legal status** Landscape reserve and hydrogeological reserve; several privately owned hunting reserves and bird sanctuary areas.

**Tenure** Part of the area is in private ownership (Azienda Valli Comacchio and Orsi-Mangelli preserve) and the rest in State ownership (Ente Delta Padano).

**Management practices** The wetland is supplied with fresh water from the river Reno, the water level being controlled. Fish-farming is replacing traditional methods of fishing. Hunting reserves are well managed, especially the Orsi-Mangelli, where shooting is moderate. Bird refuges totalling about 1,000 ha in extent have been established at vital points and it is noteworthy that several areas around the valli are still of ornithological interest, especially the non-cultivated areas of the reclaimed Valli del Mezzano.

**Threats** The threat of further land reclamation has for the time being been removed. Some pollution, from crop-spraying or carried down the river Reno, is an obvious danger to the integrity of the wetland, as is the tendency towards



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excessive destruction of the *Salicornieta* in order to enlarge the area of fishponds.

**Scientific research** Hydrobiological research by Universities of Bologna and Ferrara. Studies by a team of specialists have been undertaken with a view to establishing a regional park.

### Principal reference material

Montalenti, G. (ed.) 1967. *Relazione sulla protezione delle lagune e degli stagni costieri della penisola e delle grandi isole*. Quaderni de la Ricerca Scientifica (No. 38): C.N.R., Roma. 47 pp.

Toschi, A. and Spagnesi, M. 1971. *Ricerche di Biologia della Selvaggina*. Quad Ric. Scient. (No. 52): Lab. Zool. appl. Caccia, Bologna. 99 pp.

Ferrari, G., Pirola, A. and Piccoli, F. 1972. Saggio Cartografico della Vegetazione delle Valli di Comacchio. *Ann. Univ. Ferrara*, N.S.I. 1(2): 35–64.

Pondesan, M. and Bucci, V. 1972. Gli antichi cordoni litoranei del settore sud-occidentale delle Valli di Comacchio. *Atti Acc. Sci. Ferrara* 48: 1–18.

## 6.1. VASCHE DEL CERVARO – CANDELARO/MANFREDONIA

**Criteria for inclusion** 1a,b,e; 2a; 3c; 4a

**Geographical location** 41°32'–35'N 15°51'53'E To the south of the Gargano promontory, on the coast of the Gulf of Manfredonia and c. 10 km to the south and west of the town of that name.

**Area** c. 700 ha.

**Altitude** Sea-level.

**Water depth** Between 0.5 and 1 m.

**Wetland types** 8, 11, 18.

**Ecology** The Vasche themselves act as an overflow reservoir for flood waters of the Cervaro and Candelaro rivers; they are now mainly used as a shooting preserve. A variety of surrounding areas (especially the 'marane' – see below) can be considered as forming an ecological entity with the Vasche. The freshwater basin of the Vasche is partly covered with reeds *Phragmites*, rushes *Juncus* sp., water-lilies *Nymphaea alba*, sweet grass *Glyceria aquatica*, pondweed *Potamogeton* and *Najas marina*.

Large numbers of waterfowl visit the area in winter and during migration, in particular Mallard *Anas platyrhynchos*, Wigeon *A. penelope*, Teal *A. crecca*, Pintail *A. acuta* and Shoveler *A. clypeata*. Numerous White-fronted Geese *Anser albifrons* and some Bean Geese *A. fabalis*, totalling about 4,500, used to winter in the area, up to the mid-1960s, but have been exterminated or driven away, probably by excessive shooting pressure but also as a result of poisoning by chemicals used on the surrounding fields.

Several areas near the Vasche – along rivers, near estuaries and between dunes – are covered with brackish water in winter and support a covering of glasswort *Salicornia*. These so-called 'marane' are attractive to large numbers of birds, especially waders Charadriiformes. Neighbouring areas cultivated with rice and cereals are important feeding grounds for the ducks, as they once were for geese. Cranes *Grus grus* and Great Bustard *Otis tarda* are occasionally observed during the migration period.

**Legal status** Partly protected (private hunting reserve).

**Tenure** Private ownership.

**Management practices** The water level is controlled for the purposes of rice cultivation. Reed cutting takes place and waterways or channels are kept open. The shooting rights are of great economic value but harvesting of waterfowl is said to be moderate. Geese are no longer allowed to be shot, the area having now been established as a World Wildlife Fund wildgoose refuge.

**Threats** Reclamation may again become a danger if the economic value of the shooting seriously declines or is brought to a halt.

**Scientific research** No specific information but see next section.

#### **Principal reference material**

Montalenti, G. (ed.) 1967. *Relazione sulla protezione delle lagune e degli stagni costieri della Penisola e delle grandi isole*. Quaderni de la Ricerca Scientifica (No. 38): C.N.R., Roma. 47 pp.

Pratesi, F. 1970. *Paludi, lagune e stagni costieri in Italia*. Quaderno No. 6 di "Italia Nostra", Roma.

## **7. LAGHI PONTINI**

**Criteria for inclusion** 1e; 2a; 3a;,b,c; 4a

**Geographical location** 41°15'–30'N 12°30'–13°22'E Pontine plain stretching along the Tyrrhenian Sea coast of the Mediterranean for a distance of c. 100 km to the south-east of Rome on either side of Latina, the capital of the province of that name.

**Area** c. 2,792 ha (2,192 ha included in the four Ramsar Convention listed sites).

**Altitude** Mostly about sea level.

**Water depth** Maximum 10 m; average between 2 and 5 m.

**Wetland types** 7, 21.

**Ecology** With the exception of the Lago di Fondi, which is included in the complex but situated at its extreme south-eastern end 3 or 4 km inland, the 'pontine' lakes (Paola or Sabaudia, Caprolace, Monaci and Fogliano) are a major and very typical group of the Tyrrhenian sea coast lakes. They originated with the build-up of sand dunes along the shore and, although all of approximately the same age, they differ in their geomorphological characters, in the presence or otherwise of connections with the open sea and in their freshwater content (hence salinity, which varies between the 1% of Lago di Monaci and the 3.9% of Lago di Caprolace). Pondweeds *Potamogeton* spp. and *Chaetomorpha* are common in the lakes and marsh plant communities along their shores. The fish fauna is composed of Mulletts *Mugil* species (*M. cephalus*, *chelo*, *capito*), Eel *Anguilla anguilla*, Sand Smelt *Atherina hepsetus*, Sole *Solea* sp., Bass *Dicentrarchus labrax*, Silver Breams *Diplodus sargus* and *Sparus auratus*, and *Box salpa*, which here enjoy one of the most favourable habitats on the entire Tyrrhenian coast of Italy. The area is similarly one of the few important west coast resting and wintering places for migrating waterfowl, but shooting pressure is quite heavy.

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**Legal status** All the lakes except Lago di Fondi were included in the National Park of Circeo in October, 1975, and so have partial protection. They are also included as four separate items in the Ramsar Convention list.

**Tenure** No information but presumably mostly State ownership.

**Management practices** Exploitation for fishery. Mussels *Mytilus* sp. are grown for food in the Lago di Paola.

**Threats** Habitat alteration, including in-filling of wetland; port (Saubadia) and tourist 'villages' or other accommodation, with concomitant pollution.

**Scientific research** Undertaken by the Laboratorio Centrale di Idrobiologia, Rome.

**Principal reference material**

Montalenti, G. (ed.) 1967. *Relazione sulla protezione delle lagune e degli stagni costieri della Penisola e delle grande isole*. Quaderni de la Ricerca Scientifica (No. 38): C.N.R., Roma. 47 pp.

### 8.1 LAGO DI BURANO

**Criteria for inclusion** 1b,e; 2a; 3a,b,c; 4a,b.

**Geographical location** 42°22'–24'N 11°23'–25'E On the Tyrrhenian sea coast, 10 km east-south-east of Orbetello, in the Grosseto Province of Tuscany.

**Area** c. 410 ha.

**Altitude** Sea level.

**Water depth** Maximum 2 m; average c.1 m.

**Wetland types** 7, 11.

**Ecology** A saline lake, about 3 km long, separated from the sea by a double line of sand dunes ('tombolo'). Several plant associations typical of lagoons and marshes occur, dominated respectively by tassel pondweed *Ruppia spiralis*, reeds *Phragmites communis*, sea club-rush *Scirpus maritimus* and fen-sedge *Cladium mariscus*. A Mediterranean maquis has developed on the Tombolo di Capalbio, composed of Monterey cypress *Cupressus macrocarpa*, the juniper *Juniperus phoenicea*, olive *Olea europea* var. *oleaster*, myrtle *Myrtus communis*, mastic tree *Pistacia lentiscus*, holm oak *Quercus ilex*, etc. A herbaceous vegetation of spring sedge *Carex caryophylla*, the clover *Trifolium cherleri*, *Romulea columnae*, mossy tillaea *Tillaea muscosa* (= *Crassula tillaea*) and other species, occurs sporadically.

The lake is an important resting and wintering place for waterfowl, especially Cormorant *Phalacrocorax carbo*, Grey Heron *Ardea cinerea*, Wigeon *Anas penelope*, Teal *A. crecca*, Pintail *A. acuta*, Pochard *Aythya ferina* and Coot *Fulica atra*.

**Legal status** The lake is in a 496 ha landscape reserve and included in the Ramsar Convention list; it now also has the status of a sanctuary, managed by the World Wildlife Fund (Italian National Appeal).

**Tenure** Private ownership; WWF rents the lake.

**Management practices** Elimination of fishing would be desirable. Traffic on the road running along the tombolo should be prohibited. Extension of the sanctuary to nearby areas seems necessary.

**Threats** Pollution and, because the lake is a tourist attraction, development of the surrounding area and fires caused by careless visitors in dry summers. Exploitation of sandpits in the vicinity can also have adverse effects.

**Scientific research** Some research into the biota is now being carried out under World Wildlife Fund auspices.

**Principal reference material**

Pratesi, F. 1970. *Paludi, lagune e stagni costieri in Italia: nuove prospettive ed indirizzi per la loro conservazione*. Quaderni di "Italia Nostra" No. 6, Roma. 62 pp.

Orsomando, E. 1971. Censimento dei biotopi di rilevante interesse vegetazionale meritevole di conservazione in Italia. In an unspecified publication of Soc. Bot. Ital. (F. Pedrotti ed.) printed at Camerino.

## 8.2 LAGUNA DI ORBETELLO

**Criteria for inclusion** 1a,b,d,e; 2a; 3b,c.; 4a

**Geographical location** 42°25'–30'N 11°10'–20'E Surrounding the town of Orbetello at the base of the Monte Argentario peninsula and about 35 km south of Grosseto in south-western Tuscany.

**Area** c.3,600 ha, including the Tombolo della Feniglia, the ridge of dunes which separates the lagoon from the sea to the south.

**Altitude** Sea-level.

**Water depth** Maximum 1.5 m; average 1 m.

**Wetland type** 7.

**Ecology** A typical lagoon with salinity varying between 15% and 30% but mostly about 20%, separated from the sea by two long and narrow strips of dune ('tomboli') and divided in two by a third 'tombolo' on which the town of Orbetello is built. The vegetation is typical of a brackish water habitat, shrubby glasswort *Salicornia* (= *Arthrocnernum*) *fruticosa* and also some reedbeds predominating and particularly well developed in the northern lagoon. The 'tomboli' themselves are covered with a Mediterranean-type maquis and on the southern Tombolo della Feniglia, there are stands of pines mixed with cork oak *Quercus suber*. The shallow parts of the lagoon have a submerged vegetation of algal and aquatic species belonging to such genera as *Chaetomorpha*, *Valonia*, *Cistoseira*, *Cymodocea* and *Zostera*, which in turn support large numbers of small invertebrates such as Amphipoda (sand-hoppers) and Culicinae (mosquitoes) etc. Because of this, the lagoon is important to migrating and wintering ducks and waders, especially Wigeon *Anas penelope*, Teal *A. crecca* and Pintail *A. acuta*, and various species of Charadriiformes, and also quite a variety of other waterfowl, such as Great Crested Grebe *Podiceps cristatus*, Black-necked Grebe *P. nigricollis*, Cormorant *Phalacrocorax carbo*, Greater Flamingo *Phoenicopterus ruber*, Shelduck *Tadorna tadorna*, pochards *Aythya* spp., Red-breasted Merganser *Mergus serrator* and flocks of gulls Laridae. Breeding birds include Mallard *Anas platyrhynchos*, Montagu's Harrier *Circus pygargus*, Black-winged Stilt *Himantopus himantopus*, Kentish Plover *Charadrius alexandrinus*, Stone Curlew *Burhinus oedicephalus*, Great Spotted Cuckoo *Clamator glandarius* and Bee-eater *Merops apiaster*. There

## ITALY

are also some notable mammals such as Fallow Deer *Dama dama* (on the Tombolo della Feniglia), Wild Pig *Sus scrofa* and Wild Cat *Felis silvestris* (on the neighbouring Monte Argentario).

**Legal status** The area is a landscape reserve and part of it (887 ha) is also a listed Ramsar Convention site. The Tombolo della Feniglia and its woods are State property and a designated nature reserve.

**Tenure** Partly State and partly local government ownership.

**Management practices** About 1,000 ha of the *Salicornia* covered dunes are included in a World Wildlife Fund Reserve and therefore under conservation management. Tombolo della Feniglia is a nature reserve open to the public, where shooting is prohibited. Commercial fishing continues in the lagoon which has a good stock of eels *Anguilla*, mullets *Mugil* spp., Bass *Dicentrarchus labrax*, Tooth-carp *Aphanius fasciatus* and other species.

**Threats** Further tourist developments in the area, especially on the tomboli bordering shores of the sea. These include the construction of a marina at Cala Galera, which has led to some erosion of the southern tombolo. The enlargement of Orbetello port and the organic pollution emanating from the town are having some adverse effects. In general protection of various sectors or features of the wetland is still not adequate and needs to be extended.

**Scientific research** The Stazione Romana per la Osservazione e la Protezione degli Uccelli has been carrying out studies of the avifauna since 1965.

### Principal reference material

Pratesi, F. et al. 1972. In *Una Vita per la Natura* (F. Pedrotti ed.): pp. 331–350. Associazione Italiana per il WWF, Roma.

# JORDAN

## SUMMARY OF WETLAND SITUATION

Among the few wetlands of this semi-arid to very arid country, the Azraq Oasis in the Eastern Desert is probably the only one which is of international importance. It is an outstanding example of the ecosystems characteristic of areas in semi-arid regions where surface water is available. As such it is of the greatest importance as a migration stage for huge numbers of migrating birds, whilst concentrations of wintering waterfowl can exceed 100,000 individuals.

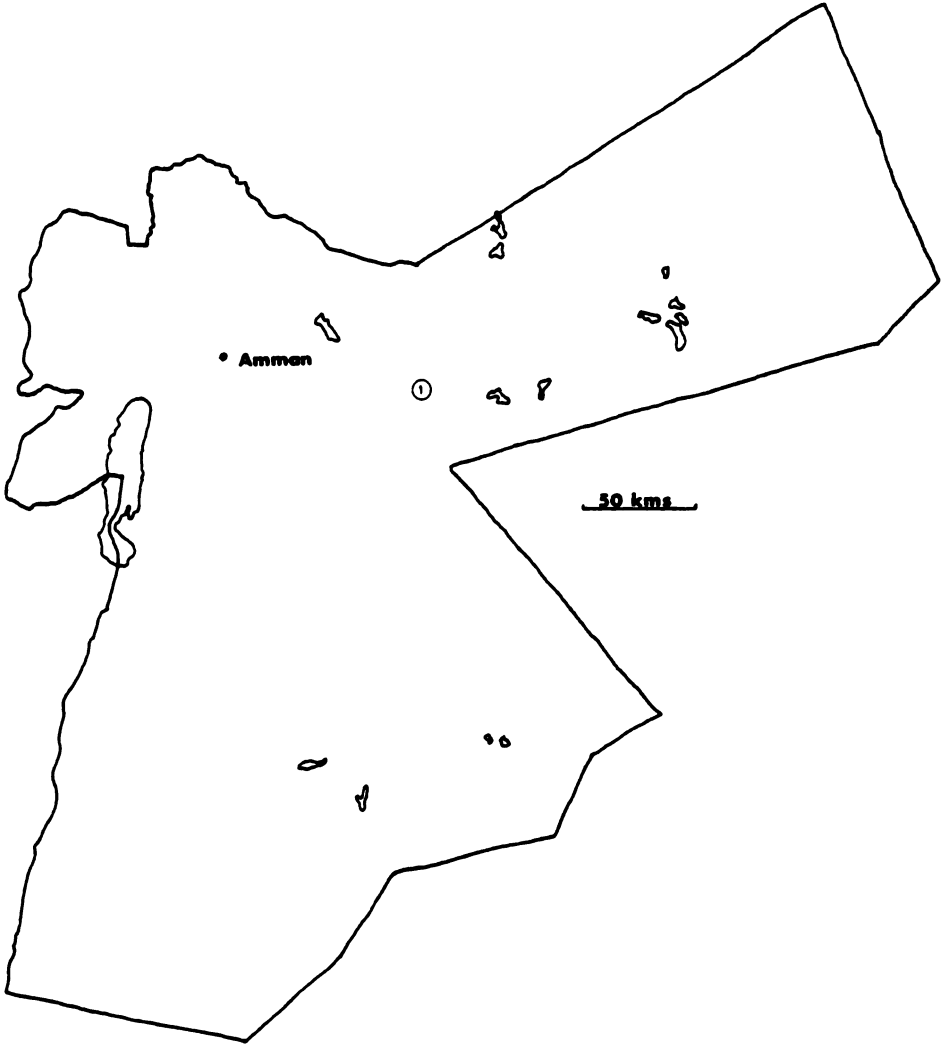
Declared by Royal Proclamation as a reserve in 1965, the Azraq Oasis has subsequently been under consideration for elevation to National Park status. In the meantime, in January 1977, with the ratification of the Ramsar Convention by the Jordanian Government, the greater part of the area, over 7,000 ha out of an estimated total of 10,000 ha, has been designated for inclusion on the Convention List of Wetlands of International Importance.

## WETLANDS OF INTERNATIONAL IMPORTANCE

\*Nominated for inclusion in the Ramsar Convention list

	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
*1.	Azraq Oasis	31°49'N	36°48'E	c.10,000 ha	1a,b,d,e; 2a,b,c; 3a,b,c; 4a Protected (Reserve) Ramsar Convention Site (7,372 ha)

# JORDAN



## DETAILS OF THE LISTED AREA

### 1. AZRAQ OASIS

**Criteria for inclusion** 1a,b,d,e; 2a,b,c; 3a,b,c; 4a.

**Geographical location** 31°49'N 36°48'E Slightly south of due east and 85 km from Amman.

**Area** c.10,000 ha, of which 7,372 ha are designated as a Ramsar Convention Site.

**Altitude** c.500 m.

**Water depth** About 0.7 m in winter, largely drying out by mid-May.

**Wetland types** 17, 23, 25.

**Ecology** Closed basin in desert country, with summer temperatures sometimes reaching 44°C, winters relatively wet and cold (occasional frosts) and an average annual rainfall of c.50 mm. The wetlands comprises freshwater pools, marshes, and large mudflats, Qa' el Azraq, situated on the eastern side of the depression, which is also fed by run-off water through several wadis from a total catchment area of c.13,000 sq. km. A large basalt plateau to the north is the most prominent geological feature. Part of the water supply is derived from two main groups of springs, the Shishan and the Druze, respectively. These and their channels, as well as some of the wadis, support a rich vegetation of rushes *Juncus* spp., sedges *Carex* spp., shrubby species of such genera as *Tamarix*, *Artemisia*, *Atriplex* and *Prunus*, and grasses including the grant reed *Arundo donax*. The production of zoo- and phyto-plankton and of some filamentous algae is high.

The vast shallow lake formed in winter is frequented by great numbers of dabbling duck – Mallard *Anas platyrhynchos* (3,000), Wigeon *A. penelope* (8,000), Teal *A. crecca* (24,000), Garganey *A. querquedula* (8,000), Pintail *A. acuta* (17,000), Shoveler *A. clypeata* (10,000) and Coots *Fulica atra* (25,000), the figures quoted being those for February 1974. The oasis is also a very important stopping-place on migration for waders Limicolae and other birds. Over 50 species have been recorded as nesting, including the Little Bittern *Ixobrychus minutus*, Squacco Heron *Ardeola ralloides*, Purple Heron *Ardea purpurea*, Water Rail *Rallus aquaticus*, Kentish Plover *Charadrius alexandrinus*, Greater Sandplover *C. leschenaultii*, Black-winged Stilt *Himantopus himantopus*, Avocet *Recurvirostra avosetta* and Pratincole *Glareola pratincola*. Some Houbara Bustards *Chlamydotis undulata* probably still breed in the area.

Among the mammals present may be mentioned local subspecies of the Asian Jackal *Canis aureus syriacus*, Red Fox *Vulpes vulpes arabica* and Striped Hyaena *Hyaena hyaena syriaca*. There are still a few Wolves *Canis lupus* and perhaps Caracal Lynx *Felis caracal*, but the main prey species of larger predators, a subspecies of the Mountain Gazelle *Gazella gazella arabica*, has declined dramatically as the result of destructive hunting methods (automatic weapons, fired from cars) and very few if any survive.

**Legal status** Declared a Reserve by Royal Proclamation in 1965 and under consideration for National Park status since the publication of a draft management plan in 1966. A substantial part of the area was included in the Ramsar Convention list of wetlands of international importance in 1977.

**Tenure** Government ownership.

**Management practices** Druze and Shishan villages with their springs are situated near the main Azraq lake and cattle (mostly cows) are grazed in the adjoining marshes. Cutting of *Arundo donax* and of the lesser reedmace *Typha angustifolia* for mat-making, between April and October, helps to promote new growth. About 6,000 cubic metres of water from the Druze springs are pumped to various towns and villages in northern Jordan. There is some fishing of introduced *Tilapia*, carp *Cyprinus* and catfish *Siluris*, a pilot project for breeding freshwater fish in artificial ponds having been initiated by the Ministry of Agriculture. Salt extraction is another important economic activity.

**Threats** Irrigation schemes could affect the suitability of the area for waterfowl. The uncontrolled grazing by cows, sheep, horses, donkeys and camels is liable to cause considerable damage to the vegetation. Hunting pressure was at one time



## JORDAN

heavy, although hunting was limited to two days a week during the period from 30 September to 31 March only, control on shooting by local villagers tending, however, to be ineffective. No information yet available about developments since Jordan ratified the Ramsar Convention.

**Scientific research** The International Jordan Expedition of 1966, organized by the Conservation of Terrestrial Communities section of the International Biological Programme, compiled a report in which data were presented on climatology, hydrology, limnology, entomology, ornithology, mammalogy, siphonaptera (fleas), human ecology, logistics and management. Several hydrological studies were also carried out between 1955 and 1968. Field station research facilities were established for a time in a former hunting lodge but later discontinued, though the University of Amman has taken over as a base for future studies.

### **Principal reference material**

- Boyd, J. M. 1966. The International Jordan Expedition 1966. *Nature* 212(5063): 333–335.
- Hemsley, J. H. and George, M. 1966. *Azraq Desert National Park, Jordan – Draft Management Plan*. International Biological Programme, Conservation of Terrestrial Communities, London.
- Nelson, B. 1973. *Azraq – Desert Oasis*. Allan Lane, London.
- Qasem, S. A. 1976. National Report for Jordan. In *Proc. Intern. Conf. on Conservation of Wetlands and Waterfowl, Heiligenhafen, Fed. Rep. of Germany, 1974*: 123–124. I.W.R.B., Slimbridge.

# LEBANON

## SUMMARY OF WETLAND SITUATION

Since 1973, only a small amount of data on the few wetlands in the Lebanon has become available, much of it relating to the rather marginal case of Palmier, Sanani and Ramkine islands (Iles des Lapins), situated about 10 km off the coast from El Mina near Tripoli. The islands, which are relatively free from pollution and have few inhabitants, are reported to be frequented by Audouin's Gull *Larus audouinii*, which is rated as 'rare' in the Red Data Books. The island of Palmier has a depression in which rainwater collects in winter, thus offering suitable habitat for migratory birds, of which over 300 species have been recorded on the island; and it would make an excellent reserve. It could also well be recommended as a suitable site for a biological and/or bird-ringing station.

On the Lebanon mainland, the remnant marshland of Ammik, in the Litani river valley, is of international importance as the only wetland of its type in the country and more especially for its scientific and educational value. It is situated on one of the principal bird migration routes in the Near East. There are also two other areas in the same valley which are known to attract migrating birds, namely the small man-made lake of Tanayel (6 ha) and the high level water storage reservoir of Qaraoun (1,000 ha).

### General references

Tohmé, G. and Neuschwander, J. 1974. Nouvelles données sur l'avifaune de la République Libanaise. *Alauda* 42(3): 243–257.

Baccar, H. 1977. A Survey of Existing and Potential Marine Parks and Reserves in the Mediterranean Region. Unpublished report prepared for the Expert Consultation on Mediterranean Marine Parks and Wetlands organised by UNEP in Tunis in January 1977.

### WETLANDS OF INTERNATIONAL IMPORTANCE

	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
1.	Palmier, Sanani and Ramkine Is. (Iles des Lapins)	34°30'N	35°40'E	15 ha (Palmier only)	1c,d,e; 2a,b; 3a Unprotected
2.	Ammik	33°45'N	35°50'E	1,500 ha	1d,e; 2a; 3a,c Unprotected

# LEBANON



## DETAILS OF LISTED AREAS

### 2. AMMIK

**Criteria for inclusion** 1d,e; 2a; 3a,c.

**Geographical location** 33°40'N 35°50'E Situated in the Beqa'a, the section of the Rift Valley which separates the Lebanon and Antilebanon mountain ranges, approximately 35 km south-east of Beirut.

**Area** c.1,500 ha.

**Altitude** No information.

**Water depth** Shallow, varying according to the amount of winter rainfall and drying out entirely or almost entirely in summer.

**Wetland type** 18.

**Ecology** Marshland bordering the Litani river, where it flows from north to south in the Beqa'a or central vale of Lebanon, before turning westwards to the sea. The marsh is usually inundated from the end of December or beginning of January until June, although water may remain in some pools till September. The annual rainfall is about 880 mm, occasionally falling and lying as snow but never for more

than 12 to 14 days a year. Flooding which follows as soon as the water table rises sufficiently, reaches its maximum in March/April. The surface soil is alluvial, of calcareous origin and is underlain by water-retaining clay layers through which water flows into the marsh. The vegetation is a reed *Phragmites* – *Typha* dominated association, dense in places but suffering from overgrazing in summer and burning in winter. Weeping willows *Salix babylonica* which colonized the area in the past, have nearly died out except for a small number along the roads; poplars *Populus* and cypress *Cupressus* spp. have now been introduced. Mammals include Common Voles *Microtus arvalis*, Asian Jackal *Canis aureus* and Red Fox *Vulpes vulpes*; reptiles Soft-shelled Turtle *Trionyx* sp., Whip-snake *Coluber gemonensis* and Grass Snake *Natrix natrix*. The amphibians recorded included Common Tree Frog *Hyla arborea*, Fire-bellied Toad *Bombina* sp., Painted Frog *Discoglossus* sp. and Common or Marsh Frogs *Rana* sp. Molluscs are abundant, notably *Melanopsis* sp., Pond Snails *Limnaea* sp., *Bithynia tentaculata*, Freshwater Nerite *Neritina* (= *Theodoxus*) *fluviatilis* and Ramshorn Snails *Planorbis* sp. The fishes included *Phoxinellus libanicus* and loach *Cobitis* sp. Breeding birds include Little Grebe *Tachybaptus ruficollis*, Little Bittern *Ixobrychus minutus*, Moorhen *Gallinula chloropus* and several species of marsh-dwelling passerines such as the Moustached Warbler *Acrocephalus melanopogon*. A most interesting variety of waterfowl, birds of prey and passerine species has been recorded on migration or wintering – several of which like the Garganey *Anas querquedula* and the Water Rail *Rallus aquaticus* are described as ‘abundant’.

**Legal status** Unprotected. The University of the Lebanon, Beirut, has developed plans for the creation of a reserve and a biological station, with tourist facilities and shooting carefully controlled so as not to disturb the ecological balance; but for the time being they have had to be shelved.

**Tenure** No information.

**Management practices** Grazing of cattle as the marsh dries in early summer.

**Threats** A project had been planned in 1973 to drain the remains of the marsh (with FAO assistance) for the purpose of growing cereal crops. This has been deferred but meanwhile hunting and shooting continue all year round without restriction as to species.

**Scientific research** In 1973, a team from the Faculté des Sciences of the University of the Lebanon had started on long term studies of the breeding and migratory birds of the area (their first report is quoted in the next section), when forced by political events to suspend their work.

#### **Principal reference material**

Tohmé, G. and Neuschwander, J. 1974. Nouvelles données sur l'avifaune de la République Libanaise. *Alauda* 42(3): 243–257.

# LIBYA

## SUMMARY OF WETLAND SITUATION

The wetlands in this basically arid or semi-arid country are few and generally small in size. The only appreciable rainfall occurs along the Mediterranean coast which is in the path of the occasional low-pressure systems (usually travelling from west to east). The Western Provinces (formerly Tripolitania) get about 300 mm of annual rainfall, while the Jabal al Akhdar in the Eastern Provinces (formerly Cyrenaica) gets up to 500 mm. The Southern Provinces (formerly Fezzan) are an extremely dry part of the Sahara stretching from the Algerian border to 19°E. Further to the east the Libyan desert extends the totally arid zone towards the Nile Valley.

The coastline is mainly low and rocky but occasionally varied by stretches of dunes. A coastal 'green-belt' from the Tunisian border via Tripoli to Misratah (Misurata) consists mainly of palm groves but these gradually thin out over the next 200 km and by the time one reaches Surt (Sirte) the coast is quite barren. On the far side of the Gulf of Sirte, to the east of Benghazi, the Jabal al Akhdar for the most part slopes steeply down from its 700 m summit ridge to the sea but beyond Darnah (formerly Derna) the coast is rather flat and backed by an approximately 20 km wide belt of sparse vegetation.

In the vicinity of Pisida, about 30 km east of the Tunisian border, the sea is shallow and a relatively minor tidal movement is sufficient to uncover mudflats which are of some importance to waders Limicolae and gulls Laridae. Between Tripoli and Zlitan seasonal watercourses carrying run-off from the Jabal Nafusah, are hemmed in by sand bars along the beaches, thus forming lagoons some of which may hold water all the year round. There are only a few of these wadis, largely confined to the Tripolitanian sector of the coast, the most important being the Wadi Kiam between Al Khums (Homs) and Zlitan and the Wadi Turghat (or Raml) about 50 km east of Tripoli. Permanent fresh water is also present at Tawurgha, about 45 km south of Misratah. All these localities are important to ducks and herons Anatidae and Ardeidae, mainly in winter and during the migration periods.

The Western Province saltflats (sebkha) in the coastal plain of Zawiyah district, near the Tunisian border, as well as those of Tawurgha to the south of Misratah, are of some importance, particularly for flamingos *Phoenicopterus ruber*, as is the Sebkha al Sahel between Benghazi and Tukrah in the Eastern Provinces, where up to 2,000 can be found in winter. Unfortunately, the freshwater pools just north of Benghazi are much disturbed and threatened by urban developments. The Grotto of Lete, also near Benghazi, contains a blind species of decapod, *Typhlocaris lethaea*, the nearest relatives of which are found in Israel and in Italy (Puglia region). It is considered to be a relict of a pristine shore fauna of the Tethys sea.

In the Southern Provinces (Fezzan) there are a number of water-bearing strata in the desert. Chains of oases extend from Adri to Brach, from Qubari to Sebha and to their west along the north and south sides of the Qubari sandsea. Another string of oases stretches about 250 km along the northern fringe of the Marzuq (Mourzouk) sandsea from Tmassah in the east to Tasawah (Tessaou) in the west,

including the large oases of Traghen and Marzuq itself. A third group of oases is in the far south-west of the country in the Ghat-Sardalas region: the small water-bodies of Ghat are the habitat of some tropical faunal elements including the fishes *Hemichromis bimaculatus* and *Barbus deserti*.

The Libyan Desert to the east has three groups of oases, one, the Jalo group 350 km SSE of Benghazi, now the centre of oil exploitation, the other two a similar distance further to the south around Tazerbo and in the great Kufrah depression (200 sq. km). In most oases fresh water is used to irrigate barley, vegetables, fruit and some cotton and is therefore available for birds, whilst the Kufrah Oasis also has four shallow saline lagoons with a vegetation of reeds and rushes, *Phragmites* and *Juncus*, and some *Tamarix*. Yet another oasis, the Al Jaghub close to the Egyptian border some 150 km from the coast, is of limnological interest because of the presence of molluscs of marine origin including a relict subspecies of cockle *Cardium edule rectidens*.

All the oases are visited by migrating birds including waterfowl in some numbers. But it is now known that migration takes place over a broad front and that birds do not depend to any great extent on the presence of waterholes in order to cross the Sahara, though ducks and waders are likely to make use of such facilities and of the rare marshlands, while saltings and the inshore waters, particularly of Tripoli, Benghazi and Tobruk harbours, sometimes support big concentrations of grebes, gulls and terns Podicipitidae and Laridae.

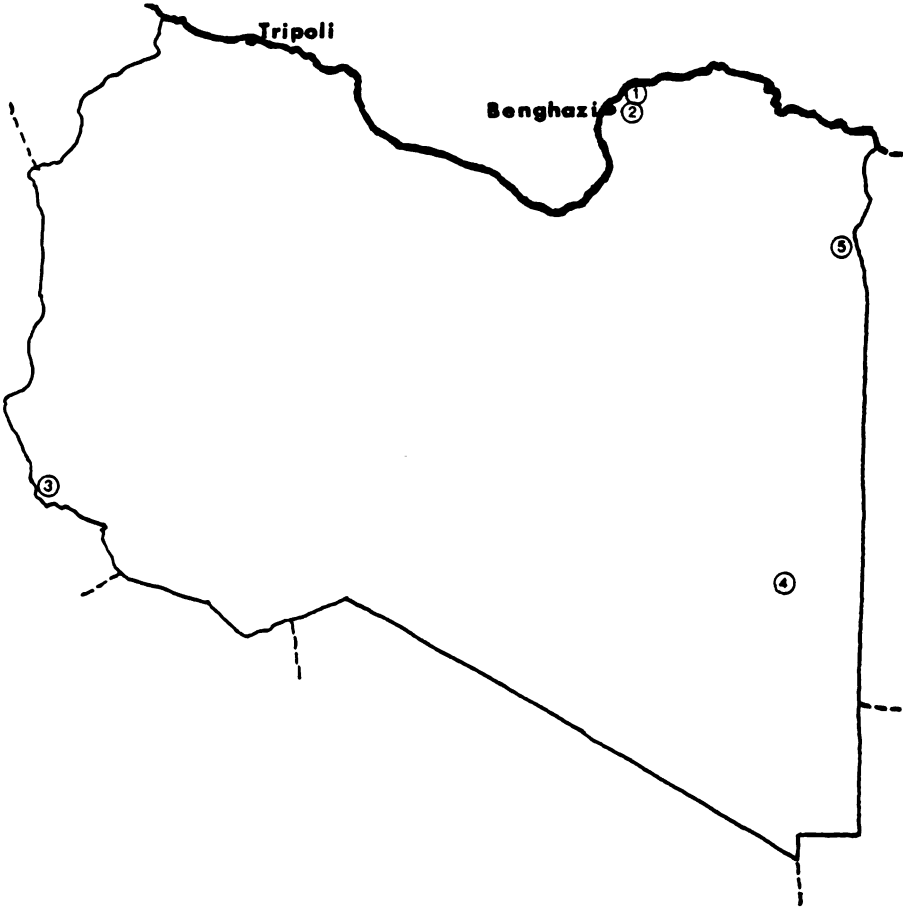
#### Principal reference

Bundy, G. 1976. *The birds of Libya*. B.O.U. Checklist No. 1. British Ornithological Union, London. 102 pp.

#### WETLANDS OF INTERNATIONAL IMPORTANCE

	Locality	Latitude	Longitude	Size	Wetland criteria/ Conservation status
1.	Sebkha al Sahel	32°30'N	20°35'E		1a; 2a Unprotected
2.	Grotto of Lete, Benghazi	32°08'N	20°30'E		1c,e; 2a,b,c Unprotected
3.	Oasis of Ghat	c.24°59'N	10°11'E		1c,d,e; 2a,b,c Unprotected
4.	Kufrah Oasis	24°20'N	23°10'E		1d,e; 2a,b,c Unprotected
5.	Al Jaghub Oasis	29°43'N	24°40'E		1c,d,e; 2a,b,c Unprotected

# LIBYA



# LIECHTENSTEIN

## SUMMARY OF WETLAND SITUATION

The River Rhine forms the international border between the Principality and Switzerland over a length of approximately 30 km. In former times the river frequently inundated the flat and wide valley, forming lakes, ponds and marshlands. The canalization of the Rhine started in 1830 and agricultural developments and urbanization have made drastic changes of the landscape since the beginning of the 20th century. Gravel extraction from the Rhine lowered the stream-bed very considerably, in fact by as much as 5 metres in some places, which resulted in turn in a widespread lowering of the water table.

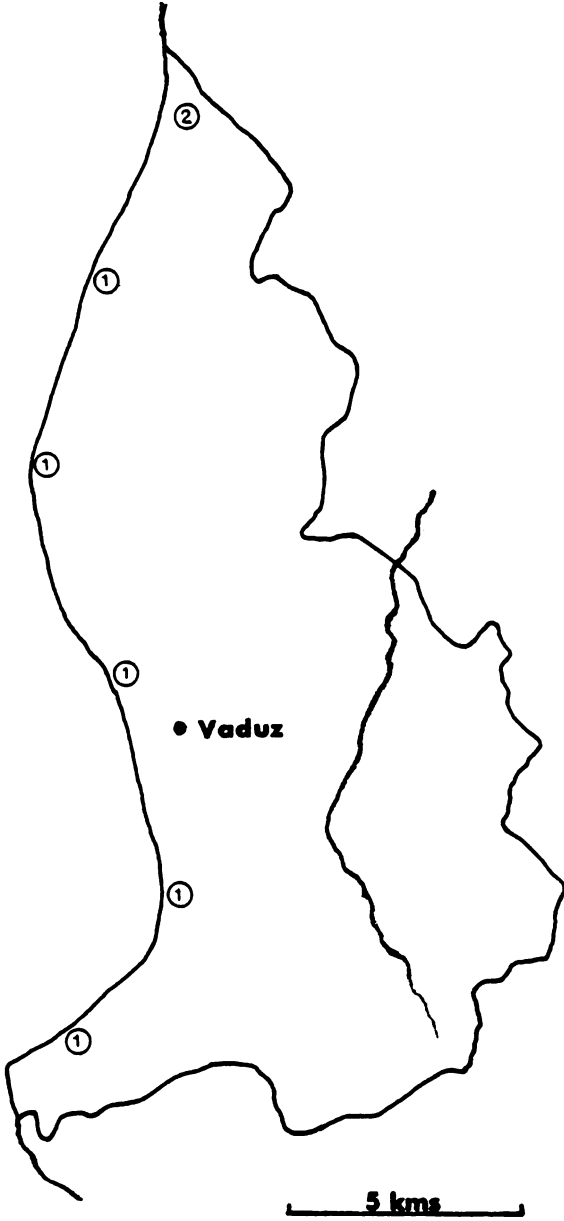
The riverine forest and most of the former wetlands have now disappeared entirely and the only remaining site of international importance for the purposes of this Directory is the Rüggele Riet, an old overgrown marshland, on which man's activities, especially reedcutting, have long had an influence. The area is nevertheless of considerable botanical interest, while the birds, reptiles and amphibians have all attracted scientific attention and been well studied. The area was put under protection in October 1978. This site and a few other smaller ones have been the subject of regular reports in the Bulletin of the Botanical and Zoological Association Liechtenstein-Sargans-Werdenberg (BZG Bericht).

## WETLANDS OF INTERNATIONAL IMPORTANCE

	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
1.	River Rhine — right bank floodplain remnants	47°03'–17'N	9°28'–33'E	c.30 km stretch of the river	4c
2.	Rüggele Riet	47°15'N	9°32'E	No information	1c,d,e; 2a; 3a,b,c Protected



# LIECHTENSTEIN



# LUXEMBOURG

## SUMMARY OF WETLAND SITUATION

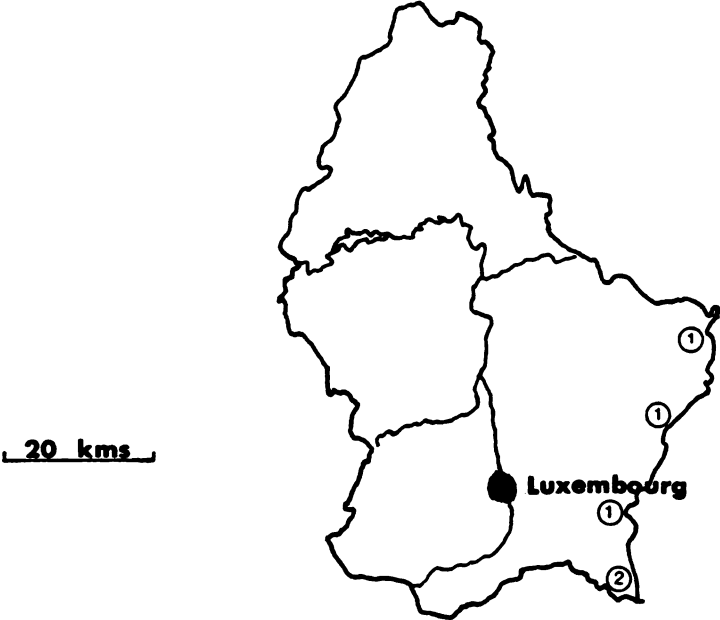
The River Moselle forms the international border between the Grand Duchy and the Federal Republic of Germany over a length of about 30 km. However, although listed as at least of some 'wetland' importance, particularly at times of high flood, the claypits of Remerschen/Wintringen, a short distance to the west of the river in the extreme south-eastern corner of the Duchy, are probably the only site of major importance to migrating waterfowl in the country. Up to 1,200 ducks Anatidae and waders Limicolae have been counted there in winter and there is no doubt of the area's potential if proper protection and management, in the interest of wildlife, were accorded. As such the wetland could become an area for study and recreation of both regional and international importance. An article on its ornithological merits was published in 1978 in *Regulus* Vol. 12 by R. Gloden, E. Melchior and J. P. Schmitz (Die Vogetlwelt des Kiesgrubengebietes Remerschen/Wintringen), pp. 281-302.

It is worth adding that an inventory of wetlands (mainly lakes and ponds, but also some barrages or otherwise favourable sections of the many rivers and streams of the Duchy) lists 53 sites and indicates over 160 waterbodies. These are particularly concentrated along the Syr, a small tributary of the Moselle, the upper waters of the Alzette (on which the city of Luxembourg itself is situated), and in the north-western corner of the country along small tributaries of the river Sure.

## WETLANDS OF INTERNATIONAL IMPORTANCE

	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
1.	River Moselle	49°33'–43'N	6°23'–30'E	c.30 km stretch of the river	4c Unprotected
2.	Remerschen/ Wintringen claypits	49°29'N	6°22'E	No information	1d,e; 3c; 4a Unprotected

# LUXEMBOURG



# MALTA

## SUMMARY OF WETLAND SITUATION

The Maltese Islands are situated about 90 km to the south of Sicily and about 200 km east-south-east of Cape Bon in Tunisia. The group consists of the main island Malta, the smaller islands of Gozo and Comino, and several rocky islets of which Filfla about 5 km south-south-west of Malta is the most important. Uninhabited areas and permanent fresh surface waters, of any considerable size, are conspicuous by their almost total absence in the islands. The only freshwater site of importance left is the Ghadira pool, north-west of the small town of Mellieha, which was gazetted as a Reserve in 1978. The water of the pool dries up completely in the summer, but it is hoped that with proper management it may become perennial (see the description which follows).

The Maltese Islands are in a very strategic position in relation to the migration of birds between Europe and Africa, and there is no doubt that a wetland resting place on Malta offering some degree of security would have great value, especially as hunting pressure in the islands generally is severe, with no close season. Apart from Ghadira, the other main areas where migrant waders and other waterfowl could rest or feed in important numbers are the salt pans and creek of Salina Bay to the east of St. Paul's Bay and the fishponds at Marsaxlokk near the south-eastern extremity of the main island; but both are much disturbed.

Brief mention may perhaps be made of the seabirds for which the small island of Filfla, mentioned above, and possibly one or two others, provide nesting places. They include the Storm Petrel *Hydrobates pelagicus*, Cory's Shearwater *Calonectris diomedea* and the Levantine Shearwater *Puffinus puffinus yelkouan*.

## WETLANDS OF INTERNATIONAL IMPORTANCE

	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
1.	Ghadira pool	35°57'N	14°23'E	112 ha	1e; 3a,c; 4a Partly protected (strict reserve 1.82 ha)
2.	Salina creek and salt pans	35°55'N	14°26'E	Not assessed	1e; 2c
3.	Marsaxlokk fishponds	35°51'N	14°33'E	Not assessed	1e; 2c

# MALTA



## DETAILS OF LISTED AREAS

### 1. GHADIRA POOL

**Criteria for inclusion** 1e; 3a,c; 4a.

**Geographical location** 35°57'N 14°23'E Situated on an isthmus at the neck of the peninsula formed by the Marfa Ridge, north-western Malta. The isthmus runs west-east between Ic-Cumnija and Mellieha Bay, a distance of about 1,280 m.

**Area** 1.8 ha, surrounded by a no-shooting buffer zone averaging 450 m wide, making a total partially protected area of c. 112 ha. Proposals for the development of the reserve proper would increase its area to c. 10.5 ha.

**Altitude** Sea level to 5 m.

**Water depth** One to 15 cm; in a few deeper pockets, 60 cm to nearly 1 metre.

**Wetland types** 23, 24.

**Ecology** The wetland originated in a deep fault, where alluvial soil has accumulated as a result of erosion of steep Upper Coralline limestone hills and in particular of exposed sections of a Blue Clay stratum. The pool itself is in a depression of impermeable clay, the surface water thus retained (largely derived from winter rains) getting steadily more saline until it dries out completely in summer (June-September). The area has been used for cultivation and saltpans in the past, but the pool is now surrounded by halophile scrub of such species as seablite *Suaeda maritima*, glasswort *Salicornia europaea* and golden samphire *Inula crithmoides*, and sandy patches supporting a rare species of arrow-grass *Triglochin bulbosum*. Bordering this is a grove of tamarisk *Tamarix gallica* on the south, a variety of halophilous vegetation on the hill slopes and plantations of *Acacia* and *Eucalyptus* on the dune separating the seastern end of the reserve from the sea. The wetter

patches also support stands of cane *Arundo donax* and common reed *Phragmites*, which together with a number of carob trees *Ceratonia siliqua* provide nest-sites for 5 out of Malta's 18 breeding birds. These 5 are all small passerines, of which the fan-tailed warbler *Cisticola juncidis* is characteristic, but faunistically the area is particularly noted for the great number of migrants of many scores of species which are attracted to it and will stay to rest and feed provided that water and hence insects are available, – and if not molested.

**Legal status** National Nature Reserve established by Legal Notice No. 126 of 1978, Protection of Birds (Amendment) Regulations. Enacted under the auspices of the Ministry of Health and Environment.

**Management practices** As yet limited, but a comprehensive plan has now been prepared by an expert in this field (H. Axell) and approved in principle by the Ministry. The pool would be enlarged by dredging and made perennial by the construction of a perimeter ditch to carry water from an 0.6 ha, 2 m deep reservoir. The latter is to be constructed at the western end of the area to store rainwater topped up with 20,000 gallons weekly of treated waste from a nearby Holiday Camp. Hides and educational facilities are included in the plan as a second priority and planting of more trees and shrubs, to give shelter and food to migrant birds, is also recommended.

**Threats** Disturbance from traffic on the busy road along the eastern boundary, and especially by picknickers and holiday-makers, remains a problem. One licensee still has shooting rights, but exercises them with discrimination. There is some poaching, also year round shooting on the nearby hills. Agriculture is tending to expand into the scrub-land and the numerous rats to be found on the edge of the cultivation suggest that rat control may become a high priority.

**Scientific research** The area has been kept under observation by ornithologists for at least 25 years. Future subjects for study are how best to diversify the habitat, attract more species, improve the landscape generally and increase the educational impact of the site. A Manager's house and reserve centre are planned together with the installation of two Heligoland traps for the capture and banding of migrants, which should enable the role of the reserve in relation to Western Palearctic bird populations to be accurately determined.

#### **Principal reference material**

Roberts, E. L. 1954. *The Birds of Malta*. Progress Press, Malta.

Sultana, J., Gauci, C. & Beaman, M. 1975. *A guide to the birds of Malta*. Malta Ornithological Society.

Bannerman, D. A. & Vella-Gaffiero, J. A. 1976. *Birds of the Maltese Archipelago*. Museums Dept., Valletta.

# MOROCCO

## SUMMARY OF WETLAND SITUATION

On the Mediterranean coast of Morocco the estuary of the Moulouya river is of international significance as a habitat for waterfowl. This is enhanced by the fact that the Spanish Islas Chafarinas, just off the Cabo di Aqua, 10 km north-west of the rivermouth, are the breeding place of perhaps two-thirds of the world population of Audouin's Gull *Larus audouinii*, which is in the Red Data Book 'rare' category.

The wetlands along the Atlantic coast are of extraordinary importance as feeding and roosting sites for great numbers of waterfowl moving between their breeding grounds in Northern Europe and wintering areas in tropical West Africa. The Merja Zerga towards the northern end of the coast and the Lagune de Khnifiss close to the southern end are reckoned to be the most valuable of these sites. The Lagune is one of the places where the nesting of the Greater Flamingo *Phoenicopterus ruber* has been recorded.

Several of the mountain lakes in the Atlas region are of limnological interest. Some of them in the Moyen Atlas offer suitable habitat for waterfowl and have important populations of the rare, declining and now possibly endangered Crested Coot *Fulica cristata*.

Finally, near to where the river Dra meets the southern border with Algeria, the highly variable Iriki wetland in some years provides suitable conditions for the Greater Flamingo *Phoenicopterus ruber* to nest.

The value of Moroccan wetlands has been officially recognized by the country's accession on 20 June 1980 to the Ramsar Convention, four sites (marked with an asterisk in the checklist which follows) being entered in the Convention list.

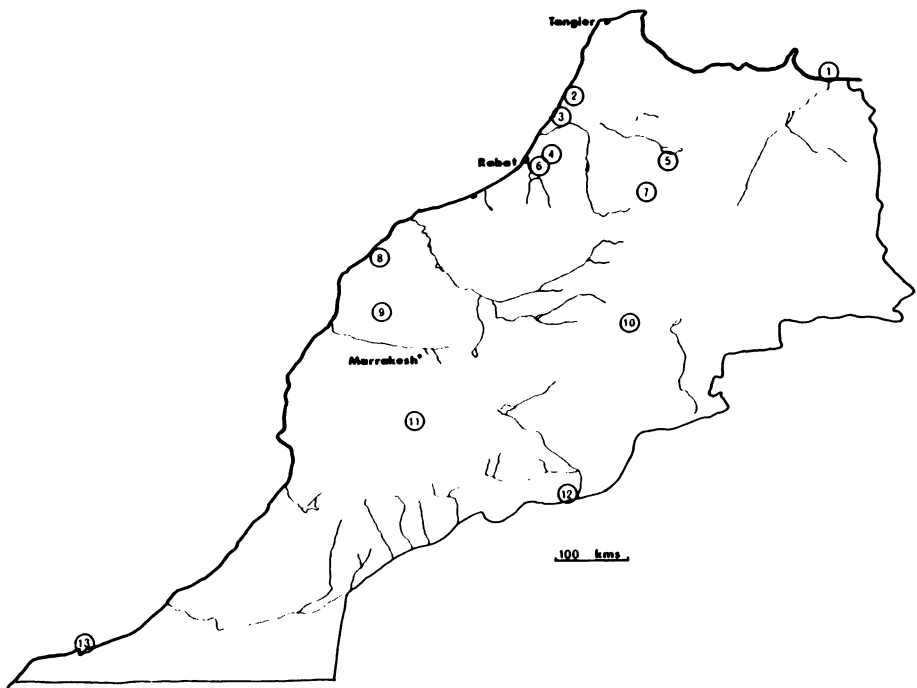
## WETLANDS OF INTERNATIONAL IMPORTANCE

### \*Nominated for inclusion in Ramsar Convention list

	Locality	Latitude	Longitude	Size	Wetland criteria/ Conservation status
1.	Moulouya rivermouth	35°20'N	2°20'W	several sq. km	1c,e; 2a; 4a,b Status uncertain
*2.	Merja Zerga	34°50'N	6°20'W	3,500 ha	1a,b; 2a; 3c; 4a Ramsar Convention Site; National Park planned
3.	Merja Sidi Mohamed Ben Mansour and Merja Daoura	34°35'N	6°30'W	No information	1a,b; 2a; 3c; 4a Unprotected
*4.	Douiyi Sidi Bou Rhaba (Lagune de Mehdiya)	34°15'N	6°40'W	150-250 ha	1a,c,d; 2a; 3c; 4a Ramsar Convention Site
5.	Merja de Douyet	34°05'N	5°00'W	No information	1c; 4a Status uncertain

	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
6.	Bas Bou-Regregg	34°00'N	6°45'W	15 km stretch of river	1a; 2a,b; 3c; 4a Unprotected
*7.	Lacs du Moyen Atlas: sources du fleuve Oumer Rbia	c.33°05'–35'N	5°05'–15'W	500–800 ha	1a,c,d,e; 2a,b; 3c; 4a,b 380 ha Lac d'Affenourir in Ramsar Convention List
8.	Lagune di Oualidia and Lagune de Sidi Moussa	32°44'–33°00'N	8°50'–9°08'W	c.1,000 ha	1a,b,c,e; 2a; 4a Unprotected
9.	Lac et salines de Zima	32°10'N	8°51'W	600 ha	1a,c; 4a Unprotected
10.	Lac Iseli	32°15'N	5°33'W	c.200 ha	1e; 4a Status uncertain
11.	Lac d'Ifni	31°02'N	7°53'W	c.35 ha	2c; 4a Unprotected
12.	Iriki	29°50'N	5°35'W	0–20,000 ha	1d; 2a; 4a Unprotected
*13.	Lagune de Khnifiss (Puerto Cansado)	28°00'N	12°25'W	c.6,000-7,000 ha	1a,b,c,d,e; 2a; 4a, b Unprotected until designated a Ramsar Convention site (1980)

## MOROCCO





## 1. MOULOUYA RIVERMOUTH

**Criteria for inclusion** 1c,e; 2a; 4a,b.

**Geographical location** 35°20'N 2°20'W Eastern end of the Mediterranean coast of Morocco, about 25 km from the Algerian border.

**Area** No figure quoted, but said to be several square kilometres.

**Altitude** Sea level.

**Water depth** Shallow.

**Wetland types** 7, 10, 11, 12.

**Ecology** Lagoons and coastal marshland separated from the sea by dunes. Of botanical interest and as habitat for waterfowl in winter and on migration, especially herons Ardeidae, Spoonbill *Platalea leucorodia*, Greater Flamingo *Phoenicopterus ruber*, Shelduck *Tadorna tadorna*, Ruddy Shelduck *Tadorna ferruginea* and several other species of duck, rails Rallidae and waders Limicolae. Several hundred pairs of Audouin's Gull *Larus audouinii* have been observed at this site, probably representing a large portion of the estimated two-thirds of the world's population of this rare species, which nest on Isabella, one of the Chafarinas islands, a Spanish possession off the Cabo di Aqua about 10 km north-west of the rivermouth. The banks of the river are densely vegetated with rushes *Scirpus* and *Juncus* spp. and glasswort *Salicornia* sp.

**Legal status** No information.

**Tenure** No information.

**Management practices** The water level is said to be controlled, but no details are available.

**Threats** A small pumping installation may possibly have been responsible for the low water level encountered on the site during a visit in February 1972, and unless operated with due regard to wildlife as well as other interests could be an adverse factor.

**Scientific research** Surveys of wintering waterfowl were carried out in 1972, by the International Waterfowl Research Bureau.

### Principal reference material

Brosset, A. 1958, 1959. Les oiseaux de l'embouchure de la Moulouya, Maroc oriental. *Alauda* 26: 36-47; 27: 36-60.

Brosset, A. and Olier, A. 1966. Les Iles Chaffarines, lieu de reproduction d'une importante colonie de Goélands d'Audouin. *Alauda* 34: 187-190.

Hovette, C. and Kowalski, H. 1972. Dénombrements de la sauvagine dans le Maghreb, Janvier/Fevrier 1972. (Stencilled).

## 2. MERJA ZERGA

**Criteria for inclusion** 1a,b; 2a; 3c; 4a.

**Geographical location** 34°50'N 6°20'W On the Atlantic coast about 70 km north of Rabat, Province de Kénitra.

**Area** Lagoon varies between 1,500 and 3,200 ha, but the total area of the Ramsar Convention site is quoted as 3,500 ha.

**Altitude** Sea level.

**Water depth** Maximum 6 m; the mean not estimated.

**Wetland types** 3, 7.

**Ecology** A brackish lagoon of 15 × 20 km depending on the tide, being connected with the sea by a creek, though mostly separated from it by dunes. Except in the tidal channel, the lagoon is shallow and vast mudflats are exposed at low tide. The vegetation bordering the lagoon is dense but apart from *Phragmites* reedbeds in some places is composed mainly of a low cover of rushes *Juncus* spp. and grasses, with glasswort *Salicornia* predominating on several small islands near the northern shore. Parts of the tidal flats are occupied by tassel pondweed *Ruppia* spp.

Probably the most important Moroccan site (with the possible exception of No. 13 Puerto Cansado) for wintering and migrating Limicolae, 300,000 to 400,000 being estimated to be present in January 1964; also for Anatidae, especially Gadwall *Anas strepera* (8,000), Wigeon *A. penelope* (21,000), Teal *A. crecca* (20,000) Pintail *A. acuta* (6,000) and Shoveler *A. clypeata* (16,000), the figures quoted derived from a December 1970 count.

**Legal status** Unprotected, but to be included in a National Park project at the planning stage in 1979 and meanwhile given *de facto* protection by its inclusion in the Ramsar Convention list with effect from 20 June 1980.

**Tenure** No information.

**Management practices** No information.

**Threats** Severe hunting pressure. The use of hovercraft has been reported. Tourist development has not yet affected the beach.

**Scientific research** I.W.R.B. surveys of wintering waterfowl were carried out in 1972, 1974 and 1975.

#### **Principal reference material**

Blondel, J. 1965. Remarques sur l'hivernage des Limicoles et autres oiseaux aquatiques au Maroc. *Alauda* 32(4).

Hovette, C. and Kowalski, H. 1972. Dénombrements de la sauvagine dans le Maghreb janvier/février 1972. (Stencilled).

Zwarts, L. 1972. Bird counts in Merja Zerga, Morocco, December 1970. *Ardea* 60: 120–123.

Johnson, A. R. and Biber, O. 1974. Dénombrements de la sauvagine hivernant le long de la côte atlantique du Maroc en janvier 1974. (Stencilled).

### **3. MERJA SIDI MOHAMED BEN MANSOUR and MERJA DAOURA**

**Criteria for inclusion** 1a,b; 2a; 3c; 4a.

**Geographical location** 34°35'N 6°30'W To the south of site No. 2 and about 50 km north of Rabat.

**Area** No precise information.

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**Altitude** Sea-level.

**Water depth** Shallow and mainly depending on amount of precipitation.

**Wetland type** 23.

**Ecology** Zone of meadows and cultivated fields bordering the coastal road south of the Merja Zerga and at times of sufficient rainfall partly inundated. It then in effect forms an entity with the Merja Zerga and is similarly important for migrating and wintering waterfowl, notably Wigeon *Anas penelope* and Shoveler *A. clypeata*, of which 6,000 and 720, respectively, were estimated to be present in January 1974; and waders such as Grey Plover *Pluvialis squatarola*, Lapwing *Vanellus vanellus* and Black-tailed Godwit *Limosa limosa* (4,500 in January 1972).

**Legal status** Unprotected.

**Tenure** No information.

**Management practices** The surrounding area is populated and cattle are grazed on the grassy margins of standing water.

**Threats** None reported.

**Scientific research** Counts of wintering waterfowl were undertaken by the I.W.R.B. in 1972 and 1974.

**Principal reference material**

Hovette, C. and Kowalski, H. 1972. Dénombrements de la sauvagine dans le Maghreb, janvier/février 1972. (Stencilled).

Johnson, A. R. and Biber, O. 1974. Dénombrements de la sauvagine hivernant le long de la côte atlantique du Maroc en janvier 1974. (Stencilled).

#### 4. DOUIYA SIDI BOU RHABA (LAGUNE DE MEHDIA)

**Criteria for inclusion** 1a,c,d; 2a; 3c; 4a.

**Geographical location** 34°15'N 6°40'W In the same general area as the last two wetlands described, but somewhat further south and only about 35 km north of Rabat, Province of Kénitra.

**Area** 150–250 ha.

**Altitude** Sea level.

**Water depth** Shallow.

**Wetland type** 11.

**Ecology** A narrow brackish coastal marsh surrounded by woods and thick marsh vegetation and separated from the sea by a major dune system. In the migration seasons the area is visited by important numbers of duck, waders and other waterfowl. Only a small proportion of the duck stay to winter, although some Marbled Teal *Anas angustirostris* were noted in January 1974. Breeding species include the Great Crested Grebe *Podiceps cristatus*, Mallard *Anas platyrhynchos*, the rare Crested Coot *Fulica cristata* and Black-winged Stilt *Himantopus himantopus*.

**Legal status** A project for giving the lagoon legal protection has, so far as is known, not yet been implemented, but the wetland has now been included in the

Ramsar Convention list so enjoys a measure of protection.

**Tenure** No information.

**Management practices** None reported.

**Threats** Tourist activities and particularly campers are having an adverse effect. The vegetation around the lagoons is being badly overgrazed.

**Scientific research** Counts of wintering waterfowl were undertaken by the I.W.R.B. in 1972 and 1974.

**Principal reference material**

Hovette, C. and Kowalski, H. 1972. Dénombrements de la sauvagine dans le Maghreb, janvier/février 1972. (Stencilled).

Johnson, A. R. and Biber, O. 1974. Dénombrements de la sauvagine hivernant le long de la côte atlantique du Maroc en janvier 1974. (Stencilled).

## 5. MERJA DE DOUIYET

**Criteria for inclusion** 1c; 4a.

**Geographical location** 34°05'N 5°00'W In the immediate vicinity of the city of Fez (Fés).

**Area** No information.

**Altitude** c.200 m.

**Water depth** No information.

**Wetland type** 18.

**Ecology** Surrounded by dense vegetation, this lake was estimated to be providing winter quarters for between 3,000 and 5,000 ducks and coots in January 1972, including in particular the two rare species Marbled Teal *Anas angustirostris* and Crested Coot *Fulica cristata*.

**Legal status** No information.

**Tenure** No information.

**Management practices** None reported.

**Threats** None reported.

**Scientific research** The site was included in an I.W.R.B. wintering waterfowl survey in January 1972.

**Principal reference material**

Hovette, C. and Kowalski, H. 1972. Dénombrements de la sauvagine dans le Maghreb, Janvier/Fevrier 1972. (Stencilled).

## 7. LACS DU MOYEN ATLAS et SOURCES DU FLEUVE OUMER RBIA

**Criteria for inclusion** 1a,c,d,e; 2a,b; 3c; 4a,b.

**Geographical location** c.33°05'–35'N 5°05'–15'W Mountainous region to the south and south-east of Azrou, Province de Meknès.

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**Area** Total water area 500 to 800 ha.

**Altitude** c.100–1500 m.

**Water depth** No information; presumably very variable.

**Wetland types** 14, 18.

**Ecology** A group of 36 mountain lakes spread over a fairly large area, of which Aaoua, Hachlaff, Tifounassine, Sidi Ali, Affennourir and Annoceur are the most interesting. The lakes are permanent and mesotrophic, with abundant vegetation both submersed and emergent. In addition to their hydrobiological interest they are of great importance for waterfowl on passage and also in winter (unless frozen over). The Daia Annoceur had an important population of 2,000 Crested Coot *Fulica cristata*, when visited in January 1972, and some Marbled Teal *Anas angustirostris* were observed as well. The Ruddy Shelduck *Tadorna ferruginea* is known to nest in the area.

The springs of the River Oumer Rbia have an interesting halophile flora and fauna. Also worth mentioning, although a considerable distance to the south and west of the area (29°58'N 5°27'W but still well within the Moyen Atlas range) is the Aguelmane Azigza lake, alkaline, rich in plankton and of considerable limnological interest.

**Legal status** None of the lakes are known to be protected, with the exception of the 380 ha Lac d’Affennourir, now designated as a Ramsar Convention site.

**Tenure** No information except for the Aguelmane Azigza, which is state-owned.

**Management practices** Probably none.

**Threats** None reported.

**Scientific research** A survey of wintering waterfowl was carried out by the I.W.R.B. in 1972.

**Principal reference material**

Gayral, P. 1954. Recherches phytolimnologues au Maroc. *Trav. Inst. Sci. chérifien, Sér. Botan.* 4.

Blondel, J. and C. 1964. Remarques sur l’hivernage des Limicoles et autres oiseaux aquatiques au Maroc (janvier 1964). *Alauda* 32(4).

Hovette, C. and Kowalski, H. 1972. Dénombrements de la sauvagine dans le Maghreb janvier/février 1972. (Stencilled).

**8. LAGUNE DE OUALIDIA et LAGUNE DE SIDI MOUSSA**

**Criteria for inclusion** 1a,b,c,e; 2a; 4a.

**Geographical location** 32°44'–33°00'N 8°50'–9°08'W About 180 km south-west of Casablanca on the Atlantic coast.

**Area** c.1,000 ha.

**Altitude** Sea level.

**Water depth** Shallow.

**Wetland type** 7.

**Ecology** A series of lagoons separated from the sea by dunes and stone walls. Vast areas are covered by glasswort *Salicornia*, intermixed here and there by patches of reeds *Phragmites*. Some artificial ponds have been constructed for oyster culture and the lagoons are surrounded by meadows and fields.

One of the most important sites in Morocco for migrating and wintering Limicolae. An endangered species, the Slender-billed Curlew *Numenius tenuirostris*, was observed here in small numbers in January 1964. Small numbers of duck winter, among which the uncommon Marbled Teal *Anas angustirostris* deserves mention. In counts made during August, September 1971 and 1972, about 18,000 waders Limicolae were estimated to be present in the 40 km stretch of the coast of an average width of a kilometre (4,000 ha), which includes this wetland.

**Legal status** Unprotected.

**Tenure** No information.

**Management practices** Oyster culture.

**Threats** Part of the lagoon near Oualidia has been drained and is being used for various development projects, but so far the remaining area is unaltered.

**Scientific research** Surveys of wintering and migrating waterfowl were undertaken by the I.W.R.B. in 1964, 1972 and 1974. A bird-ringing expedition visited the area under the auspices of the University of East Anglia in August/September 1971.

**Principal reference material**

Blondel, J. and C. 1964. Remarques sur l'hivernage de Limicoles et autres oiseaux aquatiques au Maroc. *Alauda* 32(4).

Hovette, C. and Kowalski, H. 1972. Dénombrements de la sauvagine dans le Maghreb janvier/février 1972. (Stencilled).

Pienkowski, M. W. (ed.) 1972. Report on the University of East Anglia Expedition to Morocco 1971. Norwich (mimeo.)

Pienkowski, M. and Knight, P. J. 1974. Autumn counts of waders on the Atlantic Coast of Morocco. *I.W.R.B. Bull.* 38: 89-92.

Pienkowski, M. W. (ed.) 1975. Studies on coastal birds and wetlands in Morocco 1972. Reports of the University of East Anglia Expedition to Tarfaya, Morocco 1972 and the Cambridge Sidi Moussa Expedition 1972. (Mimeographed).

## 10. LAC ISELI

**Criteria for inclusion** 1e; 4a.

**Geographical location** 32°15'N 5°33'W In the Haut Atlas about 100 km west of Ksar es Souk.

**Area** c.200 ha.

**Altitude** 2,200 m.

**Water depth** Maximum 92 m; mean depth unknown.

**Wetland type** 19.

**Ecology** An oligotrophic mountain lake with an interesting fish fauna and a phytoplanktonic flora.

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**Legal status** No information.

**Tenure** State ownership.

**Management practices** Used for fishing.

**Threats** None reported.

**Scientific research** Only a small amount of limnological research has been done on this lake.

**Principal reference material**

Gayral, P. 1954. Recherches phytolimnologiques au Maroc. *Trav. Inst. Sci. cherifien, Sér. Bot.* 4.

**11. LAC D'IFNI**

**Criteria for inclusion** 2c; 4a.

**Geographical location** 31°02'N 7°53'W Towards the western end of the Haut Atlas range, about 110 km west of the provincial capital Ouarzazate.

**Area** 35 ha.

**Altitude** 2,312 m.

**Water depth** Maximum 65 m; mean 20–30 m.

**Wetland type** 19.

**Ecology** A high mountain lake of considerable limnological interest. Its presence is due to a natural barrier or dam caused by a landslide. The waters are oligotrophic. It is probably a unique example of this type of lake in the whole of the Maghreb.

**Legal status** Unprotected.

**Tenure** State ownership.

**Management practices** Used for fishing.

**Threats** None reported.

**Scientific research** A small amount of limnological work has been undertaken.

**Principal reference material**

Panouse, J. 1963. Le Lac d'Ifni. *Bull. Soc. sci. nat. phys. Maroc* 43(1).

**13. LAGUNE DE KHNIFISS (PUERTO CANSADO)**

**Criteria for inclusion** 1a,b,c,d,e; 2a; 4a,b.

**Geographical location** 28°00'N 12°25'W

**Area** c.6,000–7,000 ha.

**Altitude** Sea level.

**Water depth** Shallow.

**Wetland type** 7.

**Ecology** Saline lagoon in communication with the sea, about 25 km long and 1 to 3 km wide. A vast complex of mudflats, some areas covered by tassel pondweed *Ruppia* spp., is exposed at low tide. The glasswort *Salicornia* steppe surrounding the lagoon gradually gives way to a 3,000 ha 'sebkha' zone, flat plain without vegetation or water.

Probably the most important wintering and migration site in Morocco for Limicolae, notably Oystercatcher *Haematopus ostralegus*, Ringed Plover *Charadrius hiaticula*, Kentish Plover *C. alexandrinus*, Grey Plover *Pluvialis squatarola*, Dunlin *Calidris alpina*, Little Stint *C. minuta*, Knot *C. canutus*, Sanderling *C. alba*, Redshank *Tringa totanus*, Curlew *Numenius arquata* and Bar-tailed Godwit *Limosa lapponica*. Other wintering birds include Spoonbill *Platalea leucorodia*, Osprey *Pandion haliaetus* and gulls Laridae. The Greater Flamingo *Phoenicopterus ruber* may breed here in some years. The endangered Slender-billed Curlew *Numenius tenuirostris* was observed in this locality in 1964, its numbers estimated as high as 700 in total.

**Legal status** Hunting reserve and now designated in its entirety a Ramsar Convention site.

**Tenure** No information.

**Management practices** None noted except for the control of hunting.

**Threats** Road building and military activity on the nearby frontier to the south could well be threatening this hitherto remote area with disturbance as well as making it more accessible.

**Scientific research** Surveys of wintering waterfowl were carried out by the I.W.R.B. in 1972 and 1974.

**Principal reference material**

Blondel J. and C. 1964. Remarques sur l'hivernage des Limicoles et autres oiseaux aquatiques au Maroc (janvier 1964). *Alauda* 32(4).

Johnson, A. R. and Biber, O. 1974. Dénombrements de la sauvagine hivernant le long de la côte atlantique du Maroc en janvier 1974. (Mimeo.).



# NETHERLANDS

## SUMMARY OF WETLAND SITUATION

The flat, open country of the Netherlands, dominated by the delta of the rivers Rhine, Maas, Schelde, IJssel and their numerous branches, has a great number of wetlands of international importance.

The Waddenzee, which extends from the north of the country along the coasts of the Federal Republic of Germany and Denmark, is undoubtedly the most important single wetland in Western Europe and of vital importance to huge numbers of waterfowl both breeding in the area and passing through during migration seasons. Its shallow and relatively warm water provides an excellent nursery-ground for many species of fish and crustacea.

In the delta area many inlets of the sea along the coast and between the islands of the Zuid-Holland and Zeeland provinces have been closed off by dikes, to prevent a repetition of the catastrophic floods of 1953, with the result that the saltwater character of the wetlands in this region is giving way to a freshwater environment. But the indications are that these areas, which always have been of great importance to waterfowl, especially wintering geese, are keeping up their former significance, whilst some of the recently drained polders of the IJsselmeer are providing additional habitats for waterfowl which are highly suited to their needs.

Inland, a number of major freshwater lake complexes, in various parts of the country, are of great importance to breeding and wintering waterfowl. Several of them are of limnological interest and many also serve recreational purposes during the summer months. The characteristic deep waterholes along riverbanks (Wielen), formed by dike-falls, are of particular scientific interest by reason of their limnological and hydrobiological qualities.

Responsibility for these wetland assets is vested in the Ministry of Culture, Recreation and Social Welfare in the Hague, as the country's Nature Conservation Authority. On 23 May 1980, the Netherlands acceded to the Ramsar Convention, nominating 6 sites (together with another 6 sites in the Netherlands Antilles) for inclusion in the Convention list. Except for de Groote Peel the six Netherlands sites are covered and indicated in the following checklist and relevant detailed descriptions.

## WETLANDS OF INTERNATIONAL IMPORTANCE

\*Nominated for inclusion in the Ramsar Convention list

	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
*1.	Waddenzee (Waddensea)	52°55'– 53°35'N	4°45'–6°33'E	c.270,000 ha	1a,b,c,d,e; 2a,b,c; 3a,b,c; 4a,c Partly protected (nature reserves, seal reserves; the 4,400 ha Bosplaat & 23 ha de Griend are Ramsar Convention sites)

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	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
2.	Friesland Levels (goose wintering- grounds)	52°50'– 53°25'N	5°20'–7°10'E	c.8,000 ha	No details available
2.1.	Anjumer Kolken				
2.2.	Beetsterzwaag area	53°03'N	6°05'E		
2.3.	Boezemlanden bij Alkmarijp				
3.	Slufter	53°10'N	4°47'E	400 ha	2a,b,c; 3a,b,c; 4a,b Protected (nature reserve)
4.	Terkappelster Poelen	53°05'N	5°46'E		No details available
5.	Coast of the Ijsselmeer between Makkum and Workum and Laaxum and Lemmer	52°50'– 53°05'N	5°21'–43'E	c.55 km shoreline	1a,b,c,d,e; 2a,b,c; 3b,c; 4a,b Partly protected
6.	Vennen (Fens) bij Wijster	52°50'N	6°35'E	c.1 ha each	Unprotected
7.	Fochteloër Veen	52°57'– 53°02'N	6°20'–25'E	616 ha	1d,e; 2a,b,c; 3a,b; 4a Protected as Nature Reserve
8.	Tjeukemeer	52°55'N	5°40'E	c.2,000 ha	No details available Unprotected
9.	Dwingelose en Kralose Heide	52°47'–49'N	6°21'–24'E	c.1,400 ha	1d,e; 2a,b; 3b,c Protected as Nature Reserve
*10.	Wieden en Weerribben	52°40'–50'N	5°55'–6°10'E	17,000 ha	1a,b,c,d,e; 2a,c; 3a,b,c; 4a,b Partly protected: Wieden as Nat. Park; and 2,500 ha of Weerribben as Nature Reserve under Ramsar Convention auspices
11.	Zwanenwater	52°50'N	4°40'E	580 ha	1a,c,d,e; 2a; 3c; 4a,b Privately owned nature reserve
12.	Lakes bordering the Ijsselmeer	52°15'–40'N	5°00'–59'E	c.22,000 ha	1a,b,c,e; 2a,b; 3a,b,c; 4a Partly protected
13.	Waterland	52°23'N	5°00'E	c.9,000 ha	1a,c; 2a,c; 3a,c; 4a Partly protected as a State nature reserve
14.	Wormer en Jisperveld	52°30'N	4°48'E	c.1,700 ha	1c,d; 2a,c; 3c; 4a Partly protected (385 ha nature reserve)

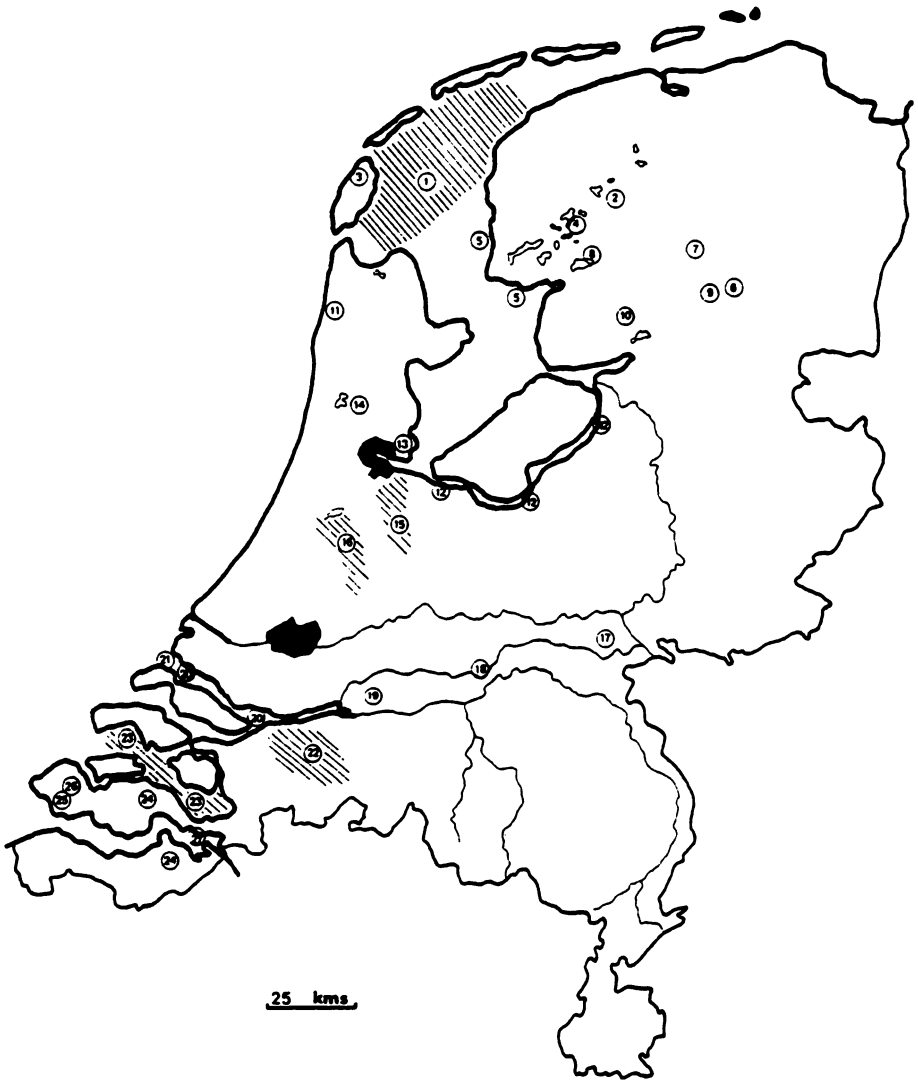
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	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criterial Conservation status</i>
15.	Oostelijke Vechtplassen				
*15.1.	Naardermeer	52°18'N	5°07'E	752 ha	1a,b,c,d,e; 2a,b; 3a,b; 4a,b Privately owned nature reserve now Ramsar Convention site
15.2.	Botshol	52°15'N	4°55'E	c.300 ha	1d,e; 2a,b; 3a,b,c; 4a,b Partly protected (incl. 62 ha nature reserve) Partly protected
15.3.	Ankeveense Plassen	52°16'N	5°05'E		Partly protected
15.4.	Kortenhoefse Plassen	52°15'N	5°05'E		Partly protected
15.5.	Wijde Blik				Partly protected
15.6.	Loenense Plassen	52°13'N	5°03'E		Partly protected
15.7.	Loosdrechtse Plassen	52°13'N	5°10'E		Partly protected
15.8.	Tienhovense Plassen	52°11'N	5°10'E		Partly protected
15.9.	Maarsseveense Plassen	52°10'N	5°10'E		
15.10	Plas Vechten	52°05'N	5°10'E		Unprotected
16.	Zuid-Holland Lakes				
16.1.	Westeinder Plassen	52°15'N	4°45'E	c.1,600 ha	
16.2.	Brasmer Meer	52°11'N	4°42'E		Partly protected
16.3.	Plassen van Langeraar	52°11'N	4°45'E	c.200 ha	
16.4.	Kager Plassen	52°11'N	4°32'E		
16.5.	Vinkeveense Plassen	52°14'N	4°50'E		
16.6.	Nieuwkoopse Plassen	52°10'N	4°45'E	c.500 ha	Partly protected
16.7.	Reeuwijkse Plassen	52°04'N	4°43'E	c.1,500 ha	
17.	Wiel bij Haalderen	51°53'N	5°56'E	c.1 ha	2a,b,c; 4a Unprotected
18.	Kil en Ulterwaarden van Hurwenen	51°49'N	5°18'E	c.450 ha	1a,d,e; 2a,c; 4a Partly protected as State Nature Reserve
*19.	Brabantse, Sliedrechtse en Dordse Biesbos	51°43'–51'N	4°37'–56'E	c.5,500 ha	1a,b,d,e; 2a; 3a,b,c; 4a Partly protected (incl. 1,500 ha State Nature Reserve and 2,650 ha Ramsar Convention site)
20.	Hollands Diep en Haringvliet	51°43'–51'N	4°02'–38'E	c.16,000 ha	1a,b,e; 2a; 3b,c; 4a Partly protected as State Nature Reserve

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	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
21.	Quackjeswater en Breede water	51°51'N	4°05'E	c.45 and 25 ha respectively	1c,d; 2a; 3a,b,c; 4a Privately owned nature reserve
22.	Noord-Brabant, Breda to Willemstad sector (goose wintering grounds)	51°35'–40'N	4°15'–50'E		
23.	Oosterschelde	51°27'–42'N	3°40'–4°17'E	c.34,000 ha	1a,b,c,d,e; 2a,b; 3a,b,c; 4a Unprotected except one small nature reserve
24.	Zeeland (goose wintering grounds)	c.51°15'–30'N	3°50'–4°00'E		
24.1.	De Poel bij Goes				
24.2.	De Putting bij Kloosterzande				
24.3.	Groot Eiland bij Hulst				
25.	Rammekenshoek	51°27'N	3°35'E	c.100 ha	Protected as State Nature Reserve
26.	Polders near Grijskerke, Walcheren	51°05'N	3°35'E		Unprotected
27.	Verdronken Land van Saaftinge	51°23'N	4°07'E	c.3,400 ha	1a,b,d,e; 2a,b; 3a,c; 4a Protected

**Note** Several stretches of river have been shown by IWRB mid-winter counts to be of international importance as waterfowl habitat, namely —  
 IJssel between Zutphen and Keteldiep  
 Waal between Kekerdom and Zaltbommel  
 Rijn between Spijk and Arnhem  
 Oude Maas between Barendrecht and Puttershoek

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## DETAILS OF LISTED AREAS

### 1. WADDENZEE (Waddensea)

**Criteria for inclusion** 1a,b,c,d,e; 2a,b,c; 3a,b,c; 4a,c.

**Geographical location** 52°55'–53°35'N 4°45'–7°10'E The marine zone situated between the mainland of the Provinces of Groningen, Friesland and Noord Holland and the fringe of islands bordering it to the west and north from Den Helder to Borkum-Emden. The Dutch Waddensea is the westernmost sector of the vast

complex of shallows stretching along the coast of the Federal Republic of Germany and thence north to Esbjerg on the west coast of Denmark.

**Area** c.270,000 ha

**Altitude** Sea level

**Water depth** Maximum c.30 m in deeper channels draining into the open sea; average between 2 and 3 m, many places drying out at low tide.

**Wetland types** 1, 2, 3, 5, 6, 7, 10, 11.

**Ecology** Mainly shallow sea large areas of which dry out at low tide, forming expanses of sand or mud intersected by a multi-branched system of big and small creeks. Salt marshes of great botanical interest occur along the coasts of islands as well as inside the dykes protecting the mainland. The following dominant types of vegetation form a succession from sea to land: Spartinion, Thero-Salicornion, Puccinellion maritimae, Puccinellio-Spergularion salinae, Armerion maritimae, Lolio-Plantaginion. The Waddenzee (with its Danish and West German sectors *q.v.*) is of extraordinary importance for breeding, moulting, migrating and wintering waterfowl. Species which nest include Eider *Somateria mollissima*, Spoonbill *Platalea leucorodia*, Avocet *Recurvirostra avosetta*, Sandwich Tern *Sterna sandvicensis* and Little Tern *Sterna albifrons*. Hundreds of thousands of other waders Limicolae, ducks Anatidae and gulls and terns Laridae, visit the area in the course of their migrations, the most numerous species (based on counts on September 1972) being Oystercatcher *Haematopus ostralegus* 242,000, Curlew *Numenius arquata* 101,650, Bar-tailed Godwit *Limosa lapponica* 51,700, Dunlin *Calidris alpina* 274,130 and Redshank *Tringa totanus* 34,750. A population of Common Seals *Phoca vitulina* still survives in the Waddenzee though its number is down to about 500 and still declining. The shallow waters are of great importance as a fish nursery.

**Legal status** Several areas are protected as state-owned, wardened nature reserves, viz. the mudflats of the Dollard (with a 14 km coastline), the De Band polder including some of its periphery (320 ha), Bildtpolden (3,200 ha), saltmarshes behind the Eendracht polder on Texel (6,700 ha), Eyerlandse Gat seal-reserve (20,000 ha), Noordsvaarder (650 ha), Bosplaat (4,400 ha, awarded the Council of Europe's Diploma), another seal-reserve south-east of Schiermonnikoog, Kobbeduinen (2,400 ha) and Griend (c.23 ha). The Bosplaat and Griend have been nominated for the Ramsar Convention list.

**Tenure** Mostly state-owned (Ministry of Finance; Domeinendienst) but small areas totalling c.4,500 ha are privately owned. The Eendracht-polder salt-marshes on Texel are on a long lease to the Netherlands Society for the Preservation of Nature Reserves (Vereniging tot Behoud van Natuurmonumenten).

**Management practices** Wardening of nature reserves and bird breeding colonies; measures to restrict the number of breeding pairs of Herring Gull *Larus argentatus*. A regional management plan for the entire Waddenzee area is an urgent requirement but still at the discussion stage.

**Threats** Mass recreation and other tourist activities; military training grounds; gas and oil exploitation; industrial and port developments; pollution by waste water; canal construction, reclamation and dyke building.

**Scientific research** Investigations into the hydrology, hydro-biology, flora, fauna and ecological aspects of the area have been carried out for many years and are still continuing. A group of scientists of different disciplines (the "Wadden Work-

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ing Group”) and the Institute for Sea Research (NIOZ) on Texel have been particularly involved in the studies undertaken for the governmental Waddensea Committee.

**Principal Reference Material**

Verwey, J. *et al.* 1966 A plea for the Waddon Sea. Contact Committee for Nature and Landscape Preservation, Den Haag.

Anon. 1974. Rapport van de Waddenzeecommissie. Staatsuitgeverij, Den Haag.

**3. SLUFTER**

**Criteria for inclusion** 2a,b,c; 3a,b,c; 4a,b.

**Geographical location** 53°10'N 4°47'E In the north-western part of the island of Texel.

**Area** 400 ha.

**Altitude** Sea level.

**Water depth** Maximum 1.5–2 m at high tide; average between 0.2 and 0.5 m, in the creeks and open water, at low tide.

**Wetland types** 1, 5, 7, 11.

**Ecology** A large coastal lagoon with shallow water and creeks in communication with the North Sea. Most of the basin is flooded only during very high tides. The vegetation zones reflect small differences in altitude: thus *Salicornietum stricta* occurs in places flooded at spring tides; slightly above that level the *Plantagini-Limonietum* alliance is found, followed by *Armerion maritimae*. The August flowering of sea lavender *Limonium vulgare* is particularly beautiful.

The Slufter is an important breeding place for Shelduck *Tadorna tadorna*, Eider *Somateria mollissima*, Oystercatcher *Haematopus ostralegus*, Avocet *Recurvirostra avosetta*, Ringed Plover *Charadrius hiaticula*, Kentish Plover *C. alexandrinus*, Lapwing *Vanellus vanellus*, Redshank *Tringa totanus*, Curlew *Numenius arquata*, Black-tailed Godwit *Limosa limosa*, and Snipe *Gallinago gallinago*. Grey Plovers *Pluvialis squatarola* and many other species of wader *Limicolae* rely on it as a feeding-ground during migration.

**Legal status** Nature Reserve under the supervision of the Forestry Service of the Ministry of Agriculture.

**Tenure** State-ownership.

**Management practices** The reserve is warded during the breeding season (March to July), when only a small strip between the beach and the polder is open to the public; grazing by sheep is used to maintain the character of the northern part of the reserve.

**Threats** Pressure from recreational activities and oil pollution are the only problems which cause some concern.

**Scientific research** A study of the physical geography and constantly changing course of the creek connecting the lagoon with the North Sea has been undertaken by the Forestry Service and the Research Institute for Nature Management (RIN).

**Principal Reference Material**

Terwindt-van den Berg, M. J. H. M. 1961. De Slufter op Texel. *Tijdschrift van het Koninklijk Nederlands Aardrijkskundig Genootschap*, tweede reeks 78(4): 374–379.

**5. COAST OF THE IJSSELMEER between Makkum and Workum and Laaxum and De Lemmer**

**Criteria for inclusion** 1a,b,c,d,e; 2a,b,c; 3b,c; 4a,b

**Geographical location** 52°50'–53°05'N 5°21'–43'E Western shorelines of Friesland to the south of the great dike (afsluitdijk) separating the IJsselmeer from the Waddenzee and about 15 and 28 km, respectively, to the west and south of the town of Sneek.

**Area** The two coastal zones comprising the wetland are about 25 and 30 km in length and 1–2 km wide (c.8,250 ha).

**Altitude** Near sea-level.

**Water depth** Maximum 1.5 m; average very shallow, 0.25–0.50 m.

**Wetland type** 18.

**Ecology** A series of formerly brackish salt marshes, partly enclosed by embankments, shallow coastal waters and sheltered bays with some sand and mud. The shores of the southern sector are bordered by the steep banks or low cliffs typical of the Gaasterland coast. The open water is still slightly brackish. The flora of the Oude Mirdum cliff is of botanical interest due to the transition from poor and dry to more fertile and wet. Some relicts of salt-tolerant vegetation occur (e.g. thrift *Armeria maritima*, sea holly *Eryngium maritimum*, sea aster *Aster tripolium*); rare plants include chestnut sedge *Scirpus* (= *Blysmus*) *rufus* (Workumerwaard), divided sedge *Carex divisa* (Makkumerwaard) and the hybrid *Carex otrubae* × *paniculata*. Coastal waters are bordered by wide belts of fennel pondweed *Potamogeton pectinatus* and reeds and rushes *Phragmites communis*, *Scirpus* spp. and *Typha* spp. occur along the shores.

The area is of very great importance to nesting, migrating, moulting and wintering waterfowl. Breeding species include Bittern *Botaurus stellaris*, Marsh Harrier *Circus aeruginosus*, Water Rail *Rallus aquaticus*, Lapwing *Vanellus vanellus*, Redshank *Tringa totanus*, Ruff *Philomachus pugnax*, Common Tern *Sterna hirundo* and Bearded Tit *Panurus biarmicus*. The area is frequented by tens of thousands of ducks, swans and geese in autumn, winter and spring, including Bewick's Swan *Cygnus bewickii*, Mute Swan *C. olor*, Greylag Goose *Anser anser*, Pink-footed Goose *A. brachyrhynchus*, White-fronted Goose *A. albifrons*, Barnacle Goose *Branta leucopsis*, Mallard *Anas platyrhynchos*, Wigeon *A. penelope*, Teal *A. crecca*, Pintail *A. acuta*, Shoveler *A. clypeata*, Tufted Duck *A. fuligula*, Scaup *Aythya marila*, Pochard *A. ferina*, Goldeneye *Bucephala clangula*, Goosander *Mergus merganser* and Smew *M. albellus*. Other numerous visitors include many species of Laridae and Limicolae, Spoonbills *Platalea leucorodia* and Cormorants *Phalacrocorax carbo*. There is still a population of Otters *Lutra lutra*.

**Legal status** The most important sectors, Makkumer en Kooiwaard (660 ha), Workumerwaard (275 ha), Stoenkherne (80 ha), Bocht van Molkwerum (1,300 ha), Mokkebank/Steile Bank (2,000 ha) and Oude Mirdumer Klif (22 ha), are



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nature reserves administered and managed by private nature conservation organizations.

**Tenure** Nearly the whole area is state-owned (Ministry of Finance, Domeinendienst). The 22 ha of Oude Mirdumer Klif are privately owned by the Vereniging tot Behoud van Natuurmonumenten.

**Management practices** When necessary the shoreline vegetation is cut or burned in winter. Controlled grazing of grassland is encouraged for conservation purposes. In most reserves, except parts of the Makkumerwaard and Workumerwaard, there is no or only limited access. The reserves are warded in the breeding season. No shooting is allowed in reserves except on a limited scale in the Workumerwaard.

**Threats** Increasing recreation, camping, and modern agricultural practices (such as early mowing) threaten the Makkumerwaard and the coast generally. Disturbance by visitors of both land and water areas may well become a more serious problem.

**Scientific research** Botanical and ornithological surveys have been undertaken.

### Principal Reference Material

Timmerman, A. 1962. De Makkumer Noordwaard als watervogel-trekreservaat. *Vanellus* 15(9).

Timmerman, A. 1962. De Workumerwaard als vogelbroedterrein. *De Levende Natuur* 65(9).

Philippona, J. and van der Meulen, H. T. 1969. De Ganzen in het Midden en Zuiden van Friesland. *Limosa* 42(3/4).

## 7. FOCHTELOËR VEEN

**Criteria for inclusion** 1d,e; 2a,b,c; 3a,b; 4a

**Geographical location** 52°57'–53°02'N 6°20'–25'E Near the border between Drenthe and Friesland Provinces, 11 km west of Assen.

**Area** 616 ha.

**Water depth** Shallow.

**Wetland types** 20, 22.

**Ecology** The Fochteloër fen is one of the last remaining typical flat peatbogs in the Netherlands, a biotope now generally rare throughout north-western and continental Europe. Its centre is still composed of the characteristic hummocks and hollows of living peat dominated by such plants as *Sphagnum* spp., white beak-sedge *Rhynchospora alba*, hare's tail *Eriophorum vaginatum*, cranberry *Oxycoccus* (= *Vaccinium*) *palustris*, marsh andromeda *Andromeda polifolia*, purple moor-grass *Molinia caerulea* and cross-leaved heath *Erica tetralix* – a habitat favoured by the bog ant *Formica picea*. The peat core is surrounded by a drained and more or less degenerate bog supporting a mixture of damp and dry heath and birch *Betula pubescens*. The wetland is an important breeding place for Teal *Anas crecca*, Black Grouse *Lyrurus tetrix*, Curlew *Numenius arquata*, Black-tailed Godwit *Limosa limosa* and Common Snipe *Gallinago gallinago* and the reptiles include the Adder *Vipera berus*.

**Legal status** Protected as a Nature Reserve.

**Tenure** 407 ha are state-owned but on a long lease to the Vereniging tot Behoud van Natuurmonumenten, which also owns the remaining 209 ha.

**Management practices** Hydrological control is exercised with a view to preventing eutrophication. Undesirable growth of birches and other woody species is checked by cutting. There is no shooting and access is very restricted.

**Threats** Exploitation of gas- and oil-bearing strata, drainage of the surrounding farmland and development of recreational facilities in the neighbourhood of the reserve are all potential threats.

**Scientific research** Research on the vegetation and on the ethology of *Lyrurus tetrrix* has been undertaken by the University of Groningen and still continues.

#### **Principal Reference Material**

Weevers, T. 1938. Het hoogveen van Fochtelloo. *De Levende Natuur* (42)(12).

Neijenhuijs, F. 1973. Hoogveen in Nederland: Een verdwijnend landschapstype? *Natuur en Landschap* 27(3/4).

Westhoff, V., Bakker, P. A., van Leeuwen, C. G., van der Voo, E. E. and Zonneveld, J. S. 1973. *Wilde Planten III*. Vereniging tot Behoud van Natuurmonumenten in Nederland, Amsterdam.

## **9. DWINGELOSE EN KRALOSE HEIDE**

**Criteria for inclusion** 1d,e; 2a,b; 3b,c; 4a,b

**Geographical location** 52°47'–49°N 6°21'–24'E About 7 km north-west of Hoogveen, Province of Drenthe.

**Area** c.1,400 ha.

**Altitude** 8–13 m above sea level.

**Water depth** Maximum 2 m in open water and marsh; average no more than 0.20 m.

**Wetland types** 19, 22.

**Ecology** The Dwingelose and Kralose Heide is the largest and most outstanding surviving sample of the original heathland of Drenthe Province. It is largely dominated by bog heather or cross-leaved heath *Erica tetralix* interspersed with several wet and still fairly oligotrophic fens supporting an *Erico-Sphagnetum magellanici* plant association. The majority of the other waterbodies have been more or less modified, mainly as a result of the inflow of guano from colonies of Black-headed Gulls *Larus ridibundus*, although a number of fens and pools in the surrounding forested area have escaped this pollution.

Waterfowl species include Black-necked Grebe *Podiceps nigricollis*, Little Grebe *Tachybaptus ruficollis*, Teal *Anas crecca*, Shoveler *A. clypeata*, Hen-harrier *Circus cyaneus*, Black Grouse *Lyrurus tetrrix*, Lapwing *Vanellus vanellus*, Curlew *Numenius arquata*, Black-tailed Godwit *Limosa limosa* and Common Snipe *Gallinago gallinago*. The wetland is also well endowed with reptiles, amphibians and invertebrates (notably Coleoptera and Lepidoptera).

**Legal status** Protected as a Nature Reserve.

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**Tenure** There are 398 ha in State ownership and 989 ha owned by the Vereniging tot Behoud van Natuurmonumenten.

**Management practices** Those used prior to the creation of the Reserve for maintaining the heathland have been continued and include grazing by sheep, burning and cutting over of sections of the heath each year, and removal of undesirable shrubs and swamp vegetation. Other measures proposed include peat-cutting, dredging of fens in a dry summer, and filling in of drainage ditches.

**Threats** Increasing pressure due to recreation; pollution; exploitation of gas- or oil-bearing strata near the reserve.

**Scientific research** A vegetation map has already been completed and current research is concentrated on the avifauna and the coleopterous and Acrididae (grasshopper and locust) populations.

### Principal reference material

van Embden, J. G. H. and Douw, M. H. 1965. De vegetatie van het Zuid-West gedeelte van de Dwingelose Heide. Report published by the Agricultural University, Wageningen.

Tjallingii, S. and Hoekstra, A. Een stukje Kralose Heide. *Kruipnieuws* 24(3/4). Date not quoted, but presumably c.1973.

## 10. WIEDEN en WEERRIBBEN

**Criteria for inclusion** 1a,b,c,d,e; 2a,c; 3a,b,c; 4a,b.

**Geographical location** 52°40'–50'N 5°55'–6°10'E Situated in the north-west of Overijssel Province, 10 km west of Meppel and Steenwijk and not far from the former Zuiderzee (now IJsselmeer) and the mouth of the river IJssel.

**Area** c.9,500 ha but totalling 17,000 ha according to the Ramsar Convention list.

**Altitude** 0.5 m below to 1 m above sea level.

**Water depth** Maximum 8 m; average 1.5–2m.

**Wetland types** 18, 19, 20, 21 and 24.

**Ecology** The Wieden and Weerribben are what remains, having been saved from reclamation, of once extensive water and peat lowlands. The landscape originated from peat-digging and is now composed as follows 38% pasture; 16% regularly cut reedland; 8% bushy reedland; 25% broads; 0.7% open peat ponds and narrow strips of land formerly used for drying peat sods; 9% now overgrown by woodland; and 3.3% hay meadows. Nearly all the broads and fens were formed by wind action, where digging of peat had been done too intensively or irregularly. Rich ecosystems have been able to develop during the long period of human activity in the natural marshland. Of special botanical interest and importance are the ponds representing various stages of Hydrocharito-Stratiotetum succession, the trembling bogs (floating masses of vegetation in former peatholes), with numerous species including bogbean *Menyanthes trifoliata*, slender cotton grass *Eriophorum gracile*, fen orchid *Liparis loeselii*, downy-fruited sedge *Carex lasiocarpa*, two-stamened sedge *C. diandra*, early marsh orchid *Dactylorhiza incarnata*, water forget-me-not *Myosotis scorpioides*, grass of parnassus *Parnassia palustris* and the bladderwort *Utricularia intermedia*, and the Cirsio-Molinietum dominated natural meadows. One species which is very rare throughout Europe, the dark sedge *Carex bux-*

*baumii*, occurs in the transition zone between trembling bog and drier unmanured meadows. The vegetational succession in the wetland eventually leads to shrubby marshes and woodland of bog myrtle *Myrica gale*, birch *Betula pubescens*, alder buckthorn *Frangula alnus* and common alder *Alnus glutinosa*.

The area is also highly important as a breeding area for waterfowl and other birds of swamps and marshy woodlands, supporting colonies of Cormorant *Phalacrocorax carbo*, Grey Heron *Ardea cinerea*, Purple Heron *A. purpurea* and Rook *Corvus frugilegus*. The fauna also includes a good range of wetland mammals, reptiles, amphibians and particularly invertebrates; the very local Large Copper butterfly *Lycaena dispar* occurs.

**Legal status** The Wieden is a National Park established by the Vereniging tot Behoud van Natuurmonumenten or national society for the preservation of nature reserves; and the Weerribben is a National Nature Reserve established by the Netherlands Government (Ministry of Cultural Affairs). A 2,500 ha section of the Weerribben is now specifically protected by virtue of inclusion in the Ramsar Convention list.

**Tenure** The 2,150 ha included in the Weerribben reserve is state-owned and the 4,004 ha of the Wieden National Park privately owned by the Vereniging tot Behoud van Natuurmonumenten.

**Management practices** A number of activities based on old agricultural practices continue, notably reed-cutting, woodland coppicing and haymaking, grazing, dredging of ditches and waterways, and localized hunting, including the operation of one duck-decoy (other decoys are in the Reserve and closed down). Recreational activities are under control and guidance.

**Threats** Water eutrophication and pollution; abandonment of long-established management practices; over-development of facilities for recreation.

**Scientific research** Hydrobiological and hydrological investigations, as well as research into the flora and fauna, have been undertaken by RIN, the University of Amsterdam and the Agricultural University of Wageningen, and are still continuing.

#### Principal reference material

Leentvaar, P. 1965. Hydrobiologische waarnemingen in het plassengebied van N. W. Overijssel I. *Biol. Jaarboek Dodonea* 33.

Schroevers, P. 1965. Hydrobiologische Waarnemingen N. W. Overijssel II. *Biol. Jaarboek Dodonea* 33.

Luther, H. and Rzóska, J. 1971. Project AQUA, IBP Handbook No. 21. Published for the International Biological Programme by Blackwells Scientific Publications, Oxford and Edinburgh.

Westhoff, V., Bakker, B. A., van Leeuwen, C. G. and van der Voo, C. G. 1971. *Wilde Planten Deel II* and List of References Deel III. Vereniging tot Behoud van Natuurmonumenten in Nederland, Amsterdam.

## 11. ZWANENWATER

**Criteria for inclusion** 1a,c,d,e; 2a; 3c; 4a,b.

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**Geographical location** 52°50'N 4°40'E Coastal dunes 23 km north-north-west of Alkmaar, Noord Holland Province.

**Area** 580 ha; open water area 15 ha.

**Altitude** 2.5 m above sea level.

**Water depth** Maximum 1.5 m; average 1 m.

**Wetland types** 7, 19.

**Ecology** A mesotrophic lake with a margin of reeds *Phragmites communis*, rushes *Scirpus* sp., sedge *Carex* sp., reedmace *Typha* sp., cut-sedge *Cladium mariscus* and willow *Salix* thickets. It is surrounded by lime-deficient dunes which enclose a second wet valley or dune slack.

Many species of waterfowl find suitable nesting sites in the area and there are Spoonbill *Platalea leucorodia* and Grey Heron *Ardea cinerea* colonies. Zwanenwater is hydrobiologically of international importance as a fresh water dune lake and is included as such in the AQUA List.

**Legal status** Protected as a Nature Reserve.

**Tenure** Privately owned by the Vereniging tot Behoud van Natuurmonumenten.

**Management practices** Although the wetland is freely accessible to members of the Society and to others on payment, visitors must keep to pathways and in general the management of the reserve is strict. A limited amount of hunting and fishing is however permitted.

**Threats** Increasing pressure from recreational use of the area; lowering of the water-table in the immediate vicinity; and pollution from outside the reserve are all potential threats.

**Scientific research** Hydrobiological investigations and surveys of breeding and migrating waterfowl have been carried out.

**Principal reference material**

Leentvaar, P. 1969. Dunewaters in the Netherlands, II – Comparison of biocommunities in the dunewaters. *Biol. Jaarboek Dodonea* 55.

Woets, D. 1972. *Vogels van het Zwanenwater*. Heynis, Zaandijk.

**12. LAKES BORDERING THE IJSSELMEER**

**Criteria for inclusion** 1a,b,c,e; 2a,b; 3a,b,c; 4a

**Geographical location** 52°15'–40'N 5°00'–59'E Situated between the reclaimed IJsselmeer-polders and the old mainland, in the Provinces of Overijssel, Gelderland, Utrecht and Noord-Holland.

**Area** The total of c.22,000 ha is made up as follows: Zwarte Meer (2,200 ha), Ketelmeer (3,800 ha), Vossemeer (270 ha), Drontermeer (560 ha), Veluwemeer (3,330 ha), Wolderwijd (1,830 ha), Nuldernauw (745 ha), Nijkerkernauw (500 ha), Eemmeer (1,005 ha), Gooimeer (2,610 ha) and IJmeer (5,000 ha).

**Altitude** About sea level.

**Water depth** Maximum 30–50 m locally in sandpits and 3–4 m in navigable canals; average of 0.7–0.8 m along former mainland shores; elsewhere c.1.5 m or a little

deeper in the Ketelmeer, IJmeer and Eemmeer.

**Wetland types** 15, 18.

**Ecology** The border-lakes (randmeren), formed by IJsselmeer reclamation projects, are situated in a low-lying zone between the new polders and the former mainland shores, their water being fresh or nearly fresh. Some 18 small islands of between 0.75 and 5 ha in size have been created in the lakes and about 10 more are planned in the newer southern lakes.

These islands, together with about 70 km of shoreline bordered by a narrow belt of reeds and rushes, provide breeding places for several species of waterfowl including Great Crested Grebe *Podiceps cristatus*, Cormorant *Phalacrocorax carbo* (occasionally on the Zwarte Meer 'Vogeleiland'), Bittern *Botaurus stellaris*, Purple Heron *Ardea purpurea*, Gadwall *Anas strepera*, Marsh Harrier *Circus aeruginosus*, Black Tern *Chlidonias niger*, Long-eared Owl *Asio otus* and Bearded Tit *Panurus biarmicus*, as well as many species of marshland Passeriformes. In autumn, winter and spring the lakes together with adjacent polders are a very important moulting, resting and feeding area for huge numbers of ducks, geese and swans, particularly Bewick's Swan *Cygnus bewickii*, Mute Swan *C. olor*, Greylag Goose *Anser anser*, Bean Goose *A. fabalis*, White-fronted Goose *A. albifrons*, Mallard *Anas platyrhynchos*, Shoveler *A. clypeata*, Tufted Duck *Aythya fuligula*, Pochard *A. ferina*, Goosander *Mergus merganser* and Smew *M. albellus*.

**Legal status** The Zwarte Meer is a State Nature Reserve. The Ketelmeer, Drontermeer and Veluwemeer are waterfowl reserves where shooting is forbidden. An additional 1,500 ha reserve for geese is to be created in the Zuid-Flevoland polder, in the extreme south of the area.

**Tenure** Mainly state-owned (Ministry of Traffic and Public Works). Some small sectors along the former mainland coast are privately owned.

**Management practices** Responsibility of the Forest Service. Large parts of the Zwarte Meer and five islands are kept as strict reserves and there is no access to a further three islands in the breeding season. Fishing, hunting and recreation are controlled. In some places reeds and bulrushes are cut.

**Scientific research** Studies of vegetational succession, of water-quality and of the avifauna have been carried out and are continuing.

#### **Principal reference material**

van Dijk, G. 1972. *Documentatie over het Veluwer- andgebied en het Veluwemeer*. Department of Nature Conservation, Agricultural University, Wageningen, Report No. 152.

Krijnsen, P. and Vette, A. Undated. *Oecologische inventarisatie en evaluatie van de randmeren en aangrenzende gebieden van de IJsselmeerpolders*. Department of Nature Conservation, Agricultural University, Wageningen, Report No. 227.

### **13. WATERLAND**

**Criteria for inclusion** 1a,c; 2a,c; 3a,c; 4a.

**Geographical location** 52°23'N 5°00'E North of Amsterdam and between it and Oostzaan, Ipendam, Monnikendam and the IJsselmeer, Noord-Holland Province.

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**Area** c.9,000 ha, including 550 ha of dike-burst potholes ("Wielen") and former gullies.

**Altitude** Sea level down to 3.5 m below sea level.

**Water depth** Maximum 1.5 m or more in the "wielen" and gullies behind the dikes protecting the eastern flank of the area; average between 1 and 1.2 m in the potholes, 0.20–0.30 m in the ditches and small channels.

**Wetland types** 18, 21, 25.

**Ecology** Low-lying grassy islands separated by a dense network of brackish water ditches and channels, similar to the Wormer en Jisperveld (next on the list). On the east there are remains of gullies and potholes resulting from former breaching of the dike. A feature of great botanical interest is the remnant of a former salt-marsh. In general, the flora and fauna are also reminiscent of the Wormer en Jisperveld wetland's, the small brackish-water bogs supporting salt-tolerant vegetation and good numbers of breeding birds of species typical of meadow or marsh, including several pairs of Bittern *Botaurus stellaris*, Spotted Crake *Porzana porzana* and Common Tern *Sterna hirundo*.

**Legal status** Partly protected as a State nature reserve.

**Tenure** 660 ha are state-owned (Varkensland, 250 ha, and nearly all the gullies and potholes, 410 ha); c.500 ha (Ilperveld) privately owned by the Noord-Hollands Landscape Association and 32 ha (Polder IJdoorn) owned by the Nature Reserve Preservation Society (Vereniging tot Behoud van Natuurmonumenten).

**Management practices** Grazing of cattle and hay-making continue; the canals and ditches are dredged or deepened periodically; there is some fishing and hunting; and recreational activities are controlled.

**Threats** Excessive leisure and holiday-time pressures, which in the close proximity of Amsterdam need to be kept in check as do such other threats as dumping of rubbish, water pollution and urban developments like roads and housing.

**Scientific research** Includes the study of the plant associations and successions, and of breeding, migrating and wintering birds, particularly waterfowl.

### Principal reference material

Wartena, J. G. R. 1967. *Natuur en Landschap van Waterland, Staatsbosbeheer*, Utrecht.

## 14. WORMER en JISPERVELD

**Criteria for inclusion** 1c,d; 2a,c; 3c; 4a.

**Geographical location** 52°30'N 4°48'E Slightly to the north and west of the Waterland site (No. 13 in the List) and about 15 km north of Amsterdam, Noord Holland Province.

**Area** c.1,700 ha.

**Altitude** c.1.5m below sea level.

**Water depth** Of waterways maximum 0.3 m, average 0.2 m; and of the fens maximum 1.5 m, average 1 m.

**Wetland types** 21, 24, 25.

**Ecology** A complex of shallow waterways and fens with many small islands and meadows. The water is slightly brackish and there is a very high water-table in the meadows, which become totally saturated in winter and spring, causing the grass to grow slowly and late in the season. Most parts can only be reached by boat.

The area provides an ideal breeding habitat for Oystercatcher *Haematopus ostralegus*, Lapwing *Vanellus vanellus*, Redshank *Tringa totanus*, Ruff *Philomachus pugnax*, Black-tailed Godwit *Limosa limosa* and Snipe *Gallinago gallinago* and is an important feeding area for Spoonbill *Platalea leucorodia*. During migration the Golden Plover *Pluvialis apricarius* is present in large numbers.

The area is also of great botanical interest: in places the vegetation is characteristic of a brackish environment and the absence of some freshwater species such as the water-lilies *Nymphaea alba* and *Nuphar luteum* is striking. The halophile species present include the subspecies *glaucus* of bulrush *Scirpus lacustris*, sea aster *Aster tripolium*, lesser sea spurrey *Spergularia salina* (= *marina*), brook-reed *Samolus valerandi*, wild celery *Apium graveolens*, mare's tail *Hippuris vulgaris*, sea milkwort *Glaux maritima*, sea arrow-grass *Triglochin maritima*, scurvy-grass *Cochlearia officinalis*, marsh mallow *Althaea officinalis* and strawberry clover *Trifolium fragiferum*.

**Legal status** Only 385 ha protected as Nature Reserve.

**Tenure** Privately owned by the Vereniging tot Behoud van Natuurmonumenten.

**Threats** Land development; use of fertilizers; recreational pressure, including weekend houses, boats, caravans and camping; introduction of exotic shrubs and trees; and other urban developments.

**Management practices** Grazing of cattle and hay-making continue; hunting is allowed with the exception of the area around Merken fen. The aim is to increase the protected area by land acquisition, in order to put some check on further recreational developments.

**Scientific research** No information.

#### **Principal reference material**

Anon. 1963. *Het Wormer- en Jisperveld*. Vereniging tot Behoud van Natuurmonumenten, Amsterdam; 1962–63 Annual Report.

Westhof, V., Bakker, P. A., van Leeuwen, C. G. and van de Voo, E. E. 1971. *Wilde Planten*, Deel II. Vereniging tot Behoud van Natuurmonumenten in Nederland, Amsterdam.

### **15.1 NAARDERMEER**

**Criteria for inclusion** 1a,b,c,d,e; 2a,b; 3a,b,c; 4a,b.

**Geographical location** 52°18'N 5°07'E About 15 km south-east of Amsterdam, Noord-Holland Province and about half way between Amsterdam and the urban complex of Hilversum.

**Area** 752 ha.

**Altitude** 1–0.5 m below sea level.

**Water depth** Maximum 1.5 m; average 1 m.

**Wetland types** 18, 21, 24.



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**Ecology** An area of freshwater fens and marshes with plant communities at several stages from open water to swampy woodland. In the long period of time during which part of the area has been strictly protected, the process of this plant succession has been largely undisturbed. The main botanical associations are Charetalia, Potameto-Nupharetum, Hydrocharito-Stratiotetum, Scirpetum lacustris, Typhetum angustifolia, Scirpo-Phragmitetum, Caricetum paniculatae, Thelypterido-Phragmitetum, Carici elongatae-Alnetum and Betuletum pubescentis. Various Orchidaceae and rare mosses occur.

The area's particular importance lies in its large colonies of Cormorant *Phalacrocorax carbo sinensis*, Grey Heron *Ardea cinerea*, Purple Heron *A. purpurea*, Spoonbill *Platalea leucorodia* and Black Tern *Chlidonias niger*.

**Legal status** The oldest Nature Reserve in the Netherlands, established in 1906. Included in the Ramsar Conventon list.

**Tenure** Privately owned by the Vereniging tot Behoud van Natuurmonumenten.

**Management practices** Control of water level; some reed-cutting; and limitations on visitor numbers in strict nature reserve sectors. The visits are by appointment and take place in a small boat accompanied by a guide.

**Threats** Decreasing supply of oligotrophic percolating water; water pollution; the presence of power lines (hazard to birds); and urban development generally.

**Scientific research** The vegetational succession has been under study for over 50 years. Ornithological research has included regular monitoring of breeding species and, in particular, studies of biology and population dynamics of the Spoonbill *Platalea leucorodia*.

### Principal reference material

Anon. 1974. *Het Naardermeer*. Vereniging tot Behoud van Natuurmonumenten, Amsterdam: Nature Reserve Guidebook.

## 15.2 BOTSHOL

**Criteria for inclusion** 1d,e; 2a,b; 3a,b,c; 4a,b

**Geographical location** 52°15'N 4°55'E About 13 km south of Amsterdam, in the Utrecht Province, bordering the Amsterdam-Utrecht motorway.

**Area** c.300 ha.

**Altitude** Between 2 and 2.5 m below sea level.

**Water depth** Shallow; no precise information received.

**Wetland types** 18, 21, 24.

**Ecology** The northern part of the Botshol is now meadowland and it is the southern part, still in a natural state with its broads and marshland, which is of particular importance botanically and ornithologically. Thanks partly to water-level control (see below under management practices) the vegetation is intermediate between that of Naardermeer and that of Waterland (Nos. 15.1 and 13 above) in the series of fresh water to brackish marshes in this part of the Netherlands. Characteristic species are greater naiad *Najas marina*, stonewort *Chara hispida*, bulrush and sea club-rush *Scirpus lacustris* and *maritimus* (both of the nominate form), cut-sedge *Cladium mariscus*, brookweed *Samolus valerandi*, wild celery

*Apium graveolens*, fool's watercress *A. nodiflorum* fritillary *Fritillaria meleagris* and marsh plume thistle *Cirsium dissectum*.

The bird species nesting in the Botshol include Great Crested Grebe *Podiceps cristatus*, Bittern *Botaurus stellaris*, Little Bittern *Ixobrychus minutus*, Purple Heron *Ardea purpurea*, Teal *Anas crecca*, Red-crested Pochard *Netta rufina*, Ferruginous Duck *Aythya nyroca*, Hobby *Falco subbuteo*, Black Tern *Chlidonias niger*, Grasshopper Warbler *Locustella naevia*, Savi's Warbler *Locustella luscinioides* and Great Reed Warbler *Acrocephalus arundinaceus*.

**Legal status** 62 ha are protected as Nature Reserve. The southern end of the wetland is set aside as a natural area in the plans of the local municipality.

**Tenure** The entire area is privately owned, the 62 ha Nature Reserve being the property of the Vereniging tot Behoud van Natuurmonumenten.

**Management practices** The water level is controlled and, in summer, kept stable by the input of mesohalinic calcareous water, resulting in fluctuations and local differences in the chloride content ranging from 300 mg/l to 1,200 mg/l and a pH of 4.5 to over 7. The reeds and swampy thicket are cut over regularly and the grass in the nature reserve is mown for hay. Hay-making also takes place in the northern meadowland, which is used for grazing cattle.

**Threats** Increasing recreational activities and water pollution are the main threats.

**Scientific research** The breeding and migratory birds are regularly monitored. Vegetation studies have been undertaken by the University of Amsterdam and are continuing.

#### Principal reference material

van de Veer, G. 1974. Inventarisatie van oecologische onderzoek resultaten uit het Vinkeveense plasseengebied.

## 17. WIEL bij HAALDEREN

**Criteria for inclusion** 2a,b,c; 4a.

**Geographical location** 51°53'N 5°56'E On the northern bank of the river Waal (a branch of the Rhine) near the village of Haalderen, 7 km north-east of Nijmegen in the Province of Gelderland.

**Area** c.1 ha.

**Altitude** c.9 m above sea level.

**Water depth** Maximum 15 m; average c.10 m.

**Wetland type** 18.

**Ecology** The "Wiel" is a small deep lake formed as the result of a break of the river-dike in 1853. "Wielen" are a typical feature of the landscape along Dutch river and coastal dikes and, being the deepest natural waters in the Netherlands, have very special characteristics due to their depth, small surface area and water quality, which is usually eutrophic and stratified. In autumn the anaerobic underlying water layers and the aerobic upper water layers interchange, sometimes causing mass fish mortality. The few higher plants can only grow along the narrow

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strip where land and water meet. The open water is very rich in plankton of several species.

**Legal status** Unprotected.

**Tenure** Privately owned.

**Management practices** Some sport-fishing takes place.

**Threats** Pollution by disposal of wastes.

**Scientific research** Hydrobiological research has been carried out as part of a comparative study of "wielen".

**Principal reference material**

Kokke, P.A. 1958. De diatomeeen flora van een wiel bij Haalderen. *De Levende Natuur* 61.

Leentvaar, P. 1958. Observations on the plankton of some inland waters, especially "Wieden" in the Netherlands. *Beaufortia* 73(6).

Luther, H. and Rzóska, J. *Project Aqua* IBP Handbook No. 21, published by Blackwells Scientific Publications, Oxford and Edinburgh: Pp. 48-49.

**18. KIL en UITERWAARDEN van HURWENEN**

**Criteria for inclusion** 1a,d,e; 2a,c; 4a.

**Geographical location** 51°49'N 5°18'E On the south bank of the river Waal (branch of the Rhine), 14 km north of 's Hertogenbosch, Gelderland Province.

**Area** 4-5 m above sea level.

**Water depth** Maximum 6 m; average 2 m.

**Wetland type** 12.

**Ecology** River floodplain traversed by a 300-year-old meander of the river Waal, with which it is in communication at periods of high water level. The vegetation of the meander has consequently developed over a long period without interference and a slow progression towards dry land is taking place. The numerous transitional stages between 6 m-deep water and land are demonstrated by the series of successional plant communities visible: Potametum lucentis, Potameto-Nupharetum, Hydrocharito-Stratiotetum, Scirpo-Phragmitetum, Scirpetum lacustris, Typhetum angustifoliae, Glycerion maximae, Caricetum acuto-vesicariae, Valeriano-Philipenduletum and Salicion albae. The old river-bed and the surrounding grassland are also very important hydrobiologically and ornithologically. Many species of marsh birds nest, thousands of ducks and geese winter and exceptional numbers of Lapwing *Vanellus vanellus* and Black-tailed Godwit *Limosa limosa* pass through in spring.

**Legal status** Partly (48 ha) protected as a State Nature Reserve.

**Tenure** The 48 ha are state-owned and the remaining 400 ha privately owned.

**Management practices** There is no admittance to the nature reserve except for a few fishermen and research workers. Hay-making, grazing and some hunting continue in the privately owned grassland areas.

**Threats** Plans for the development of a harbour on this site have been dropped,

but extraction of sand and input of polluted water from the Waal are the main existing dangers.

**Scientific research** Botanical and hydrobiological studies have been carried out.

**Principal reference material**

van Donselaar, J. *et al.* 1961. On the ecology of plant species and plant communities in former riverbeds. *Wentia*, RIVON-communications Nos. 91–94.

Schimmel, H. J. W. 1966. Het Staatsnatuurreservaat Kil van Hurwenen bij Zaltbommel. *Natuur en Landschap* 20(3/4).

**19. BRABANTSE, SLIEDRECHTSE en DORDSE BIESBOS**

**Criteria for inclusion** 1a,b,d,e; 2a; 3a,b,c; 4a.

**Geographical location** 51°43'–51°N 4°37'–56'E North of the Amer, west of the Spijkerboor and Steurgat, in the delta area of the rivers Waal and Bergsche Maas, to the south and south-east of Sliedrecht and Dordrecht, respectively, Zuid-Holland and Noord-Brabant Provinces.

**Area** c. 5,500 ha, not including the polders.

**Altitude** Sea level to c.1.5 m.

**Water depth** Maximum 4 m but in the Nieuwe Merwede channel as much as 10 m; average between 1.5 and 2 m, but only 0.5 to 1 m in the narrower creeks.

**Wetland type** 12.

**Ecology** Until 1970 the Biesbos was a fresh water though tidal area. This situation changed with the completion of the Haringvliet dam and tidal movement virtually ceased. There is now only a rise and fall of c.15 cm (maximum 25 cm) twice a day, while the maximum difference in water level over the whole year is 1.5 m and depends on water supply and wind. The area is bounded by the Waal and Maas, both of them branches of the Rhine, between which a network of large and small creeks enclose a mixture of polders, water reservoirs, marshland and swampy woodland. The natural vegetation of reeds, bulrushes and willow-osiers *Salix* sp. is changing with the invasion of common species such as nettles and thistles, *Urtica dioica* and *Cirsium* spp., which have given the landscape a very untidy look; but north of the Nieuwe Merwede the floodplain still supports grassland and osier-beds of considerable interest.

The Biesbos is still a very important breeding area for birds. Species include Night Heron *Nycticorax nycticorax*, Grey Heron *Ardea cinerea*, Greylag Goose *Anser anser*, Shelduck *Tadorna tadorna*, Gadwall *Anas strepera*, Marsh Harrier *Circus aeruginosus*, Corncrake *Crex crex*, Kingfisher *Alcedo atthis* and Bearded Tit *Panurus biarmicus*. Several of these and many other species use it as a staging post on migration or for moulting, resting, feeding or wintering, most notably (in numbers of international importance) the Greylag Goose *Anser anser*, Mallard *Anas platyrhynchos*, Teal *A. crecca*, Pintail *A. acuta*, Tufted Duck *Aythya fuligula* and Pochard *A. ferina*, and, as a post-breeding feeding-place in particular, the Cormorant *Phalacrocorax carbo* and Spoonbill *Platalea leucorodia*.

**Legal status** About 1,500 ha of the Biesbos are protected as State Nature Reserve and all land outside the dikes is classified as 'natural area' in the land use plans of

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the neighbouring municipalities. 2,650 ha of the Biesbos are also included in the Ramsar Convention list.

**Tenure** About 2,700 ha are state-owned, 1,500 by the Ministry of Culture, Recreation and Social Work, and 1,200 by the Ministry of Finance. The rest of the area is in private ownership.

**Management practices** Some sectors of the nature reserves are not open for recreational use or for hunting, but managed as strict reserves, and likewise some of the creeks are closed to motor-boats. Osier and reed-cutting, mowing of grasslands and the grazing and mowing of a favourite wintering-ground of geese are continuing activities. Fishing and catching of ducks in decoys are also practised in places.

**Threats** Mass recreation; water pollution; installation of power lines; and reservoir construction in the more important waterfowl resting areas of the Reserve are the most serious threats.

**Scientific research** Research into the successional stages of the vegetation and the ornithology, zoology, hydrobiology and entomology is being carried out.

### Principal reference material

Over de hartslag van het National Park de Biesbos, Grontmij, de Bilt, 1970.

Zonneveld, I. S. 1970. De Biesbosch is dood, leve de Biesbosch. *Natuur en Landschap* 24(4).

## 20. HOLLANDS DIEP en HARINGVLIET

**Criteria for inclusion** 1a,b,e; 2a; 3b,c; 4a.

**Geographical location** 51°43'–51°N 4°02'–38'E The 48 km long and 2 to 5 km wide stretch between the former islands of Voorne and Putten and the Hoekse Waard on its north bank and the former islands of Goeree and Overflakkee and the Noord-Brabant mainland shore on its south bank, and from the Haringvliet dam in the west to the Moerdijk bridge in the east. The entire area is no more than 20 to 25 km from Rotterdam, to the south and south-west of that city.

**Area** c.16,000 ha, including the river banks outside the main dikes.

**Altitude** From 1m below to 1.5 m above sea level.

**Water depth** Maximum 45 m (Haringvliet) and 27 m (Hollands Diep); average 5 m (Haringvliet) and 8.5 m (Hollands Diep).

**Wetland type** 12.

**Ecology** One of the former estuaries of the Rhine (Waal) and Maas rivers, closed off in 1970 from the sea by a dam, through which the river water is sluiced into the sea. The only present seawater connection is via the narrow Spui, Oude Maas and Nieuwe Waterweg channels. Water cannot be released through the sluices at high tide, so the water level of the area fluctuates by between 15 and 25 cm twice a day. The water is becoming fresher (salinity less than 300 mg Cl/1) and typical brackish and salt water biocenoses are disappearing. The sector dominated by bulrush *Scirpus lacustris* subsp. *glaucus*, which is very important for geese and ducks both as food and also as cover in the moulting season, has decreased to about 25 percent of its former size. The riverine floodplain has been invaded by

freshwater-dependent plants, producing a rather rough tangle of vegetation compared with that of the old saltmarshes, which together with the adjacent banks, shores and mudflats are still very important as a stopping-place for moulting, feeding and resting of great numbers of ducks and geese, though a diminishing number of waders. The most numerous species are Greylag Goose *Anser anser*, Bean Goose *A. fabalis*, White-fronted Goose *A. albifrons*, Barnacle Goose *Branta leucopsis*, Shelduck *Tadorna tadorna*, Mallard *Anas platyrhynchos*, Teal *A. crecca*, Wigeon *A. penelope* and Shoveler *A. clypeata*. As previously noted the number of limicoline species feeding on the saltings has declined, but Cormorant *Phalacrocorax carbo* and Great Crested Grebe *Podiceps cristatus* seem to have benefitted from the changed conditions and become more numerous. Several of the duck species mentioned nest in the area, as do Little Grebe *Tachybaptus ruficollis*, Marsh Harrier *Circus aeruginosus*, Water Rail *Rallus aquaticus*, Avocet *Recurvirostra avosetta*, various plovers *Charadrius* spp., Redshank *Tringa totanus*, Ruff *Philomachus pugnax*, and various gulls and terns Laridae and Sterninae. Among the mammals the Otter *Lutra lutra*, which is still to be found in several places, is notable.

**Legal status** Some important areas of mudflat, bank and former salting have been included in State Nature Reserves or given protection under the Nature Conservation Law.

**Tenure** Most of the mudflats, banks and ex-salting, together with areas of open water, are state-owned but there is still some privately owned land.

**Management practices** Reed-cutting, hay-making, cattle grazing, fishing and hunting still continue in the area, though hunting is not permitted in the nature reserves (which are wardened).

**Threats** Changes in agricultural use; industrial development including power lines; water pollution; hunting; and recreation pressure.

**Scientific research** The response of the flora and fauna to the changing environment has been under constant study which is likely to continue indefinitely.

#### **Principal reference material**

Beeftink, W. G. 1955. De zoutvegetatie van Z. W. Nederland beschouwd in Europees verband. Agricultural University, Wageningen: Report No. 65.

Ouweneel, G. L. 1971. Het pleisteren van ganzen in het Hollands Diep/Haringvliet in het seizoen 1970/71. *De Levende Natuur* 74: 121–128.

Kuypers, J. W. M. 1974. De Beninger en Korendijkse slikken, vegetatie en fauna. Department of Nature Conservation, Agricultural University, Wageningen: Report No. 216.

## **21. QUACKJESWATER en BREEDE WATER**

**Criteria for inclusion** 1c,d; 2a; 3a,b,c; 4a.

**Geographical location** 51°51'N 4°05'E Dunes of the island of Voorne, 30 km south-west of the Hague and at the northern end of the Haringvliet dam.

**Area** Quackjeswater c.45 ha; Breede Water 25 ha.

**Altitude** 2–3 m above sea level.

## NETHERLANDS

**Water depth** Maximum Quackjeswater 1.5 m, Breede Water 1 m; average Quackjeswater 0.75 m, Breede Water 0–0.75 m (depending on the flow in ingress channels).

**Wetland types** 6, 19.

**Ecology** Mesotrophic dune lakes of great botanical and ornithological interest. Quackjeswater originated from a creek which existed about 300 years ago and Breede Water was a coastal plain up till 75 years ago. The lakes support a freshwater vegetation in the middle of a dune vegetation which is very rich and has many rare plant species. The principal lakeside plant associations are typhetum angustifoliae and Scirpo-Phragmitetum; there are swampy thickets of common and eared sallows *Salix cinerea* and *S. aurita*, of alder *Alnus glutinosa*, the birches *Betula verrucosa* (= *pendula*) and *B. pubescens*; and, round Quackjeswater, only, a colourful fringe of Yellow Flag *Iris pseudacorus* bordered, still in saturated ground, by blunt-flowered rush *Juncus subnodulosus*, creeping brown sedge *Carex disticha*, bog pimpernel *Anagallis tenella*, moonwort *Botrychium lunaria* and bog-rush *Schoenus nigricans*, which are all still used for hay-making.

Breeding birds of the area include Great Crested Grebe *Podiceps cristatus*, Little Grebe *Tachybaptus ruficollis*, Grey Heron *Ardea cinerea*, Shelduck *Tadorna tadorna*, Gadwall *Anas strepera*, Teal *A. crecca*, Shoveler *A. clypeata*, Tufted Duck *Aythya fuligula*, Pochard *A. ferina*, Water Rail *Rallus aquaticus*, Great Reed Warbler *Acrocephalus arundinaceus*, and Bearded Tit *Panurus biarmicus*.

**Legal status** Protected as a Nature Reserve.

**Tenure** Privately owned. Both the lakes and their immediate surroundings, are the property of the Vereniging tot Behoud van Natuurmonumenten.

**Management practices** A limited amount of hunting, fishing and hay-making is permitted and recreational use of the wetland is subject to direction.

**Threats** Mass recreation; and growth of industrial establishments, with consequential air-pollution, and of ('Europoort') harbour developments, in the vicinity.

**Scientific research** Survey of breeding birds and investigation of the hydrobiology and the vegetation are the principal projects which have been undertaken and are still continuing.

### Principal reference material

Leentvaar, P. 1969. Dune waters in the Netherlands II. Comparison of bio-communities in the dunewaters. *Biol. Jaarboek Dodonea* 55.

Blom, C. W. M. P. and Blom-Steinbusch, A. M. 1974. Een vegetatiekartering van het Natuurmonument "Quackjeswater" in de duinen van Voorne. *De Levende Natuur* (77(1)).

## 23. OOSTERSCHELDE

**Criteria for inclusion** 1a,b,c,d,e; 2a,b; 3a,b,c; 4a.

**Geographical location** 51°27'–42'N 3°40'–4°17'E Between the islands of Schouwen, Tholen and Noord- and Zuid Beveland, to the west of Bergen op Zoom in the extreme south-west of the country.

**Area** 34,000 ha.

**Altitude** Sea level.

**Water depth** Maximum c.50 m; average 6 m.

**Wetland types** 4, 5, 11.

**Ecology** The Oosterschelde is a sheltered inlet of the North Sea, with the character of an inland sea due to the only partial exchange of water with the open sea. Its mixture of deep gullies, shallows and mudflats (c.12,000 ha) and saltings (475 ha) makes it a complex of very great botanical, ornithological and geological interest. The water is very clear and of high salinity; its relatively warm temperature in summer favours a number of southern species; and it is rich in species (500–600 animal, 140 plant) and the numbers in which they occur, and is of exceptional importance to migrating waterfowl, especially waders Limicolae but also to tens of thousands of Anatidae including Greylag Goose *Anser anser*, White-fronted Goose *A. albifrons*, Brent Goose *Branta bernicla*, Barnacle Goose *B. leucopsis*, Shelduck *Tadorna tadorna*, Pintail *Anas acuta* and Shoveler *A. clypeata*. The Shelduck is also among the breeding species and others include Avocet *Recurvirostra avosetta*, Ringed Plover *Charadrius hiaticula*, Kentish Plover *C. alexandrinus*, Common Tern *Sterna hirundo*, Arctic Tern *Sterna paradisaea*, Sandwich Tern *Sterna sandvicensis* and Little Tern *Sterna albifrons*.

**Legal status** Apart from one small nature reserve the Oosterschelde has no protected status.

**Tenure** State-ownership.

**Management practices** Hunting and fishing continue. The culture of oysters and mussels is of importance.

**Threats** Various projects were under study for closing off the Oosterschelde from the sea and the solution adopted should permit free exchange of water through caissons which are only shut at unusually high tides. Some impact must also be expected from the construction of secondary dams in the eastern part of the area for the purpose of improving the Schelde/Rijn connection. There are other projects for harbour development and industrial complexes near Bergen op Zoom. Some of the flats exposed at low tide are under increasing pressure for various recreational uses.

**Scientific research** Biological and hydrological investigations are being carried out by the Delta Institute at Yerseke and fishery research by the RIVO at IJmuiden.

**Principal reference material**

Anon. 1974. *Rapport Commissie Oosterschelde*. Staatsuitgeverij, Den Haag.

Wolff, W. J., Parma, S. and Groeneveld, F. P. 1974. *Oosterschelde, pleidooi voor veilig voortbestaan*. Stichting Zeeuws Coördinatie-orgaan voor Natuur-, Landschaps- en Milieubescherming, Middelburg.

**27. VERDRONKEN LAND VAN SAAFTINGE**

**Criteria for inclusion** 1a,b,d,e; 2a,b; 3a,c; 4a.

**Geographical location** 51°23'N 4°07'E Close to the border with Belgium and only 22 km north-west of Antwerp, on the south bank of the Westerschelde.

**Area** c.3,400 ha.



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**Altitude** 2 m below to 3 m above sea-level.

**Water depth** Maximum 6–7 m at exceptionally high tides; a metre or less in the gullies at low tide.

**Wetland types** 8, 11.

**Ecology** Salting and mudflat intersected by creeks and inundated twice a day at the peak of the tide. The higher levels near the dikes are only covered by water during spring-tides. The mixture of fresh water from the river Schelde and salt water from the sea produces biologically very interesting transitional stages from brackish to salt water ecosystems.

This is an important breeding area for waterfowl including Shelduck *Tadorna tadorna*, Gadwall *Anas strepera*, Marsh Harrier *Circus aeruginosus*, Water Rail *Rallus aquaticus*, Oystercatcher *Haematopus ostralegus*, Avocet *Recurvirostra avo-setta*, Ringed Plover *Charadrius hiaticula*, Little Ringed Plover *C. dubius*, Kentish Plover *C. alexandrinus*, Redshank *Tringa totanus*, Ruff *Philomachus pugnax*, Curlew *Numenius arquata*, Black-tailed Godwit *Limosa limosa*, Herring Gull *Larus argentatus*, Common Gull *L. canus*, Black-headed Gull *L. ridibundus*, Common Tern *Stern hirundo*, Arctic Tern *S. paradisaea*, Black Tern *Chlidonias niger* and Short-eared Owl *Asio flammeus*. As a wintering area and migration stage it is of importance to several of the above (including Shelduck and the waders) and also to large numbers of Greylag Goose *Anser anser*, Bean Goose *A. fabalis*, White-fronted Goose *A. albifrons*, Mallard *Anas platyrhynchos*, Wigeon *A. penelope*, Teal *A. crecca*, and Pintail *A. acuta*.

**Legal status** State Nature Reserve.

**Tenure** 3,050 ha owned by the State (Ministry of Finance, Domeinendienst); and 350 ha privately owned.

**Management practices** Cattle are extensively pastured on the higher, often privately owned, ground and some four flocks of sheep, of about 200 head each, also obtain grazing. Visitors to the Reserve must be accompanied by a guide and are only allowed entry outside the birds' breeding season.

**Threats** Various kinds of industrial pollution, mainly emanating from the expanding harbour and industrial complexes of Antwerp beyond the Dutch border; construction of the Paalhoek canal, inland from the dike, and industrial development along its banks; and a project for straightening out the bend in the Westerschelde, south of Bath, by excavating a new channel.

**Scientific research** No information received.

**Principal reference material**

Sponselee, G. M. P. 1971. Om het behoud van Saaftinge. *Het Vogeljaar* 19(4).

Wolff, W. J. 1972. Het Verdrongen Land van Saaftinge, grootste en laatste schorregebied van de Delta. *Natuurbehoud* 3(4).

Hielkema, J. U. 1973. Het verdrongen land van Saaftinge: Waardebepaling bodem, vegetatie, bedreiging. Department of Nature Conservation, Agricultural University, Wageningen: Report No. 167.

# NORWAY

## SUMMARY OF WETLAND SITUATION

With its long, rugged coastline, fjords, multitude of large and small islands, watercourses, lakes and vast mires, Norway offers excellent breeding, feeding, moulting and roosting areas for a great variety of migrating waterfowl. The coastal waters and some of the lakes in the southern part of the country also provide important wintering grounds for many of the more northerly breeding species.

Geologically Norway is of great scientific interest and many of the lakes, fjords and other water bodies are of international importance for limnological research.

The principal Conservation Authority in Norway is the Conservation Inspector in the Ministry of the Environment (Myntgt. 2, Oslo-Dep.). A special working group for Scandinavian co-operation in the field of international nature conservation has drawn up a list of 40 wetland sites in Norway and seven more in Svalbard, which are deemed to be of outstanding importance. For the purposes of the Directory a further 15 sites in Norway have been included, based on the MAR list of 1965, the AQUA List of 1971 and information on a few additional sites of limnological interest which has recently become available, bringing up the total, with those for Svalbard, to the 62 sites listed below.

Norway became a party to the Ramsar Convention on 9 July 1974. So far only one wetland, Akersvika Nature Reserve (No. 34), has been entered in the Convention List.

## WETLANDS OF INTERNATIONAL IMPORTANCE

\*Nominated for inclusion in the Ramsar Convention list

	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
1.	Varangerfjord area, incl. Munkefjord and Pasvikdalen (Finnmark)	69°00'– 70°20'N	28°30'– 31°00'E	c.19,300 ha	1a; 2a; 4a Unprotected
2.	Mivtjåvrre (Finnmark)	69°55'N	27°33'E	4,400 ha	2b; 4a,b Unprotected
3.	Vesterbotten, Stabburneset (Finnmark)	70°20'N	25°00'E	No information	1b; 2a,b; 4a Unprotected
4.	Sennalandet (Finnmark)	70°10'N	23°45'E	No information	2a; 4a Unprotected
5.	Vestre Finnmarksvidda incl. Bavta, Gorze and Anar jokka (rivers) (Finnmark)	c.69°00'N	24°00'E	c.25,000 ha	2a; 4a Unprotected

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	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criterial Conservation status</i>
6.	Senja I. (Troms)	69°15'N	17°30'E	No information (island of c.1,000 sq. km)	2a; 4a Partly protected
7.	Andøy I. (Nordland)	69°15'N	16°00'E	No information (island of c.420 sq. km)	2a; 4a Partly protected
8.	Strengelvåg/Gisløy Meløy/Stormyra (Nordland)	68°55'N	15°10'E	No information	2a; 4a Unprotected
9.	Børselv/ Grunnvatn Knutvatn/ Djupvatn/ Forsåvatn (Nordland)	68°15'N	16°50'E	No information	2a; 4a Unprotected
10.	Kvitblikvatn area (Nordland)	67°20'N	15°30'E	No information	2a; 4a Unprotected
11.	Hamarøy/Steigen peninsula and islands (Nordland)	67°57'– 68°05'N	15°00'–40'E	c.6,250 ha	2a; 4a Unprotected
12.	North-west Dønna I. (Nordland)	66°10'N	12°30'E	600 ha	2a; 4a Unprotected
13.	Vega archipelago (Nordland)	65°38'N	11°52'E	No information	1a; 2a,b; 4a Unprotected
14.	Velfjord (Nordland)	65°25'–30'N	12°10'–40'E	c.1,000 ha	2a; 4a Unprotected
15.	Sundet and Snåsavatn (Nord Trøndelag)	64°08'N	11°40'E	No information	2a; 4a Unprotected
16.	Ørlandet/Stor Fosna (Sør Trøndelag)	63°40'N	9°30'E	No information	2a; 4a Unprotected
17.	Forra valley incl. Forrymyrene (Nord Trøndelag)	63°35'N	11°30'E	c.11,500 ha	1d,e; 2a; 3a,b; 4a Unprotected
18.	Tautra (Nord Trøndelag)	63°35'N	10°40'E	No information	1a; 2a; 4a Unprotected
19.	Havmyran (Sør Trøndelag)	63°30'N	8°40'E	c.5,000–8,000 ha	1d,e; 2a; 3c; 4a Unprotected
20.	Smøla archipelago (Møre og Romsdal)	63°20'N	8°00'E	c.20,000 ha	1a; 2a; 3b; 4a Unprotected
21.	Sandblåstvågen/ Gaustadvågen (Møre og Romsdal)	63°00'N	7°20'E	No information	2a; 4a Unprotected
22.	Lake Femunden (Hedmark, Sør Trøndelag)	61°56'– 62°25'N	11°41'–55'E	20,200 ha	1d,e; 2a,b,c; 3a,b,c; 4a,b Unprotected
23.	Makkevika/ Kvalneset (Møre og Romsdal)	62°30'N	6°00'E	No information	1a; 2a; 4a,b Partly protected

	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
24.	Grimstadvatnet (Møre og Romsdal)	62°20'N	6°00'E	No information	2a; 4a Unprotected
25.	Fokstumyra (Oppland)	62°08'N	9°15'E	750 ha	2a; 4a Protected
26.	Skjellåmyrene (Hedmark)	61°55'N	10°16'E	c.800 ha	2a; 4a Unprotected
27.	Atnasjøen complex (Hedmark/ Oppland)	61°55'N	10°05'E	c.530 ha	1d,e; 2a; 3a,b; 4a Unprotected
28.	Hornindalsvatnet (Sogn og Fjordane)	61°54'–59'N	6°02'–31'E	5,080 ha	2b; 3b; 4a,b Unprotected
29.	Bessvatn (Oppland)	61°31'N	8°45'E	447 ha	1e; 2a,b; 3c Unprotected
30.	Gjende lake (Oppland)	61°29'N	8°37'E	1,380 ha	1e; 2a,b; 3c; 4a,b Unprotected
31.	Øvre Heimdalsvatn (Oppland)	61°25'N	8°43'E	77 ha	2a,b; 3b; 4a Unprotected
32.	Botnavassdraget (Sogn og Fjordane)	61°15'N	5°20'E	—	2a; 4a Unprotected
33.	Hedemarksvidda mires (Hedmark)	61°00'N	11°00'E	530 ha	1d,e; 2a; 4a,b Unprotected
*34.	Akersvika (Hedmark)	60°50'N	11°08'E	c.300 ha	2a; 4a Ramsar Convention site
35.	Rønnasmyra (Hedmark)	60°35'N	12°10'E	160 ha	1d,e; 2a; 3a; 4a Temporarily protected
36.	Vestrevatn mire, Osterøy (Hordaland)	60°32'N	5°30'E	200 ha	2a; 4a,b Unprotected
37.	Langavassmyra (Hordaland)	60°17'N	7°28'E	c.150 ha	1d; 2a; 4a,b Unprotected
38.	Kinso river and lake complex (Hordaland)	60°10'–22'N	6°43'–7°05'E	No information bu the complex extends over c.300 sq. km	1d; 2a; 3b; 4a,b Unprotected
39.	Møsvatnstangen (Telemark)	59°50'N	8°10'E	c.1,000 ha	2a; 4a Unprotected
40.	Northern Lake Oyeren with the rivers Svellet, Mitelva and Leirelva (Akershus)	59°50'– 60°23'N	10°43'– 11°15'E	c.6,900 ha	1a,d,e; 2a; 3a,b; 4a Protected
41.	Fiskumvannet (Buskerud)	59°45'N	9°50'E	200–300 ha	2a; 4a Unprotected
42.	Grunnane (Vestfold)	59°37'N	10°20'E	c.110 ha	1a; 2a; 4a Unprotected

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	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
43.	Vidmyr (Aust-Agder)	59°30'N	7°20'E	500 ha	1d,e; 2a; 3a; 4a,b Unprotected
44.	Tyrifjord (Buskerud)	c.60°00'N	10°10'E	13,400 ha	2a,c; 3a,b,c; 4a Unprotected
45.	Borrevatn (Vestfold)	59°25'N	10°26'E	c.240 ha	1c,d,e; 2a,b,c; 3a,b,c; 4a Unprotected
46.	Kurefjorden (Østfold)	59°21'N	10°45'E	c.800 ha	2a; 4a Unprotected
47.	Måmyra (Rogaland)	59°15'N	6°13'E	200 ha	1d,e; 2a; 4a Unprotected
48.	Presterødkilen (Vestfold)	59°15'N	10°20'E	c.90 ha	2a; 4a Unprotected
49.	Ilene/Korten (Vestfold)	59°15'N	10°20'E	c.120 ha	2a; 4a Unprotected
50.	Børsesjø (Telemark)	59°15'N	9°38'E	c.90 ha	1d,e; 2a; 4a,b Unprotected
51.	Øra (Østfold)	59°10'N	11°00'E	1,100–1,200 ha	1a,d,e; 2a; 3a; 4a Unprotected
52.	Arekilen (Østfold)	59°02'N	11°02'E	30 ha	2a,d; 3b; 4a,b Unprotected
53.	Rørholtfjorden (Telemark)	59°00'N	9°20'E	590 ha	2a,b,c; 3a,b; 4a,b Unprotected
54.	Grudevatnet (Rogaland)	58°48'N	5°37'E	74 ha	2a; 4a Unprotected
55.	Revet and Orrevatn (Rogaland)	58°45'N	5°31'E	600 ha + 1.5 km of shoreline	1a; 2a; 3a; 4a Unprotected

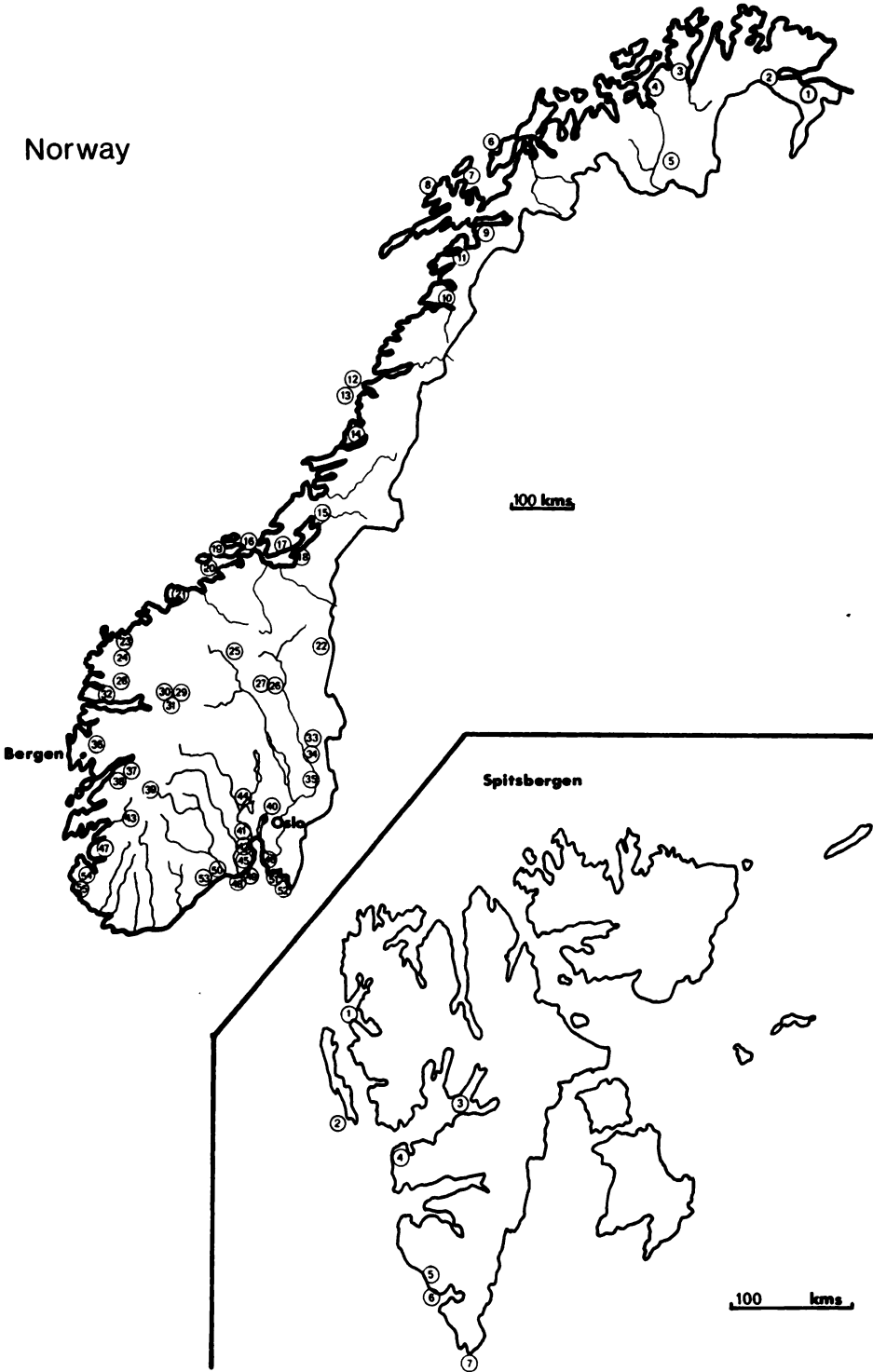
**PART TWO: SVALBARD (Spitzbergen)**

N.b. no estimates of size have been provided.

	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Wetland criteria/ Conservation status</i>
1.	Kongsfjorden	78°56'N	12°18'E	1a,d; 2a; 4a,b Protected (bird reserve)
2.	Forlandsøyane	78°20'N	11°36'E	1d; 2a; 4a,b Protected (bird reserve)
3.	Gåsøyane	78°30'N	16°10'E	1d; 2a; 4a,b Protected (bird reserve)
4.	Kapp Linné	78°03'N	13°36'E	1a,d; 2a; 4a Protected (bird reserve)
5.	Isøyane	77°08'N	14°48'E	1a,d; 2a; 4a,b Protected (bird reserve)

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	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
6.	Dunøyane	77°04'N	15°00'E		1a,d; 2a; 4a,b Protected (bird reserve)
7.	Sørkappøya	76°28'N	16°40'E		1d; 2a,b; 4a,b Protected (bird reserve)

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**DETAILS OF LISTED AREAS****1. VARANGERFJORD, MUNKEFJORD and PASVIKDALEN**

**Criteria for inclusion** 1a; 2a; 4a.

**Geographical location** 69°00'–70°20'N 28°30'–31°00'E Of the three sectors, the Munkefjord, to which the present description largely refers, is about 20 km north-west of Kirkenes at the eastern extremity of Finnmark *fylker* or 'County', Varangerfjord extending for 60 km beyond it and the Pasvik valley along the USSR border from the vicinity of Kirkenes to a point some 80 km to the south.

**Area** c.19,300, of which the Munkefjord sector accounts for c.1,200 ha.

**Altitude** Sea level.

**Water depth** Shallow, but no precise information available.

**Wetland types** 3, 4, 5, 6, 8, 11.

**Ecology** The Munkefjord sector comprises a coastal zone about 8 km in length between the Neiden and Munke rivermouths, bordered by shallow water, sandbanks and shingle. It is one of the most important migration stopping-places and wintering areas for ducks Anatidae and waders Limicolae in northern Norway, among the species and numbers recorded 300 Eider *Somateria mollissima*, 200 Long-tailed Duck *Clangula hyemalis*, 2,100 Goosander *Mergus merganser* and 2,500 Knot *Calidris canutus* being noteworthy.

**Legal status** Unprotected, but the establishment of reserves is under consideration.

**Tenure** Private ownership.

**Management practices** None reported.

**Threats** None at present noted.

**Scientific research** No information.

**Principal reference material**

Anon. 1973. Oversikt over viktige våtmarker i Norden. Report to the Nordic conservation authorities.

**3. VESTERBOTTEN, STABBURSNESET**

**Criteria for inclusion** 1b; 2a,b; 4a.

**Geographical location** 70°20'N 25°00'E On the western shore of the head of the Porsangen fjord, Finnmark *fylker*, about 140 km south of Nordkapp (the North Cape).

**Area** No information.

**Altitude** Sea level.

**Water depth** No information.

**Wetland types** 3, 5, 11, 21.

**Ecology** An extensive coastal area with various types of wetland, including the



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small delta of the Stabburselv. This is believed to be another of the more important wetlands in Norway for migrating Anatidae and Limicolae and has particular importance as a moulting place for Eider *Somateria mollissima*.

**Legal status** Unprotected.

**Tenure** Private ownership.

**Management practices** None reported.

**Threats** Plans for the partial drainage of the site have been reported.

**Scientific research** There has been some limited research but no details have been furnished.

**Principal reference material**

Anon. 1973. Oversikt over viktige våtmarker i Norden. Report to the Nordic conservation authorities.

The Zoologisk Museum, Universitetet i Tromsø, is a source of information for this area.

**13. VEGA Archipelago**

**Criteria for inclusion** 1a; 2a,b; 4a.

**Geographical location** 65°38'N 11°52'E Off the coast of Nordland *Fylker*, 25 km north-west of Brønnøysund.

**Area** One of the largest shallow-water areas in Norway, with one big (c.8,400 ha) and at least 22 small islands scattered over c.1,250 sq. km of shallows.

**Altitude** (– of wetland areas) sea level to c.0.5 m.

**Water depth** Not exceeding 100 m.

**Wetland types** 3, 5, 10, 11, 19, 22.

**Ecology** Shallow waters surrounding the group of islands but mainly to the west of the main island, Vega. The latter also has a number of shallow freshwater lakes and watercourses supporting a rich vegetation and there are extensive tracts of coastal peatland.

The archipelago is an important breeding, moulting, migration and wintering area for waterfowl. Breeding species include Black-throated Diver *Gavia arctica*, Red-throated Diver *G. stellata*, Grey Heron *Ardea cinerea*, Golden Plover *Pluvialis apricaria*, Lapwing *Vanellus vanellus*, Redshank *Tringa totanus*, Ruff *Philomachus pugnax*, Curlew *Numenius arquata*, and Common Snipe *Gallinago gallinago*. For both breeding and moulting this is the most important Norwegian locality for Greylag Goose *Anser anser* and it also harbours substantial populations of sea ducks, Whooper Swan *Cygnus cygnus*, Mallard *Anas platyrhynchos* and Limicolae.

**Legal status** Unprotected.

**Tenure** Private ownership.

**Management practices** None at present.

**Threats** Drainage, dike-construction and tourist developments are potential threats in some places.

**Scientific research** Only limited research, mainly of a survey nature, has been undertaken.

**Principal reference material**

As for the two previously described areas.

**17. FORRA ONVRADET (valley) incl. FORRAMYRENE**

**Criteria for inclusion** 1d,e; 2a; 3a,b; 4a.

**Geographical location** c.63°35'N 11°30'E The mires are in the upper Forra valley which is divided between the Communes of Levanger, Stjørdal, Meraker and Verdal, about 90 km north-west of Trondheim in Nord-Trøndelag fylker.

**Area** 11,500 ha (Forramyrene or the mire area only).

**Altitude** 400–500 m.

**Water depth** Not quoted.

**Wetland types** 13, 21, 22.

**Ecology** Various mire types are represented, so that a mixed flora of western and eastern, lowland and mountain species is to be found within the area.

It is an important breeding ground for waterfowl including Black-throated Diver *Gavia arctica*, Red-throated Diver *G. stellata*, Bean Goose *Anser fabalis*, Crane *Grus grus*, Ruff *Philomachus pugnax* and Great Snipe *Gallinago media*.

**Legal status** Unprotected.

**Tenure** Partly state and partly private ownership.

**Management practices** None.

**Threats** A project for a hydroelectric power station is at present the main threat.

**Scientific research** Systematic biological research has been carried out over the whole area since 1970.

**Principal reference material**

Moen, Asbjørn, 1973. Landsplan for myrreservater i Norge. *Norsk Geogr. Tidsskr.* 27: 173–193.

**19. HAVMYRAN**

**Criteria for inclusion** 1d,e; 2a; 3c; 4a.

**Geographical location** 63°30'N 8°40'E Hitra island, 90 km west of Trondheim in Sør-Trøndelag fylker.

**Area** Estimated at between 5,000–8,000 ha.

**Altitude** 50–150 m.

**Water depth** Not quoted.

**Wetland types** 19, 20, 21, 22.

**Ecology** The centre of the island of Hitra is dominated by an open mire landscape

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with many small freshwater lakes and a high degree of variation in its character. The biggest mire (Havmyrene) is an ombrotrophic complex with typical oceanic vegetation. It also has a rich avifauna, breeding species including Red-throated Diver *Gavia stellata*, several species of Anatidae, Golden Plover *Pluvialis apricaria* and Dunlin *Calidris alpina*. The area was listed as a mire of international importance by the TELMA (Conservation of Peatlands) Project.

**Legal status** Unprotected.

**Tenure** Private ownership.

**Management practices** None.

**Threats** Construction of holiday cabins is the principal threat but drainage and cultivation of parts of the area are also problems.

**Scientific research** No information.

### Principal reference material

Moen, Asbjørn, 1973. Landsplan for myrreservater in Norge. *Norsk Geogr. Tidsskr.* 27: 173–193.

## 10. SMØLA Archipelago

**Criteria for inclusion** 1a,2a; 3b; 4a,b.

**Geographical location** 63°20'N 8°00'E About 35 km north of Kristiansund, in Møre og Romsdal fylker, bordering on the south-west, as Hitra island (site of Listed Area 19) borders it on the north-east, the entrance to one of the main channels leading into Trondheimsfjord.

**Area** c.20,000 ha.

**Altitude** Sea-level to 30 m.

**Water depth** Not quoted.

**Wetland types** 3, 5, 10, 11, 22.

**Ecology** The archipelago consists of Smøla Island and several smaller ones, in which various types of wetlands are represented, the two principal components being coastal peatland and shallow island-dotted marine areas. All are important for the nesting, moulting, migration or wintering of a variety of waterfowl; for example, Norway's largest colony of Grey Heron *Ardea cinerea* (190–200 nests) is in this area and it has an important breeding population of Greylag Goose *Anser anser*. It has been estimated that up to 5,500 sea-ducks use it for wintering.

**Legal status** Unprotected.

**Tenure** Private ownership.

**Management practices** None reported.

**Threats** Some threats from drainage are known to exist.

**Scientific research** Recent ornithological studies have been carried out by Videnskapselskapets Museum Trondheim.

**Principal reference material**

Suul, J. 1975. Ornithological report on Smøla archipelago (title not quoted). Videnskapsselskapets Museum, Trondheim.

**22. LAKE FEMUNDEN**

**Criteria for inclusion** 1d,e; 2a,b,c; 3a,b,c; 4a,b.

**Geographical location** c.61°56'–62°26'N 11°41'–55'E Between the towns of Røros, Elga, Drevsjø and Engerdal, parallel with and close to the Swedish border, the northern end of the lake (c.16 km of its total length of 55 km) being in Sør-Trondelag fylker, the rest in Hedmark.

**Area** 20,200 ha.

**Altitude** 662 m above sea level.

**Water depth** Maximum 131 m; average 29.6 m.

**Wetland types** 19, 20.

**Ecology** Lake Femunden, the second largest lake in Norway, is only slightly affected by human activities. Its drainage basin lies on Cambrian rocks, of the sparagmite group, and quaternary deposits of unsorted moraine material, stratified gravel and boulders. Dead-ice terrain in depressions between mountain slopes is a distinctive topographic feature, dating back to the lower Glamsjø, an ice-dammed lake formed during the period of ice-retreat.

The area has the typical plant and animal associations of oligotrophic lakes in a region where humus input is only slight. Its fish species include Grayling *Thymallus thymallus*, Arctic Charr *Salvelinus alpinus* and Whitefish or Powan *Coregonus lavaretus*. Zoogeographically there are numerous elements of eastern origin, including stone-flies Plecoptera, of which more than 25 different species have been found, making this a faunistically rich site, whereas most similar waterbodies in Norway have an impoverished aquatic fauna.

**Legal status** The lake is situated near the border of the proposed National Park of Femundmarka, which could result eventually in a total ban on hydro-electric developments and touristic exploitation in the area;

**Tenure** Mainly state-ownership.

**Management practices** Fishing and some tourism are allowed.

**Threats** None at present.

**Scientific research** Beginning in 1966 investigations have been undertaken as a contribution to the International Hydrological Decade (IHD) Programme.

**Principal reference material**

Skulberg, O. 1970. Betydningen av Femunden og vassdrag i Femundsmarke for naturviteskapelige forskning. *Norsk Natur* No. 2.

Luther, H. and Rzóska, J. 1971. Project Aqua: a source book of inland waters proposed for conservation. *IBP Handbook* No. 21, published for IBP by Blackwell Scientific Publications, Oxford and Edinburgh; p. 50 (includes additional references).

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**27. ATNASJØEN complex (incl. Atna river and mire)**

**Criteria for inclusion** 1d,e; 2a; 3a,b; 4a

**Geographical location** 61°55'N 10°05'E About 85 km north of Lillehammer, on the border between Hedmark and Oppland fylker.

**Area** – of Atnasjøen lake 530 ha; the length of the relevant section of the Atna river is c.40 km; the size of the mire is not quoted.

**Altitude** At source of Atna river c.1,140 m; at lake level 696 m.

**Water depth** No information.

**Wetland types** 13, 19, 21, 22.

**Ecology** The Atna is one of the few large watercourses in south-central Norway having a shifting riverbed marked by typical erosive or accumulative landforms. The bottom fauna of the Atnasjøen, the lake through which it flows, is surprisingly rich considering the low level of dissolved nutrients, a phenomenon of considerable limnological interest. Thus there is a dense growth of quillwort *Isoetes lacustris*, bur-reed *Sparganium* sp., Ranunculus spp., mare's-tail *Hippuris vulgaris* and sedges *Carex* spp. The area has an interesting avifauna and the fish population of the lake, which includes Trout *Salmo trutta* and Arctic Charr *Salvelinus alpinus*, has also been well studied, particularly as the valley, the Atnedalen, forms a scientific and topographical unit with the Rondane National Park to its immediate west.

**Legal status** Unprotected.

**Tenure** Mostly private ownership.

**Management practices** The National Environment Preservation Board has given priority to the Atnasjø marshes in the national plan for bird sanctuaries.

**Threats** A plan exists for a dam to raise the water level of Atnasjøen by 40 m, which although it might not influence the protected Rondane National Park areas directly, would certainly to some extent reduce their value.

**Scientific research** The local Sør Nesset research station, owned and established by the Norwegian Academy of Sciences, has been the site for a series of geological, geographical, zoological and botanical (plant ecology and pedology) research projects for over 25 years.

**Principal reference material**

Høydahl, H. *et al.* Reports of the Sør Nesset research station.

There have also been a large number of publications on the geology, flora and fauna of the neighbouring Rondane National Park.

**28. HORINDALSVATNET**

**Criteria for inclusion** 2b; 3b; 4a,b.

**Geographical location** 61°54'–59'N 6°02'–31'E Immediately to the east of Nordfjordeid and 60 km south of Alesund, Sogn og Fjordane fylker.

**Area** 5,080 ha.

**Altitude** 52 m.

**Water depth** Maximum 514 m; average 237 m.

**Wetland type** 19.

**Ecology** Hornindalsvatnet is the deepest lake in Europe and is bordered by steep precipices at an angle of 60 degrees. Its water is weakly acidic and contains one of the smallest concentrations of electrolytes of any water in the world, its specific conductivity being close to the values obtained for distilled water. Although there are some fish, the biota is rather poor in number of species, but the arthropoda include the copepod *Cyclops scutifer* and the cladocers *Daphnia longispina* and *Holopedium gibberum*. The lake is completely frozen over in winter but its water still circulates, even the deepest part being saturated with oxygen.

**Legal status** Legislation is proposed to ban hydroelectric development or other interferences in the area.

**Tenure** Private ownership.

**Management practices** None.

**Threats** None at present.

**Scientific research** A number of limnological studies have been undertaken.

**Principal reference material**

Strøm, K. M. 1941. Die tiefsten Norwegischen seen. *Geol. Meere Binnengew* 4.

Anon. 1970. Kontaktutvalget for vassdragsreguleringer. Foreløpig innstilling. Obtainable from the Norwegian Ministry of Environment.

### 30. GJENDE lake

**Criteria for inclusion** 1e; 2a,b; 3c; 4a,b.

**Geographical location** 61°29'N 8°37'E South-eastern flank of the Jotunheimen mountains, near the town of Gendesheim, about 100 km north-west of Lillehammer in Oppland fylker.

**Area** 1,380 ha.

**Altitude** 984 m.

**Water depth** Maximum 149 m; average unknown.

**Wetland type** 19.

**Ecology** Gjende is of great limnological and geochemical interest. It is the highest fjord lake in Norway and consequently the recipient of a considerable amount of glacial ooze. Secchi disc transparency is at times no more than 1.5 m, in contrast with nearby Bessvatnet (Listed Area No. 29) and, again unlike Bessvatn, its water is not thermally stratified. The littoral zone is exposed and rocky with sparse vegetation. The bottom fauna is dominated by chironomids, while the typical planktonic entomostraca are the copepod *Cyclops scutifer* and the cladocer *Daphnia longispina*. The only species of fish occurring in the lake is the Trout, *Salmo trutta*, feeding partly on *Cnepia tredecimata*.

**Legal status** The lake is included in a project for a National Park.

**Tenure** Mainly state ownership.

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**Management practices** None.

**Threats** None at present.

**Scientific research** Has been mainly directed to the geological history, analysis of sedimentation, plankton populations and hydrobiology.

**Principal reference material**

Strøm, K. M. 1938. Norwegian mountain lakes. *Arch. Hydrobiol.* 33.

Kjensmo, J. 1971. Gjende. A glacier-fed mountain lake. *Verk. int. Ver. Limnol.* 18.

**31. ØVRE HEIMDALSVATN**

**Criteria for inclusion** 1a,b; 3b; 4a.

**Geographical location** 61°25'N 8°43'E At the south-eastern corner of the highest peaks of the Jotunheimen mountains, in Oppland *fylker*, about 25 km east of the eastern end of the Sognefjord and 210 km north-east of Bergen.

**Area** 77 ha.

**Altitude** 1,090 m above sea level.

**Water depth** Maximum 13 m; mean 4.7 m.

**Wetland type** 19.

**Ecology** A lake basin formed by damming caused by a ground moraine and an ablation moraine. The ground rocks are largely basic plutonic rocks, such as schists and mylonites, lying within a thrust belt. The lake waters are oligotrophic and the soft muddy bottom has a vegetation of quillwort *Isoetes lacustris* and *Scorpidium scorpioides* moss. Characteristic bottom faunal elements are *Lepidurus arcticus*, the amphipod *Gammarus lacustris*, *Lymnaea peregra* and ramshorn *Gyraulus (Planorbis) acronicus*. The only fish present is the Trout *Salmo trutta*.

**Legal status** Unprotected.

**Tenure** The lake and most of its catchment belongs to the state-run Royal Norwegian Agricultural Department (Landbruksdepartementet).

**Management practices** No information.

**Threats** None reported.

**Scientific research** Site of Norwegian IBP/PF (International Biological Programme, section on production freshwaters) studies of lake productivity.

**Principal reference material**

An unpublished report by K. W. Jensen but further publications should become available shortly.

**33. HEDEMARKSVIDDA mires**

**Criteria for inclusion** 1d,e; 2a; 4a,b.

**Geographical location** c.61°00'N 11°00'E Plateau 25 km north-east of Hamar, in the Hedmark *fylker*.

**Area** 530 ha.

**Altitude** 600–700 m.

**Water depth** No information.

**Wetland types** 19, 20, 21, 22.

**Ecology** An area of upland peatlands, consisting of large level fens and variable mires sensitive to changes in hydrological conditions. The site was listed by Project TELMA (for the conservation of peatlands) as one of international importance.

**Legal status** Unprotected.

**Tenure** Private ownership.

**Management practices** None.

**Threats** None at present.

**Scientific research** No information.

**Principal reference material**

Moen, Asbjørn, 1973. Landsplan for myrreservater i Norge. *Norsk Geografisk Tidsskrift* 27: 173–193.

### 35. RØNNASMYRA

**Criteria for inclusion** 1d,e; 2a; 3a,4a

**Geographical location** c.60°35'N 12°10'E About 60 km south-east of Hamar, in the *fylker* of Hedmark, close to the towns of Flisa and Grue and to the border with Sweden.

**Area** 160 ha.

**Altitude** 160–180 m.

**Water depth** No information.

**Wetland types** 20, 22.

**Ecology** A complex of concentric raised bogs dominated by ombrotrophic vegetation not far from the Asnes forest. The bog margins tend to be minerotrophic and marked by a belt of the sedge *Carex globularis*. The site was rated as of international importance by Project TELMA (for the conservation of peatlands).

**Legal status** The area has been given temporary legal protection.

**Tenure** Private ownership.

**Management practices** No information.

**Threats** Drainage and agricultural exploitation.

**Scientific research** No information.

**Principal reference material**

Moen, Asbjørn, 1973. Landsplan for myrreservater i Norge. *Norsk Geografisk Tidsskrift* 27: 173–193.



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**36. VESTREVATN mire, OSTERØY island**

**Criteria for inclusion** 2a; 4a,b.

**Geographical location** c.60°32'N 5°30'E The mire is to the east of the Vestre lake, in the north centre of the island of Osterøy, 25 km north-east of Bergen, Hordaland fylker.

**Area** 200 ha.

**Altitude** 150 m.

**Water depth** No information.

**Wetland types** 19, 21, 22.

**Ecology** A typical mire of western Norway, consisting of a mosaic of swamp and woodland. The dominant vegetation is ombrotrophic but some large minerotrophic patches are to be found, to some extent associated with a richer flora and the presence of less common species. The site was rated as of international importance by Project TELMA (for the conservation of peatlands).

**Legal status** Unprotected.

**Tenure** Private ownership.

**Management practices** None.

**Threats** None at present, but a hydroelectric installation constructed at nearby Herlandsfoss could lead to a lowering of the water table with adverse consequences on the flora.

**Scientific research** No information.

**Principal reference material**

Moen, Asbjørn, 1973. Landsplan for myrreservater i Norge. *Norsk Geografisk Tidsskrift* 27: 173–193.

**38. KINSO river and lake complex**

**Criteria for inclusion** 1d; 2a; 3b; 4a,b.

**Geographical location** 60°10'–22'N 6°43'–7°05'E The river drains the south-western slopes of the Hardangervidda, the plateau below the 1,862 m Hardanger-Jøkulen peak and traverses or taps four principal lakes, the Omkjel-, Kinse-, Stavali- and Vei-vatn, on its way to the upper Hardangerfjord, which it reaches at Kinsarvik.

**Area** The total length of the river and its tributaries is about 43 km and, together with its eight lakes the total 'wetland' area might be estimated at about 300 sq. km.

**Altitude** From c.1,450 m at source to sea level at Kinsarvik.

**Water depth** Maxima: Omkjelvatn c.30 m, Kinsevatn c.5 m, Veivatn c.40 m.

**Wetland types** 13, 19, 21.

**Ecology** The Kinso watercourse is representative of those in typical Norwegian west coast valleys with high precipitation and lush vegetation. The tributary valleys,

coming from the steep ridge to the west, are deeply incised by ice action and stream erosion. In the upland tundra of the Hardangervidda the Kinso runs through an open valley forming the Omkjel- Vei- and Stavali- lakes, the fauna of Omkjelvatn being particularly unusual. The entire complex is of outstanding geological and limnological interest for research and as a reference area. The flora is of equal interest, and includes many scarce calcicolous species.

**Legal status** Unprotected. The Kinso river rises on the border of the proposed Hardangervidda National Park. Extension of the park to include at least the upper course of the river and its associated lakes would be a valuable improvement.

**Tenure** Mostly private ownership.

**Management practices** None reported.

**Threats** A hydroelectric development plan exists and a power-plant has already been installed at Nykkjesøy on the lower part of the river.

**Scientific research** No information.

**Principal reference material**

Ahlmann, H. W. 1919. Geomorphological studies in Norway. *Geogr. Ann.*

**40. NORTHERN LAKE ØYEREN with the rivers SVELLET, NITELVA and LEIRELVA**

**Criteria for inclusion** 1a,d,e; 2a; 3a,b; 4a.

**Geographical location** 59°50'–60°23'N 10°40'–11°15'E About 15 km east of Oslo, the associated rivers extending to about 40 km north of Oslo, mainly within the *fylker* or 'county' of Akershus.

**Area** c.6,900 ha.

**Altitude** 103 m above sea level.

**Water depth** Maximum 5 m; average c.0.5 m.

**Wetland types** 9, 12, 18.

**Ecology** The Nitelva and Leirelva meander through deposits of Pleistocene marine clay and are eutrophic in their lower courses. The shallow northern end of Lake Øyeren, into which they flow, is in effect the beginning of the river Glomma delta and the lake becomes progressively less eutrophic towards its southern outlet. The main plant associations are *Magnocaricetum*, *Eleocharetum* and *Potametum* and the dominant species are slender spiked sedge *Carex gracilis* (= *acuta*), slender spike-rush *Scirpus* (= *Eleocharis*) *acicularis*, a waterwort *Elatine triandra*, creeping spearwort *Ranunculus reptans*, the crowfoot *R. peltatus*, and perfoliate pondweed *Potamogeton perfoliatus*. The main species of phytoplankton are *Asterionella formosa* and *Fragilaria crotonensis*, and there are several species of blue-green algae.

Some 23 species of freshwater fish have been identified, a number of them migrating at certain times of the year between the deeper southern and shallower northern part of the lake. The area supports a rich avifauna and is of particular importance as a feeding and roosting site in the migration seasons and in winter. It is the most important wintering site for Whooper Swan *Cygnus cygnus* in Norway, up to 550 having been counted.

**Legal status** Protected as a Nature Reserve since 1975.

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**Tenure** Multiple private ownership.

**Management practices** A management plan for the area is to be drawn up. Present uses include water supply, domestic and industrial effluent disposal, timber transport, fishing, hunting and recreation.

**Threats** Pollution from industry up-river, dike-construction, recreational activities.

**Scientific research** Various limnological and ornithological studies have been undertaken.

**Principal reference material**

Several publications by the Zoologisk Museum, Universitetet i Oslo, the Norsk Institutt for vannforskning, and the Ministry of Environment, Oslo.

**43. VIDMYR**

**Criteria for inclusion** 1d,e; 2a; 3a; 4a,b.

**Geographical location** c.59°30'N 7°20'E Northern end of Aust-Agder *fylker* in the Bykle commune, 160 km north-north-west of Kristiansand and 90 km east-north-east of Stavanger.

**Area** 500 ha.

**Altitude** 850 – 1,000 m.

**Water depth** No information.

**Wetland type** 21.

**Ecology** A large complex of sloping and level fens. The vegetation is mainly poor and minerotrophic though some areas support a rather richer growth. The mire was rated as a site of international importance by Project TELMA (for conservation of peatlands).

**Legal status** Unprotected.

**Tenure** Private ownership.

**Management practices** No information.

**Threats** Drainage and cultivation.

**Scientific research** No information.

**Principal reference material**

Moen, Asbjørn, 1973. Landsplan for myrreservater i Norge. *Norsk Geografisk Tidsskrift* 27: 173–193.

**44. TYRIFJORD**

**Criteria for inclusion** 2a,c; 3a,b,c; 4a.

**Geographical location** c.60°00'N 10°10'E In Buskerud *fylker* and about 21 km at its nearest point from Oslo, which is to the east-south-east.

**Area** 13,400 ha (made up of two parts, Holsfjord 12,130 ha and the smaller, shallow Steinsfjord, 1,280 ha).

**Altitude** 64 m above sea-level.

**Water depth** Maximum Holsfjord 295 m, Steinsfjord 22 m; mean Holsfjord 114 m, Steinsfjord 11.6 m.

**Wetland types** 18, 19, 20.

**Ecology** An important limnological site for lake metabolism and productivity studies. The geochemical differences of the rocks of the catchment area of each of the two sections of Tyrifjord, together with their morphological differences, result in the markedly variable characteristics of their waters. Steinsfjord lies on cambro-silurian sediments providing a relatively good nutrient supply to the lake waters which are shallow and become trophogenic and stagnant in summer. Holsfjord has a deep basin with steep sides and its water is derived from areas poor in dissolved nutrients, resulting in thermal stratification.

**Legal status** Unprotected.

**Tenure** Private ownership.

**Management practices** Recreation and fishing (particularly for crayfish *Potamobius astacus*) are allowed.

**Threats** Increasing use of the fjords for waste disposal.

**Scientific research** A classic limnological site, used for training courses by the University of Oslo.

**Principal reference material**

Luther, H. and Rzóska, J. 1971. Project Aqua: a source book of inland waters proposed for conservation. IBP Handbook No. 21, Blackwells Scientific Publications, Oxford and Edinburgh: pp. 50–51 (contains an extensive list of relevant publications).

#### 45. BORREVATN

**Criteria for inclusion** 1c,d,e; 2a,b,c; 3a,b,c;4a,b.

**Geographical location** 59°25'N 10°26'E On the western shore of the entrance to Oslofjord and 60 km south-west of the city, and a short way east of the town of Horten is the Borre district of Vestfold fylker.

**Area** c.240 ha (quoted as 208 ha in the AQUA List).

**Altitude** 9 m.

**Water depth** Maximum 15.2 m; average 6.4 m.

**Wetland type** 18.

**Ecology** The lake is of considerable geological and hydrological interest, its basin being formed as a result of the combined effects of glacial erosion along a fault line and marginal glacial deposits. A large end-moraine dams Borrevatn to the south and forces its outflow to start from its northern end. The deposits in this formerly submarine area consist of clay, sand and gravel. The lake is situated at the northern limit of eutrophic lakes in Europe, such lakes therefore being rated as rare in Norway.

The flora and fauna are highly diversified: approximately 300 species of invertebrates are found in the lake, including the crustacean *Gammarus duebeni* Lillj.,

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a species of shrimp considered to be a relict from c.2,500 years ago when the lake was part of Oslofjord. It lives in one of the ditches flowing into the lake. The avifauna is exceptionally rich both in species and numbers but no details are available. In general the littoral zone is very varied and in places supports a rich macro-vegetation.

**Legal status** Unprotected at present but there is a proposal to make the lake a Nature Reserve.

**Tenure** Private ownership.

**Management practices** The town of Horten draws its water supply from the lake but subject to certain limits.

**Threats** Discharge of sewage into the lake, drainage of surrounding land for agricultural purposes and demands for increased water supplies for Horten are among the factors liable to disturb the ecological balance of the site.

**Scientific research** This lake has been more thoroughly studied than any other in Norway.

### Principal reference material

Skulberg, O. M. 1957. Borrevatn, an eutrophic lake in the county Vestfold. Hydrographic and biological observations – December 1954 – November 1955. 155pp. (Dissertation in botany deposited at the University of Oslo; in Norwegian).

Økland, J. 1964. The eutrophic lake Borrevatn (Norway). An ecological study on shore and bottom fauna with special reference to gastropods, including a hydrographic survey. *Folia limnologica scandinavica* 13: 1–337.

## 47. MAMYRA

**Criteria for inclusion** 1d,e; 2a; 4a.

**Geographical location** 59°15'N 6°13'E About 8 km south-south-east of Hjelme-landsvagen and 36 km north-east of Stavanger, in *fylker* Rogaland; principally on the southern flanks of the Ardalsheiene and Hestheii (582 m) and overlooking the Bønardalen, to the north-west of the upper Tysdal lake (Øvre Tysdalsvatn).

**Area** 200 ha.

**Altitude** 450 – 550 m.

**Water depth** No information.

**Wetland type** 22.

**Ecology** A mixture of mire components, mostly on a south-facing slope, the upper edge of the mire forming a typical terrain-covering complex. Smaller mires interspersed with drier areas occur at the north-eastern end of the area, which was rated as of international importance by Project TELMA (for the investigation and conservation of peatlands).

**Legal status** Unprotected.

**Tenure** Private ownership.

**Management practices** None reported.

**Threats** Drainage and cultivation.

**Scientific research** No information.

**Principal reference material**

Moen, Asbjørn, 1973. Landsplan for myrreservater i Norge. *Norsk Geografisk Tidsskrift* 27: 173–193.

**51. ORA**

**Criteria for inclusion** 1a,d,e; 2a; 3a; 4a.

**Geographical location** 59°10'N 11°00'E On the eastern shore of the entrance to Oslofjord, at the mouth of the river Glomma; immediately south of the town of Fredrikstad, in *fylker* Østfold.

**Area** 1,100 – 1,200 ha.

**Altitude** Sea level.

**Water depth** maximum 25 m (but mostly less than 5 m); average 0.5 – 1 m.

**Wetland types** 6, 8, 9, 10.

**Ecology** A shallow, eutrophic brackish water area in the delta of the Glomma. It is transected by a deeper channel (where the maximum depth of 25 m is found), which has a higher salt content than the shallows, reflected by the quite markedly marine character of its flora and fauna. The area as a whole, with its lush vegetation, marks an important zoogeographic boundary.

Waterfowl breeding in the area include Greylag Goose *Anser anser*, Wigeon *Anas penelope*, Pintail *A. acuta*, Shoveler *A. clypeata*, Water Rail *Rallus aquaticus*, Dunlin *Calidris alpina schinzii*, Ruff *Philomachus pugnax*, Curlew *Numenius arquata* and Caspian Tern *Hydroprogne ischegrava*. The wetland is also of great importance to migrating and wintering waterfowl, with, for example, up to 450 Whooper Swans *Cygnus cygnus* recorded.

The fish population is unusual in that the many fresh- and salt-water species present are more typical of those of the Gulf of Bothnia than of the North Sea. Mammals are represented by Ground Vole *Arvicola terrestris*, Short-tailed Vole *Microtus agrestis* and Brown Rat *Rattus norvegicus*, and more rarely by Blue Hare *Lepus timidus*, Red Fox *Vulpes vulpes*, Badger *Meles meles*, the American Mink *Mustela lutreola vison* (introduced), Otter *Lutra lutra*, Common Seal *Phoca vitulina* and Elk *Alces alces*. Four of the five amphibians occurring in Norway have been found in the area: Smooth Newt *Triturus vulgaris*, Common Toad *Bufo bufo*, Common Frog *Rana temporaria* and Moor Frog *Rana arvalis*.

**Legal status** Unprotected but a proposal to establish a Reserve is under consideration.

**Tenure** Partly state and partly private ownership.

**Management practices** None. The area is used for hunting, as a military training ground, and as a rubbish-dump.

**Threats** In addition to the serious threat posed by the use of the area as a dump, there are plans to take over part of it for developing industrial and port facilities.

**Scientific research** Various studies in limnology and biology have been carried

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out by the Zoologisk Museum Universitetet i Oslo and Norsk Institutt for vannforskning (NIVA), Oslo.

**Principal reference material**

In addition to publications by the institutes named in the previous section, the following call for mention:

Andersen, B. A. and Lid, G. 1968. Øraomradet – et stykke verdifull østlandsnatur i faresonen. *Norsk natur*. 3.

Andersen, B. A. and Lid, G. 1972. Vertebratfaunaen i Øraomradet ved Fredrikstad. *Fauna* 25. (With English summary).

**52. AREKILEN**

**Criteria for inclusion** 1d; 2a; 3b; 4a, b.

**Geographical location** 59°02'N 11°02'E About 25 km south-east of Fredrikstad, in Østfold fylker, on a peninsula facing the Swedish border.

**Area** 30 ha.

**Altitude** 1 m above sea level.

**Water depth** 0.8 m

**Wetland type** 18.

**Ecology** A natural eutrophic basin dammed by morainic and marine clay sediments. The water area is rapidly becoming overgrown by macrophytic vegetation, dominated by reeds *Phragmites communis* but with several species of rush *Scirpus*, whilst a dense submerged vegetation includes whorled water-milfoil *Myriophyllum verticillatum*, hornwort *Ceratophyllum demersum*, horned pondweed *Zannichellia palustris* and holly-leaved naiad *Najas marina* (for which this is one of the few stations in Norway). It is also the only known Norwegian locality for the Shiny Ramshorn watersnail *Segmentina nitida*. Finally, among the many bird species, the presence of the Marsh Harrier *Circus aeruginosus*, Water Rail *Rallus aquaticus* and Spotted Crake *Porzana porzana* may be noted.

**Legal status** Unprotected, but the creation of a bird reserve in the area has been proposed.

**Tenure** Private ownership.

**Management practices** No information received.

**Threats** None reported.

**Scientific research** Hydrobiological investigations were carried out in the area by the Norwegian Institute for Water Research in 1970. The avifauna and freshwater fauna have been periodically studied.

**Principal reference material**

Norderhaug, M. 1958. Trekk fra Arekilen og dens fugleliv. *Sterna* 3/4.

Anon. 1968. Vern av naturlig næringsrike innsjøer i Norge. Norsk institutt for vannforskning, Blindern 1968.

**53. RØRHOLTFJORDEN**

**Criteria for inclusion** 2a,b,c; 3a,b; 4a,b.

**Geographical location** 59°00'N 9°20'E Part of Tokke-vatn (lake), about 25 km south-west of Skien, in the south-eastern corner of Telemark fylker.

**Area** 590 ha.

**Altitude** 60 m.

**Water depth** maximum 147.5 m; average 64.8 m.

**Wetland types** 18, 19, 20.

**Ecology** The Rørholtfjorden is the classic example of a lake with 'trapped' sea water, which constitutes a water-layer at a depth of between 132 and 147.5 m. It is thought to have originated some 6,000 years ago, during the glacio-isostatic uplift of the land surface. It is of great scientific interest for investigations into reduction processes in sea water and sediments.

**Legal status** Unprotected.

**Tenure** Private ownership.

**Management practices** The water level is slightly raised and lowered for hydro-electric power supply purposes, but no further development or exploitation of the site is being permitted.

**Threats** None at present.

**Scientific research** A full year's hydrographical research has been undertaken mainly on the ionic composition of the trapped sea water.

**Principal reference material**

Strøm, K. 1957. A lake with trapped seawater. *Nature* 180.

Strøm, K. 1962. Trapped seawater. *New Scientist* 13.

Lande, A. 1972. Trapped Sea-Water in Rørholtfjorden. *Schweiz. Zeitschr. f. Hydrol.* Col. 34.

**55. REVET and ORREVATN**

**Criteria for inclusion** 1a; 2a; 3a; 4a.

**Geographical location** 58°45'N 5°31'E About 20 km south-south-west of Stavanger, Rogaland, not far to the south of the Figgio rivermouth.

**Area** The lake, Orrevatnet, is about 600 ha in size and the coastal, Revet, sector is c.1.5 km long.

**Altitude** Sea level to 4 m.

**Water depth** No information.

**Wetland types** 11, 18.

**Ecology** Revet comprises a stretch of sandy shore bordered by the shallows of three distinct reefs and, as such, is an important area for migrating waterfowl. The Orrevatn is a shallow, eutrophic to mesotrophic freshwater lake separated from the sea by the Revet shoreline. The vegetation includes pastures and croplands,



## NORWAY

dune areas with sand couch *Agropyron junceiforme* and marram *Ammophila arenaria*, patches of coniferous woodland and the reedy margins of the lake itself. Fish production, mainly of Salmonid species, is high. Counts have shown that migrating or wintering waterfowl can include up to 150 Whooper Swans *Cygnus cygnus*, 1,000 Greylag Goose *Anser anser* and 4,000 ducks, as well as large numbers of waders Limicolae.

**Legal status** A protected status for the area has been proposed but is not known to have been implemented.

**Tenure** Private ownership.

**Management practices** None.

**Threats** Proposals for partial drainage of the Orrevatn would reduce the lake area by about 20% and lower the water level by 0.7 m.

**Scientific research** The Revtangen (Tangen Reef) ornithological station has undertaken several studies in the area.

### Principal reference material

The Zoologisk avdeling, Stavanger Museum, Stavanger, is the principal source of information on this area.

(Svalbard).

## 2. FORLANDSØYANE

**Criteria for inclusion** 1d; 2a; 4a,b.

**Geographical location** 78°20'N 11°36'E An archipelago of several small islands to the west of Prins Karls Forland and incorporated in the National Park of that name. The Forland itself is the westernmost of the main group of islands, to the north of the entrance to Isfjorden and 40 km from the nearest settlement.

**Area** No estimate given.

**Altitude** Sea level to 4 m.

**Water depth** No information.

**Wetland types** 3, 5, 10.

**Ecology** Three islands (Sørøya, Midtøya and Nord-øya) and a number of islets (the biggest of them c.1 km long), which have several small freshwater ponds and moss-bog vegetation and are surrounded by shallow water.

The area is internationally important as a breeding area for various waterfowl of high latitudes, including Pink-footed Goose *Anser brachyrhynchus*, Brent Goose *Branta bernicla hrota*, Barnacle Goose *B. leucopsis*, Eider *Somateria mollissima*, Arctic Skua *Stercorarius parasiticus* and Arctic Tern *Sterna paradisaea*.

**Legal status** The area has been a bird reserve since 1973 and is part of the Prins Karls Forland National Park.

**Tenure** State-ownership.

**Management practices** The reserve is closed to ordinary visitors and no human activities are allowed in its vicinity when the birds are breeding.

**Threats** None.

**Scientific research** Ornithological studies have been carried out by the Norsk Polar Institut.

**Principal reference material**

Several publications by the Norsk Polar Institut (1330 Oslo Lufthavn, Norway).

# PAKISTAN

## SUMMARY OF WETLAND SITUATION

The importance of the Pakistan wetlands became apparent during midwinter counts carried out by specialists of the International Waterfowl Research Bureau (IWRB) in February 1971 and 1973 and in the winters of 1973/1974 and 1974/1975. The Indus Valley proved to be a major wintering ground for Palearctic waterfowl breeding in Central and Northern Asia, to which they migrate via Afghanistan but probably also directly across the higher ranges of the Himalaya. Most of the natural lakes in this basically semi-arid and arid country have disappeared over the last fifty years as a result of irrigation projects and drainage aimed at providing more arable land for food production. However, several new lakes were created upstream of dams constructed in recent years on the River Indus, for the purpose of storing water for human consumption as well as for irrigation. Some have become very important wintering areas for waterfowl and these and other wetlands, particularly in the great valleys of Sind and Punjab, are feeding grounds for huge concentrations of Anatidae and also for coots *Fulica atra*. Elsewhere, the mudflats and mangrove vegetation along the coast of the Arabian Sea provide particularly favourable habitat for herons, ibises and pelicans, as well as great numbers of waders Limicolae.

The Government is well aware of the extraordinarily rich natural resources represented and indicated by these birds and has developed an active conservation policy. The Forest Department and the Sind Wildlife Management Board have especially distinguished themselves in the creation of protected areas and many of the state-owned lakes have become Game Sanctuaries. Such natural lakes as survive are often in private ownership, but they are generally used for hunting on only a few days a year. However they are well managed and are kept free from disturbance for the rest of the year. Pakistan ratified the Ramsar Convention in July 1976 and to date has designated nine wetlands for inclusion in the List of the Convention.

Several wetlands in the Punjab are of importance to threatened species. Thus the White-headed Duck *Oxyura leucocephala* winters in some numbers on Lake Khabbaki (a Ramsar Convention site), Lake Nammal (a Game Sanctuary) and the Kharrar Jheel. The rare Bar-headed Goose *Anser indicus* seems to have its main wintering area in Pakistan at Tauna Barrage (430, December 1973) and at Chasma Barrage (45, March 1975). Other areas with notable concentrations of a wide variety of waterfowl in winter are Lal Suhanra in the Bahawalpur District of the Punjab; and the Ghauspur Jheels in the Jacobabad District, Lakes Drigh (a Ramsar Convention site) and Langh, Larkana District, and Kalri Lake (a Ramsar Convention site), Hadero Dhand (a Game Sanctuary) and Haleji Dhand (a Ramsar Convention site). Thatta District, all in Sind.

The mouth of the River Indus is another area of special interest, with its extensive mudflats and mangroves (mainly *Avicennia officinalis* and *Ceriops candoleana*). Bird species frequenting it include Spot-billed Pelican *Pelecanus philippensis*, Western Reef Heron *Egretta gularis* and Grey Heron *Ardea cinerea* and many species of Limicolae. The construction of dams and large scale irrigation

projects further upstream has reduced the flow of water and many former rice growing areas near the rivermouth, around Keti Bandar for example, have been replaced by dry pastures.

The Black Finless Porpoise *Neophocaena* (= *Neomeris*) *phocaenoides* inhabits the tidal zone of the Indus and shallows along the coast. Five species of marine turtles occur in territorial waters, namely the Green Turtle *Chelonia mydas*, Olive Ridley *Lepidochelys olivacea*, Loggerhead *Caretta caretta*, Leatherback *Dermochelys coriacea* and Hawksbill *Eretmochelys imbricata*. Killing of turtles which come ashore in large numbers for breeding (notably in Hawkes Bay and Sandspit) has been banned, as is the collecting of eggs.

About 285 species of fish have so far been recorded from Pakistan waters. Important genera are the snappers *Lutjanus*, pony-fish *Leiognathus*, javelin-fish *Pomadasys*, the breams *Sparus* and *Sargus*, *Crinieus* and scat *Scatophagus*. Molluscs of economic importance include *Plocuna* sp., found in shallow waters of creeks and along the coast, and the oysters *Ostrea gryphoides*, *O. cuculata* and *O. discoides*, which are common in the creek system of Korangi. Commercial fishing has increased greatly and the stock of shrimps is showing signs of depletion. Research is being carried out to measure the effects of fishing on stocks and to develop conservation measures.

In conclusion, it should be noted that the appended list of 27 wetlands, which includes of course the nine 'Ramsar Convention sites', is still of a somewhat provisional or preliminary nature, many potentially important sites having yet to be investigated and further details, particularly those related to size, ascertained.

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- Koning, F. J. and Walmsley, J. G. 1973. I.W.R.B. Mission to West Pakistan, February 1973. Stencilled report; abstract in *IWRB Bulletin* 35: 64-72.
- Koning, F. J. and Dijksen, L. J. 1974. I.W.R.B. Mission to West Pakistan, Winter 1973/1974. Stencilled report; abstract in *IWRB Bulletin* 37: 71-76.
- Koning, F. J. and Koning-Raat, M. J. 1975. I.W.R.B. Mission to West Pakistan, Winter 1974/1975. Stencilled report; abstract in *IWRB Bulletin* 29/40: 58-61.
- Syed Qadir Mohiuddin, 1976. National Report of Pakistan. In *Proceedings of Regional Meeting on the Promotion of Marine Parks and Reserves in the Northern Indian Ocean, including the Red Sea and Persian Gulf*, Tehran, March 1975. IUCN Publications new series No. 35, Morges, Switzerland, pp. 86-88.

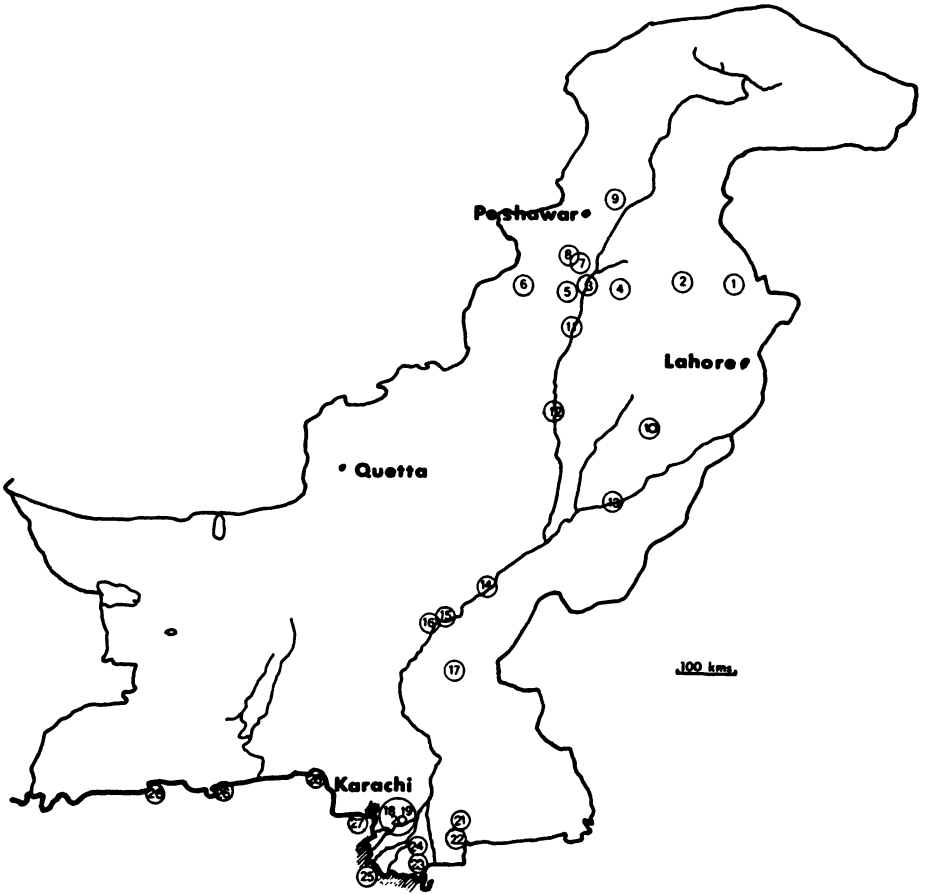
**WETLANDS OF INTERNATIONAL IMPORTANCE**

\*Nominated for inclusion in Ramsar Convention list

	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
1.	Rasul Barrage, Jhelum	32°46'N	73°40'E	No information	1b Unprotected
*2.	Khabbaki Lake, Jhelum	32°37'N	72°14'E	283 ha	1c,d Game Sanctuary/ Ramsar Convention List
3.	Nammal Lake, Salt Range	32°40'N	71°49'E	1,000–2,500 ha	1c,d; 2a Game Sanctuary
4.	Uchali Lake, Salt Range	32°33'N	72°02'E	150 ha	1c; 2b Unprotected
*5.	Thanedar Wala, Game Reserve, Bannu	32°35'N	71°05'E	4,047 ha	No information Ramsar Convention List
*6.	Malugul Dhand, Bannu	33°00'N	70°36'E	405 ha	No information Ramsar Convention List
*7.	Tanda Dam reservoir, Kohat	33°35'N	71°29'E	405 ha	No information Ramsar Convention List
*8.	Kandar Dam reservoir, Kohat	33°36'N	71°29'E	251 ha	No information Ramsar Convention List
*9.	Kheski Reservoir, Peshawar	34°00'N	72°02'E	263 ha	No information Ramsar Convention List
10.	Kharrar Jheel, Lyallpur, Punjab	30°52'N	72°32'E	700–1,000 ha	1b,c; 2a Unprotected
11.	Chasma Barrage, Mianwali, Punjab	32°25'N	71°28'E	8,000 ha	1a,b,d,e; 2a Unprotected
12.	Taunsa Barrage, Dera, Punjab	30°42'N	70°50'E	No information	1a,b,c,d,e; 2a Unprotected
13.	Lal Suhanra, Bahawalpur, Punjab	29°22'N	71°57'E	2,000–3,000 ha	1a,b,d,e; 2a Protected
14.	Ghauspur Jheels, Jacobabad, Sind	28°08'N	69°09'E	600 ha	1a,b,d,e; 2a Unprotected
*15.	Drigh Lake, Larkana, Sind	27°34'N	68°06'E	164 ha	1a,b,d,e; 2a Ramsar Convention List
16.	Langh Lake, Larkana, Sind	27°30'N	68°05'E	No information	1a,b,d,e; 2a Unprotected
17.	Nara Canal Area, incl. Sanghar Jheel, Jamrao Head, Sanghiaro, Soonahri & Sadori lakes; Sanghar, Sind	c.25°45'– 26°30'N	68°52'– 69°38'E	No information	1a,b,d,e; 2a Partly protected

	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
*18.	Kalri Lake (Kinjhar Lake Game Sanctuary), Thatta, Sind	24°52'N	68°03'E	13,468 ha	1a,b,c,d,e; 2a; 3a,c Ramsar Convention List
19.	Hadero Dhand, Thatta, Sind	24°49'N	67°52'E	2,318 ha	1a,b,d,e; 2a; 3a,c Game Sanctuary
*20.	Haleji Dhand, Thatta, Sind	24°47'N	67°46'E	1,704 ha	1a,b,d,e; 2a; 3a,c Ramsar Convention List
21.	Tando Bago Area, Hyderabad, Sind	24°45'N	68°57'E	No information	1b,d; 2a Unprotected
22.	Lakes south of Badin, incl. Sandho & Salt Chanki; Tatta/ Hyderabad, Sind	c.24°30'N	68°50'E	No information	1a,b,d,e; 2a Unprotected
23.	Lakes nr. Ladiun, incl. Gungri, Dho, Talli, Sanbher & Gujo; Thatta, Sind	c.24°20'N	68°10'E	No information	1d,e; 2a Unprotected
24.	Lakes nr. Sujawal, incl. Gur & Maboobshah; Thatta, Sind	c.24°36'N	68°06'E	No information	1d; 2a Unprotected
25.	Indus rivermouths, from Gharo east of Karachi to Indian border	23°40'– 24°44'N	67°28'– 68°13'E	No information	1c,d,e; 2a,b; 3a Unprotected
26.	Coastal creeks with mangroves (6-10 localities)	c.23°40'– 25°40'N	c.63°30'– 68°15'E	No information	1d,e; 2a,b,c; 3a Unprotected
27.	Hawkes Bay/ Sandspit Marine Turtle beaches	c.24°47'N	67°02'E	No information	1c,d,e; 2a,b; 3a Protection for Turtles

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# POLAND

## SUMMARY OF WETLAND SITUATION

The north of Poland is especially rich in lakes and marshes, the majority of them providing excellent habitat for breeding and migrating waterfowl. Most of the freshwater sites freeze over in winter, so wintering ducks and geese, for example, are comparatively few.

The most important wetland complex is formed by the Mazurian Lakes in the north-eastern part of the country and includes over 4,000 lakes with a total surface of about 115,000 ha, the largest being Sniardwy (10,600 ha) followed by Mamry (10,400 ha). Reserves have been established on several of the lakes and a Mazurian Landscape Park was reported to be in the planning stage in 1976.

The Mazurian lakes are of various types, ranging from shallow with dense vegetation to deep with rather poor plant cover, and are often surrounded by forest. They are of great limnological interest and seven of them were included and described in the Project AQUA source book. Their importance from the Project MAR viewpoint, that is to say to waterfowl, is equally great. Typical breeding species are Cormorant *Phalacrocorax carbo*, Bittern *Botaurus stellaris*, Grey Heron *Ardea cinerea*, Black Stork *Ciconia nigra*, Mute Swan *Cygnus olor*, Greylag Goose *Anser anser*, several of the *Anas* Ducks and raptors including White-tailed Eagle *Haliaeetus albicilla* and Osprey *Pandion haliaetus*. Lake Luskajno, already a Nature Reserve, was nominated for inclusion in the Ramsar Convention List, when Poland acceded to the Convention in November 1977. It is notable for having the densest breeding population of Mute Swans *Cygnus olor* in Europe (about 1,000 pairs). Designation of three further reserves for the Convention List is under consideration. Lake Druzno situated in the extreme north-west of the Mazurian complex, near Elblag, is already an ornithological reserve.

Between the Mazurian Lakes and the town of Bialystok a considerable area of marshland is to be found along the Biebrza river and Augustowski canal; of the original 50,000 ha, about 3,500 ha have been protected and hope has been expressed that a further 18,000 could be saved (Nowak 1970). Characteristic breeding birds of this important area again include *Botaurus stellaris*, *Ardea cinerea* and *Ciconia nigra*, others being the Black Grouse *Lyrurus tetrix*, Ruff *Philomachus pugnax*, Curlew *Numenius arquata* and Penduline Tit *Remiz pendulinus*.

Although in general the wetlands elsewhere in Poland tend to be smaller, Lake Miedwie in the north-west, near Szczecin, Liwia Luza and Lubiawskie lakes close to the Baltic coast, and Lebsko and Gardno lakes further to the east and only separated from the sea by a narrow strip of land, are all of interest to breeding waterfowl and harbour large concentrations during the migration seasons. The two last-named are of particular importance as breeding places of the Crane *Grus grus*, *Anser anser* and *Cygnus olor*, and have been included in a National Park. Another important nesting area, this time for Anatidae and Limicolae, is the Ptasi Raj reserve situated around the Wisla (Vistula) river mouth and including two densely overgrown lakes.

Moving further south, the Zegrze reservoir, situated just north of Warsaw near



the confluence of the Bug and Narew rivers, is of importance to migrating waterfowl, as are the marshes to the west of Warsaw and north-west of Lodz along the Warta river and also the vast fishpond complex of Milicz well to the south-west and about 60 km north of Wrocław. Incidentally, the fishpond complex, created in the 14th century, has or had a good breeding population of *Anser anser* (200 pairs according to the MAR List), several species of *Anas* and some *Botaurus stellaris* and *Ciconia nigra* although in winter and during the migrations hundreds more geese, mainly *Anser anser* and White-fronted Goose *A. albifrons*, and several thousand duck arrive.

In the south-east are Imielty Lug Lake and marshes, surrounded by uninhabited peat bogs and vast forests. Breeding species include *Ciconia nigra*, various *Anas* species, *Lyrurus tetrix*, *Grus grus*, Little Crake *Porzana parva*, Redshank *Tringa totanus* and Green Sandpiper *T. ochropus*. Anatidae and Limicolae are abundant during the migration seasons. But the most important wetlands in southern Poland are situated to the west of Krakow, the fishponds of Zator 40 km from the city, the reservoir of Goczalkowice further upstream and the fishponds of Lezczak near Racibórz. All three are of interest because of their varied breeding bird populations as well as their importance to waterfowl migrating through the Moldawska Gate, the main pass between the Sudety and Carpathian ranges.

Finally, mention should be made, although they are not yet listed here as wetlands of international importance, of two recently protected sites, lakes Dobskie and Warmolty, which sustain large numbers of waterfowl. There have also been two more contributions to the conservation of sites which include a substantial amount of good waterfowl habitat, namely the creation of the Suwalki Landscape Park, with a protected zone of 8,470 ha, and of the Wigry Landscape Park (10,940 ha) with a protected area of 2,770 ha, both of them in the extreme north-east corner of the country about 25 km from the USSR border.

The best results of ornithological research carried out in many of the wetlands referred to, have been mostly published in the Polish Academy of Sciences' *Acta ornithologica*, those of the limnological research, for many years centred on the Hydrobiological Station of the Academy's Institute of Ecology at Mikołajki, in Hydrobiological Bulletins. The importance of the limnological literature is indicated by the extent of translation into other languages.

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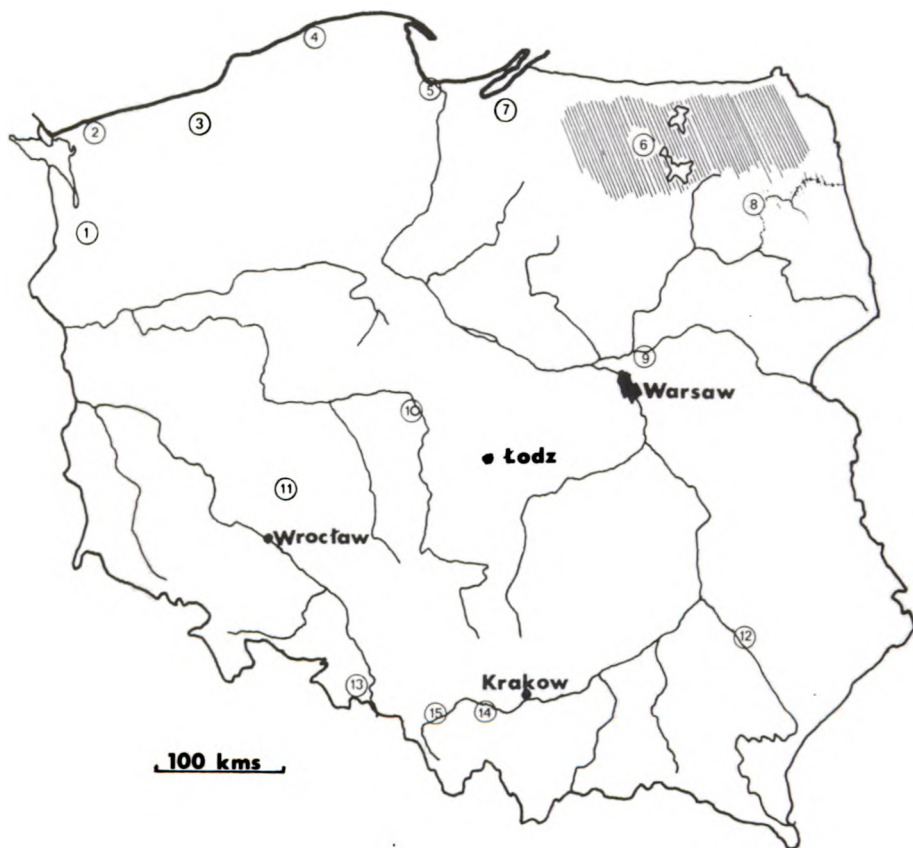
## WETLANDS OF INTERNATIONAL IMPORTANCE

## \*Nominated for inclusion in the Ramsar Convention list

	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria†/ Conservation status</i>
1.	Lake Miedwie	53°15'N	14°52'E	3,677 ha	1a,b,d; 2a
2.	Liwia Luza lake	54°10'N	15°05'E	220 ha	1a; 2a
3.	Lubiatowski lake	54°10'N	16°15'E	370 ha	1a; 2a
4.	Lebsko and Gardno lakes	54°45'N	17°30'E	4,000 ha	1a,d; 2a Protected; included in National Park
5.	Ptasi Raj, Wisla rivermouth	54°20'N	18°50'E	200 ha	1d; 2a Protected
6.	Mazurian lakes	53°15'– 54°20'N	19°00'– 23°00'E	115,280 ha	1a,b,c,d,e; 2a; 3a,b,c
• 6.1	Luknajno	53°49'N	21°37'E	680 ha	Landscape Park to include the following lakes of which areas indicated are protected: Karas (689 ha); Gaudy (319 ha); Luknajno (680); Oswin (1,000); Pogubie Wielkie (800); Kruklin (200); Ilgi (90); Mamry (200)
7.	Lake Druzno	54°10'N	19°30'E	2,343 ha	1a,d; 2a; 3c
8.	Biebrza river and Augustowski canal	53°25'–45'N	22°30'–35'E	50,000 ha (MAR List) but large areas subsequently drained	1d,e; 2a; 3b,c Protected area 3,500 ha in 1968
9.	Zegrze reservoir	52°30'N	21°05'E	3,000 ha	1a,b No hunting
10.	Warta river marshland, from 52°N to Kolo	52°00'–10'N	18°37'–40'E	2,500 ha	1a,b,d; 2a Unprotected
11.	Fishponds near Milicz	51°30'N	10°05'E	7,980 ha	1a,d,e; 2a; 3a,b Partly protected (5,302 ha)
12.	Imielty Lug Lake and marshes	50°40'N	22°15'E	165 ha	1a,b,d; 2a Unprotected
13.	Fishponds of Lezczak near Racibórz	50°05'N	18°10'E	272 ha	1d; 2a Protected
14.	Fishponds near Zator	50°00'N	19°23'E	500 ha	1d; 2a Unprotected
15.	Goczalkowic reservoir	49°55'N	18°55'E	3,000 ha	1a,b; 2a; 3b Unprotected

† Criteria are often a matter of conjecture in the absence of specific information.

# POLAND



## DETAILS OF LISTED AREAS

### 6. MAZURIAN LAKES

**Criteria for inclusion** 1a,b,c,d,e; 2a; 3a,b,c.

**Geographical location** 53°15'–54°20'N 19°00'–23°00'E Olsztyn Province, north-east Poland.

**Area** 115,280 ha.

**Altitude** 116 m.

**Water depth** No specific information, but see under Ecology.

**Wetland types** 18, 20.

**Ecology** A large number of lakes of glacial or post-glacial origin, resulting from glacial excavation of channels or from stagnant ice left in low-lying areas after the retreat of the ice, all of them on a base of morainic sands and gravels. Lake depths vary according to their origins, some being shallow with mean depths of 4–7 m, others having a maximum depth of 44 m. Most are eutrophic in character. The

shallower lakes usually have a broad shoreline zone dominated by reeds *Phragmites communis*. Beyond, the surrounding area is a mixture of forest and farmland.

The area is of great limnological interest with special reference to productivity and phytosociological problems. Breeding birds recorded from the area include Cormorant *Phalacrocorax carbo*, Bittern *Botaurus stellaris*, Grey Heron *Ardea cinerea*, Black Stork *Ciconia nigra*, Mute Swan *Cygnus olor*, Greylag Goose *Anser anser*, several duck *Anas* spp. and raptors such as the White-tailed Eagle *Haliaeetus albicilla* and Osprey *Pandion haliaetus*. Luknajno Lake has one of the most concentrated nesting populations of mute swan in Europe (about 1,000 pairs).

**Legal status** A comprehensive Landscape Park for the area was under consideration in 1976 and at least seven lakes are now wholly or partly protected as reserves, including Luknajno, which has also been designated as Poland's first wetland on the Ramsar Convention List and as a Biosphere Reserve under UNESCO's Man and the Biosphere Programme.

**Tenure** Presumably state ownership.

**Management practices** Some of the lakes are used for fishery purposes and for recreation and there is extensive reed cutting.

**Threats** Pollution, already affecting some of the Mazurian lakes (e.g. Jeziorak at the western end of the complex).

**Scientific research** The Polish Academy of Sciences has a Hydrobiological Station on Mikolajski lake and this and the Hydro-Meteorological Institute near Mragowo, 20 km to the west, have undertaken intensive studies since about 1953.

**Principal reference material**

Kajak, Z., Hillbricht-Ilkowska, A. and Pieczynska, E. 1972. The Production Processes in several Polish lakes. In Z. Kajak & A. Hillbricht-Ilkowska (eds) *Productivity Problems of Freshwaters*, Warsaw-Krakow.

Dobrowolski, K. A. 1973. Role of Birds in Polish Wetland Ecosystem. *Polish Archives of Hydrobiology* (Polskie Archiwum Hydrobiologii) 20(1): 217-221.

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## SUMMARY OF WETLAND SITUATION

Several Portuguese wetlands are of special importance as feeding areas for great numbers of wintering and migrating waders and gulls, namely the Ria d'Aveiro, the Tejo Estuary, the Ria Sado and the mudflats and marshes near Faro, the last-mentioned mainly for Limicolae. The Ria d'Aveiro, about 60 km south of Porto, comprises a 6,000 ha lagoon and a network of channels, much of them covered by rushes and eel grass *Juncus* and *Zostera*. The lagoon is full of fish but the excessive algal growth prevents large scale fishing. The algae are harvested for fertilizer and production reached 150,000 tons a year in the decade ending 1977. In the northern part of the lagoon, connected with the sea by a narrow inlet, Saltpans provide favourable habitat for the waders and gulls and there is a heronry in the *Pinus pinaster* stand round Sao Jacinto, on the sandbar separating the lagoon from the sea. In 1971 this colony had nearly 400 nests of Cattle Egret *Bubulcus ibis* and Little Egret *Egretta garzetta*, but the area has lost its importance as a breeding place for other species of waterfowl, mainly because of disturbance. Hunting pressure in winter is severe, but there are plans for establishing a 1,500 ha Nature Reserve at Pateira de Fermentelos, comprising a marsh with reedbeds.

The Tejo (Tagus) estuary upstream of Lisbon is a vast intertidal zone of mudflats uncovered at low tide, bordered by c.2,800 ha of saltmarsh and ricefields which, in 1950-54, attained a total of c.21,000 ha. Inland to the east the polder-landscape has been somewhat modified by industrial installations but the estuary is still frequented in winter and migration time by over 50,000 waders of such species as Avocet *Recurvirostra avosetta*, sandpipers *Calidris* spp. curlews *Numenius* spp., and godwits *Limosa* spp., as well as by several thousand duck, mainly Mallard *Anas platyrhynchos*, Wigeon *A. penelope*, Teal *A. crecca*, Shoveler *A. clypeata* and Pochard *Aythya ferina*. The Greater Flamingo *Phoenicopterus ruber* occasionally occurs. Some 22,850 ha of the saltmarsh, mudflats at Pancas and islands of the inner estuary, including Mouchão do Lombo do Tejo, Mouchão da Pova, Mouchão do Alhandra and Mouchão des Garcas, are included in a 'Reserva Natural' but only the Pancas flats and saltmarsh and the lagoon on Mouchão do Lombo are strict reserves.

Nearly 100 km up the Tejo from Lisbon and north of Santarém, the Nature Reserve of Paul do Boquilobo near Golega was established on a temporary basis until 1978. It included a freshwater marsh with a lake and surrounding willow *Salix* and poplar *Populus* stands, with abundant submerged and emergent vegetation, the sedges being grazed by horses and cattle in summer. The reserve had the most important mixed heronry in Portugal (*Egretta garzetta*, *Bubulcus ibis*, Squacco Heron *Ardeola ralloides* and Night Heron *Nycticorax nycticorax*, with a total of about 2,000 nests). In winter the area was visited by up to 2,500 duck mainly *Anas platyrhynchos* (1,000) Pintail *A. acuta* (500) and *A. clypeata* (400 to 500), but also *A. crecca*, *A. penelope* and Gadwall *A. strepera*. It is to be hoped that the protected status of this exceptional site will be reinstated, if this has not already been done.

The Ria Sado estuary, 50 km south-east of Lisbon and immediately south of Setubal, again comprises vast mudflats and saltmarshes, with several small reser-

voirs for irrigation purposes and extensive rice-fields. Up to 20,000 waders winter in this varied habitat, including Avocet *Recurvirostra avosetta*, Redshank *Tringa totanus* and Curlew *Numenius arquata*.

Last of the major sites for wintering waders and gulls, the vicinity of Faro and the coastal strip eastwards to Tavira consist of a mixture of sandy islands, coastal marshes and mudflats. The Ludo marsh in particular is excellent waterfowl habitat and the site of a newly established nature reserve, very necessary in the light of the hunting pressure and tourist development of the Algarve region.

A few other areas also deserve mention. The Ilha Berlengo some 12 km off-shore from Peniche, 70 km north of Lisbon, has nesting colonies of seabirds, mainly Herring Gull *Larus argentatus* but also Cory's Shearwater *Calonectris diomedea*, of the Atlantic race *borealis*, and Razorbill *Alca torda* in small numbers. South of Lisbon, the coast between Sesimbra and Setubal, declared a 'Parque Natural' in 1977, is composed of calcareous cliffs of paleontological interest, the cliff tops covered by a rich maquis-type flora and the off-shore rocks providing nesting ledges for Guillemots *Uria aalge*. Further south again the cliffs of Cabo de São Vicente are still inhabited by the Peregrine *Falco peregrinus* and the Chough *Pyrhocorax pyrrhocorax*, and provide an excellent look-out post for studying migration. Separated from the Portuguese mainland by some 1,200 km of the Atlantic Ocean, the Ilhas Selvagens, situated between Madeira and the Canary Islands should also be mentioned for their important breeding colonies of seabirds, which include Cory's Shearwater *Calonectris diomedea*, Frigate Petrel *Pelagodroma marina*, Madeiran Petrel *Oceanodroma castro*, Little Shearwater *Puffinus assimilis* and Bulwer's Petrel *Bulweria bulwerii* and for their rich flora with several endemic species such as a birdsfoot-trefoil *Lotus paivae* and a squill *Scilla latifolia*. The seabird colonies, which were decimated in 1975 and 1976 by fishermen taking not only young but also adults from the nest, are reported to be recovering since the islands were wardened and became a protected area in 1977.

The Secretaria de Estado do Ambiente, and especially the Servicio de Parques Reservas e Patrimonio Paisagistico, and CEMPA (Centro de Estudos de Migrações a Protecção de Aves) are making great efforts to set up a network of reserves in Portugal. One result should be to amplify the scientific data on wetlands, which except for population studies of wintering waders carried out under the auspices of the I.W.R.B. and others, are still very inadequate. The information used in the descriptions of two listed areas included below was kindly made available by Joanna Kilmartin from data collected for her forthcoming 'Field Guide to National Parks of Europe'.

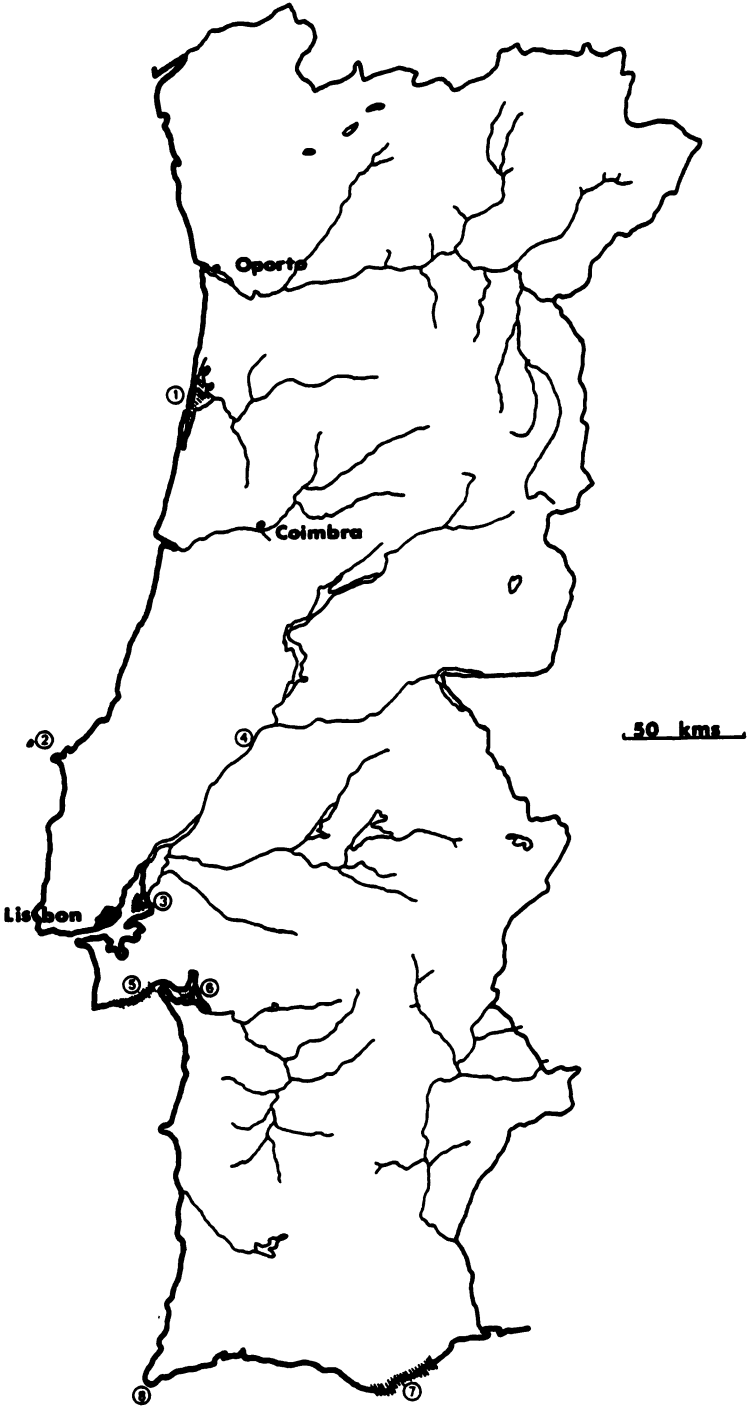
## WETLANDS OF INTERNATIONAL IMPORTANCE

	Locality	Latitude	Longitude	Size	Wetland criteria/ Conservation status
1.	Ria d'Aveiro	40°30'–51'N	8°30'–45'W	16,500 ha	1a,b,e; 2a; 3a,c Unprotected
2.	Ilha Berlengo	39°25'N	9°30'W	c.250 ha	1e; 2a Unprotected
3.	Tejo (Tagus) Estuary incl. Mouchão do Lombo do Tejo, da Povoia, do Alhandra and des Garcas	38°40'–55'N	8°55'–9°05'W	22,600 ha	1a,b,c,d,e; 2a; 3a,c; 4a Partly protected

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	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
4.	Paul do Boquilobo Reserve, Golega	39°20'N	8°30'W	393 ha	1a,d,e; 2a; 3c Temporarily protected: current position uncertain
5.	Sesimbra – Setubal coast incl. Pedra da Anixa islets	38°26'–31'N	8°54'–9°06'W	c.20,000 ha	1d; 2a; 3c Protected as a National Park
6.	Ria Sado	38°22'–34'N	8°30'–50'W	9,000 ha	1b,e; 2a; 3c Unprotected
7.	Faro-Tavira coastal marshes and mudflats	36°58'–37°03'N	7°37'–8°00'W	c.15,000 ha	1b,d,e; 2a; 3a,b,c,; 4a Partly protected (Ludo and Ria Formosa reserves)
8.	Cabo de São Vicente	37°01'N	8°59'W	Not defined	1c,d,e; 2a; 3c Unprotected
9.	Ilhas Selvagens	30°00'N	16°00'W	c.1,000 ha	1a,c,d,e; 2a; 3b Protected

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## DETAILS OF LISTED AREAS

**3. TAGUS ESTUARY** including Mouchão do Lombo do Tejo, Mouchão da Povoia, Mouchão do Alhandra and Mouchão des Garcas

**Criteria for inclusion** 1a,b,c,d,e; 2a; 3a,c; 4a.

**Geographical location** 38°40'–55'N 8°55'–9°05'W Along the southern and eastern shores of the Tejo estuary from the vicinity of Barreiro, immediately opposite Lisbon, about 36 km upstream to the bridge over the river near Vila Franca de Xira.

**Area** c.22,600 ha.

**Altitude** Sea level.

**Water depth** No information received.

**Wetland types** 7, 8, 12, 25.

**Ecology** A complex of saline marshlands, mudflats, shallow lagoons and polder along the southern and eastern shores of the tidal estuary, with a hinterland of dry grassland, cornfields and stone pine *Pinus pinea* and cork oak *Quercus suber* woodland. The consolidated dunes, damp hollows and marshlands have a varied Lusitanian flora, especially striking in early spring. A decorative pest species, the water hyacinth *Eichhornia crassipes*, introduced in the vicinity in 1940, has unfortunately invaded the area, choking up the channels and reducing the fish population.

The wetland sectors offer excellent feeding and roosting sites for large numbers of wintering and migrating waterfowl, especially waders (up to 70,000), including an estimated 75 percent of the European population of Avocet *Recurvirostra avosetta*. Other limicoline species frequenting the flats are Grey Plover *Pluvialis squatarola*, Ringed Plover *Charadrius hiaticula*, Dunlin *Calidris alpina*, Redshank *Tringa totanus*, curlews and whimbrel *Numenius* spp. and godwits *Limosa* spp. Among the ducks Mallard *Anas platyrhynchos* and Shoveler *A. clypeata* are common, Teal *A. crecca* less so. The Greater Flamingo *Phoenicopterus ruber* is a regular visitor, as is the Greylag Goose *Anser anser*; the Spoonbill *Platalea leucorodia* more occasional.

Due to the varied habitats and abundant food available, conditions are favourable for nesting and among the species which do so the Purple Heron *Ardea purpurea*, Grey Heron *A. cinerea*, Marsh Harrier *Circus aeruginosus*, Avocet *Recurvirostra avosetta*, Black-winged Stilt *Himantopus himantopus* and Collared Pratincole *Glareola pratincola* are noteworthy. Others breeding in the drier surrounding zone include Cattle Egret *Bubulcus ibis*, Black Kite *Milvus migrans*, Black-shouldered Kite *Elanus caeruleus*, Short-toed Eagle *Circaetus gallicus*, Montagu's Harrier *Circus pygargus*, Red-legged Partridge *Alectoris rufa*, Little Bustard *Otis tetrax*, Stone Curlew *Burhinus oedipnemus*, Red-necked Nightjar *Caprimulgus ruficollis*, Bee-eater *Merops apiaster*, Roller *Coracias garrulus*, Spotless Starling *Sturnus unicolor* and Azure-winged Magpie *Cyanopica cyanus*. Several species of reptiles and amphibians occur in the park, notably the European Pond Terrapin *Emys orbicularis* and the Stripe-necked Terrapin *Mauremys caspica*.

**Legal status** Most of the riverbanks and islands are included in three strict nature reserves and thus legally protected.

**Tenure** State ownership within the area of the reserves.

**Management practices** Shooting or other forms of exploitation of the natural resources are forbidden with the exception of fishing. Access to the park for visitors is by road to the perimeter only. Footpaths then lead to several points of interest. The public is not, however, allowed into the strict nature reserves and entry by boat, camping and lighting of fires are likewise prohibited.

The reserve is managed by the SPRPP (see Summary *ad. fin.*) and receives a grant from the World Wildlife Fund.

**Threats** The spread of water hyacinths has already been mentioned; there is a serious risk of pollution as the reserve is surrounded by military and naval as well as oil-refinery and other industrial installations.

**Scientific research** No information but the Centro de Estudos de Migrações e Protecção de Aves has been active in the area.

**Principal reference material**

*Natureza e Paisagem.* Bulletin published by CEMPA.

**7. FARO-TAVIRA** coastal marshes and mudflats

**Criteria for inclusion** 1b, d, e; 2a; 3a,b,c; 4a.

**Geographical location** 36°58'–37°03'N 7°37'–8°00'W Extending along the south coast of the Algarve from a point c.7 km due west of Faro eastwards to Tavira, a distance of c.50 km, and, at its widest, about 5 km south and south-east of Faro.

**Area** c.10,500 ha, of which 744 ha are protected as the Ludo Game Reserve.

**Altitude** Sea level.

**Water depth** No information received.

**Wetland types** 5, 7, 11, 17, 24.

**Ecology** An intertidal zone of coastal marshes, mudflats and sea-inlets (in a continual process of deposition and erosion), as well as a complex of lagoons, both brackish and freshwater marshes, salt pans and partially-drained strips of land, the whole backed by a fairly arid zone of pinewood and cultivation. The Mediterranean-type flora of the warmer and more sheltered spots includes dwarf fan palm *Chamaerops humilis*, the endemic rockrose *Tuberaria major* and abundant narcissus, irises and gladioli.

The reserve lies beneath the flypaths of Faro Airport and is surrounded by orchards, farmland and patches of urban development. Despite all these disturbances, it provides suitable habitat for many species of waterfowl, marine and freshwater fish, and, in particular, for bivalve molluscs and crustaceans. Among the birds which are attracted are the Greater Flamingo *Phoenicopterus ruber*, Spoonbill *Platalea leucorodia* and Avocet *Recurvirostra avosetta* and those known to nest include Little Egret *Egretta garzetta*, Grey Heron *Ardea cinerea*, White Stork *Ciconia ciconia*, Black-winged Stilt *Himantopus himantopus*, Kentish Plover *Charadrius alexandrinus* and Redshank *Tringa totanus*. The rarer breeding species include the relatively scarce Gull-billed Tern *Gelochelidon nilotica* and the Purple Gallinule *Porphyrio porphyrio*, which elsewhere in Europe does so only in southern Spain and Sardinia. There is also a colony of Little Terns *Sterna albifrons* in one of the dune areas and some Cory's Shearwater *Calonectris diomedea*, Cormorant *Phalacrocorax carbo*, Shag *P. aristoteles*, Guillemot *Uria aalge* and Razorbill *Alca torda* nest on rocks off the shore. In winter or the migration seasons

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other species recorded include Teal *Anas crecca*, Wigeon *A. penelope*, Pintail *A. acuta*, large numbers of waders, especially Knot *Calidris canutus* and a variety of terns Sterninae. The Pin-tailed Sandgrouse *Pterocles alchata*, a rare breeding bird in Portugal, nests in the reserve.

**Legal status** The Ludo Game Reserve (744 ha) established in 1978, has only partial legal protection, but there is a proposal to upgrade it to strict Nature Reserve status. The Ria Formosa Nature Reserve, which embraces the whole area including the Ludo Reserve, may eventually be incorporated in the proposed Algarve Nature Park, which would extend the partially protected area to the Spanish border near Castro Marim.

**Tenure** Partly state and partly private ownership.

**Management practices** The Ria Formosa Nature Reserve is managed by the SPRPP (see end of Summary). Exploitation of natural resources is prohibited in the Ludo Reserve except for fishing. Outside this reserve some areas have been drained and planted up with cord-grass, whilst the marsh and mudflat fauna is intensively exploited, producing for example nearly 90 percent of the country's shellfish. Access by visitors to protected areas is by road (not by boat) to the perimeter and thence by footpath to vantage spots.

**Threats** Increasing from the intensive tourist development of surrounding areas.

**Scientific research** No information but CEMPA (see under Research Section in description of Wetland 3 above) is known to have undertaken some studies.

### **Principal reference material**

None listed.

# ROMANIA

## SUMMARY OF WETLAND SITUATION

The area comprising the Delta of the Danube and the Dobrogea is undoubtedly one of the finest and most diversified wetlands in Europe, only rivalled by the Delta of the Volga, USSR, the largest of the European Deltas; the Marismas del Guadalquivir, Spain; the Camargue, France; and the Waddensea, shared by the Netherlands, the Federal Republic of Germany and Denmark.

Moving up the Danube one finds that many of the once extensive marshes and lakes in its floodplains or again in those of the rivers Timiș and Begheiu (in the plain of Banat in the far west of Romania) have now been drained. Thus the marshes of Satchinez not far north of Timișoara are all that remains of a vast area which covered about 800,000 ha before draining commenced in the 18th century. An ornithological reserve of about 100 ha has been saved and although draining of the surrounding areas continues, conditions in the reserve have so far been little affected.

No new information about the third area listed below, the Nedeia-Bistretj lake and floodplain area, close to the western end of the border with Bulgaria, has become available since 1970. At that time the White-fronted Goose *Anser albifrons* was still using the wetland as a feeding and roosting site. In the MAR List of 1965 a fourth area was listed, the Giurgiu – Oltenita area and the marshlands of Otomani, surrounding Lake Greaca due south of Bucharest: both sectors had a highly diversified flora and avifauna, but it is feared they have been totally converted into arable land. However, a little further to the east the lake complex around Călărași (44°12'N and 27°22'E) is said to have big breeding colonies of waterfowl and may in effect have replaced the previous area and deserve to be listed (article by E. Vespremeanu published in *Travaux du Museum d'Histoire Naturelle 'Grigore Antipa'* Vol. 6, 1966).

Although the Danube delta, the Dobrogea lakes and the floodplains mentioned above are certainly also of great limnological interest, additional wetlands of international importance from that point of view include a number of mountain lakes in the Carpathians and various peatbogs. Examples of these and of other Project AQUA sites are included in the List which follows and one of them (Tinovul Lucs) is described in detail. Further information about several of Romania's wetlands is to be found in Pop, E. and Salageanu, N. 1965. *Nature Reserves in Romania*. Meridiane Publishing House, Bucharest.

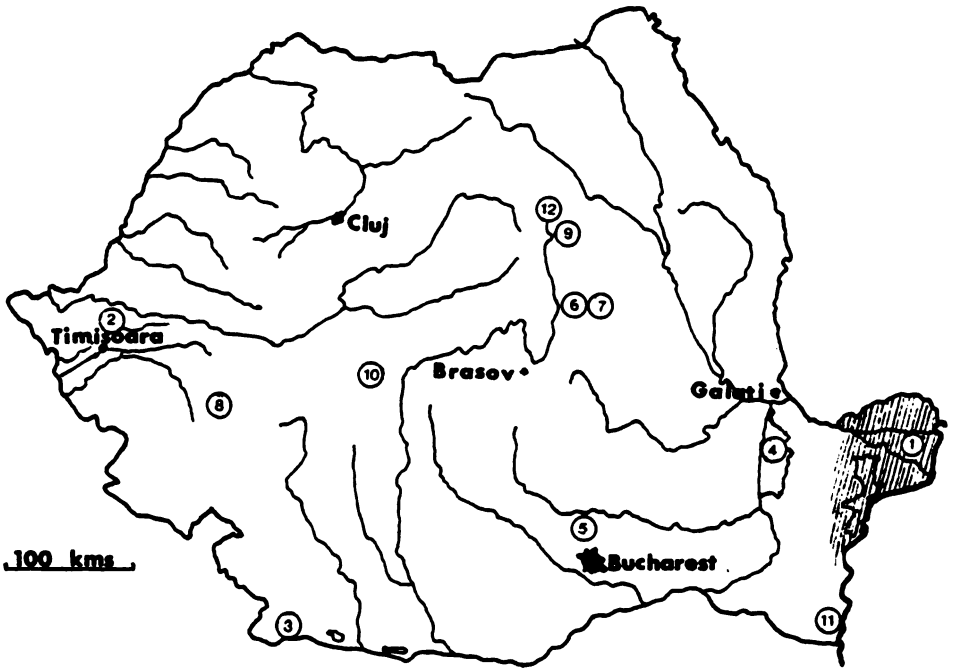
## WETLANDS OF INTERNATIONAL IMPORTANCE

	<i>Locaity</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
1.	Danube Delta and Dobrogea, incl. Razelm and Sinoe lakes	44°25'– 45°28'N	28°45'– 29°40'E	435,000 ha	1a,b,c,d,e; 2a,b; 3a,b,c; 4a Partly protected (55,000 ha); two National Parks planned

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	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
2.	Satchinez marshland Banat Region	45°51'–55'N	21°02'–22°04'E	1,000 ha	1d,e; 2a; 3a,c; 4a Partly protected (100 ha)
3.	Nedeia – Bistreţu area Oltenia Region	43°47'–54'N	23°27'–50'E	35,000 ha	1a(?),d,e; 2a; 3c Unprotected
4.	Insula Mica a Bralie (Braila Island)	44°40'–45°15'N	27°50'E	10,000 ha	Criteria unassessed Partly protected
5.	Caldaruşani	44°45'N	26°15'E	224 ha	Criteria unassessed Unprotected
6.	Lake Mohos incl. associated peatbogs	46°08'N	25°40'E	80 ha	Criteria unassessed Partly protected
7.	Lake Sfinta Ana	46°08'N	25°53'E	22 ha	Criteria unassessed Unprotected
8.	Muntii Retezatului mountain-lake complex	45°05'–29'N	22°31'–23°11'E	No information	Criteria unassessed Partly protected (National Park buffer zone)
9.	Lake Rosu	46°40'N	25°35'E	10 ha	Criteria unassessed Unprotected
10.	Lake Cilcescu	45°25'N	23°37'E	3 ha	Criteria unassessed Partly protected
11.	Lake Techivghiol	44°05'N	28°35'E	1,068 ha	Criteria unassessed Unprotected
12.	Tinovul Lucs (Luci peatland complex)	46°47'N	25°24'E	120 ha	Criteria unassessed Partly protected

# ROMANIA



## DETAILS OF LISTED AREAS

### 1. DANUBE DELTA and DOBROGEA (incl. Razelm and Sinoe Lakes)

**Criteria for inclusion** 1a,b,c,d,e; 2a,b; 3a,b,c; 4a.

**Geographical location** 44°25'–45°28'N 28°45'–29°40'E The Black Sea shore and USSR border form eastern and northern sides of this triangular expanse of wetland, the western side coinciding with the road linking the towns of Tulcea and Constanta.

**Area** Totals about 435,000 ha, of which 285,000 are enclosed by the three main branches of the river and the remaining 150,000 ha extend southwards of the delta proper and include the great lagoons of Razelm and Sinoe and several smaller lakes.

**Altitude** Near sea level.

**Water depth** Variable and depending on floods, which are quite frequent. The maximum is about 5 m near Tulcea, 3.5 m in the central Delta, about 1 m near the rivermouths and 2 m in the lagoon zone.

**Wetland types** 7, 9, 11, 12, 17, 18, 23, 24, 25.

**Ecology** From its source in the Black Forest mountains in south-west Germany and fed by about 3,000 tributaries, the Danube reaches the Black Sea in Romania after a 2,800 km journey. About 75 km from the mouth, the main stream divides into three branches, the Chilia, forming the border with the USSR, the Sulina and

the Sfintu Gheorghe. Some 236,000 ha of the vast complex of freshwater marsh, lakes, reedbeds and fields are covered by swamp vegetation, the delta itself being the second biggest in Europe after the Volga Delta in the USSR. Compared with the Camargue in France, which is only half the size, maximum summer temperatures are only a fraction lower, but in winter thanks to the eastern continental climate the temperature falls well below that of the Rhône delta and the river-mouths freeze over almost every year, the shores being covered with snow for several weeks. Most of the 400 mm annual rainfall occurs during thunderstorms from May to August but is quickly evaporated by the high summer temperatures.

About 95% of the area consists of freshwater lakes and reedbeds, *Phragmites communis* accounting for 120,000 ha and *Typha* spp. for 50,000 ha. The lakes are interconnected by narrow channels and most of the reedbeds grow on a floating mass of decaying vegetation ('*plaur*'), with the result that changes in the distribution of open water caused by the drifting of the *plaur* makes navigation difficult. The small scattered areas of higher ground (up to 3 m above sea level), often along the banks of channels, support stands of willow *Salix*, poplar *Populus*, alder *Alnus* and some oak *Quercus*, and provide occasional sites for the villages of fishermen. Some *Salix* clumps also occur in the marshes and are often occupied by heronries. Woodland is found only at Cara Orman and Pas Letea in the centre and north of the delta, respectively.

Along the shores of lakes Razelm and Sinoe, which are connected by narrow inlets to the Black Sea, their reedbeds separated from the sea only by a narrow strip of sand, saline areas occur and there are a few salt lakes in the Dobrogea between Razelm and the Sfintu Gheorghe channel. A rich fish fauna includes Carp *Cyprinus carpio*, Pike *Esox lucius*, Wels *Silurus glanis*, Zander *Stizostedion lucioperca* and one or two species which come in from the sea to spawn in the fresh water, such as the sturgeons *Acipenser* spp.

Although there are only a very few islets off the shore to attract nesting seabirds, the breeding birds of the Delta and Dobrogea are very diverse, with 162 species recorded as compared with 138 in the Marismas of the Guadalquivir and 134 in the Camargue region. Unfortunately the White Pelican *Pelecanus onocrotalus* population has declined since the beginning of this century, but there were still about 2,500 pairs in 1961 and numbers although liable to some fluctuations appear to have stabilized since the creation of the Buhaiovia-Hrecisca reserve in the northern Sulina channel zone, where there were about 2,000 pairs in 1976 and 1977. As for the Dalmatian Pelican *Pelecanus crispus*, whose numbers declined sharply from the 1,300 pairs of 1939, about 100 pairs were reported to be still nesting at Grindul Ciinelui and also a few pairs, in 1976 and 1977, on Sacalin island at the mouth of the Sfintu Gheorghe channel.

Surveys of other waterfowl of the delta showed that the Great White Egret *Egretta alba* breeds in various places and that the Trei Iezere-Bogdaproste-Babitele sector still contained one or two large heronries, for which the most recent (1961) figures available are: Cormorant *Phalacrocorax carbo* several hundred pairs, Pygmy Cormorant *P. pygmeus* 1,000 pairs, Night Heron *Nycticorax nycticorax* 2,500, Squacco Heron *Ardeola ralloides* 2,000, Spoonbill *Platalea leucorodia* 100 and Glossy Ibis *Plegadis falcinellus* 1,000 pairs. Other waterfowl nesting in the area include Bittern *Botaurus stellaris*, Little Bittern *Ixobrychus minutus*, Purple Heron *Ardea purpurea*, Grey Heron *A. cinerea*, White Stork *Ciconia ciconia*, Mute Swan *Cygnus olor*, Greylag Goose *Anser anser* and, most commonly of the ducks, Mallard *Anas platyrhynchos* and Ferruginous Duck *Aythya nyroca*. The rare White-headed Duck *Oxyura leucocephala* may perhaps still breed and the Ruddy Shelduck *Tadorna ferruginea* no doubt does so though it has declined in recent

years. The characteristic passerines are the River Warbler *Locustella fluviatilis*, Savi's Warbler *L. luscinioides*, Reed Warbler *Acrocephalus scirpaceus*, Marsh Warbler *A. palustris*, Great Reed Warbler *A. arundinaceus*, Icterine Warbler *Hippolais icterina*, Thrush-nightingale *Luscinia luscinia*, Bearded Tit *Panurus biarmicus*, Penduline Tit *Remiz pendulinus* and Reed Bunting *Emberiza schoeniclus*.

The delta and its surroundings are an extremely important wintering ground for huge numbers of White-fronted Goose *Anser albifrons* (maximum 500,000, December 1968) and stopping-place on migration as well as winter quarters for a variety of duck such as Mallard *Anas platyrhynchos*, Pintail *A. acuta*, Shoveler *A. clypeata*, Red-crested Pochard *Netta rufina*, Tufted Duck *Aythya fuligula* and Pochard *A. ferina*. This is also one of the few known wintering areas of the Red-breasted Goose *Branta ruficollis*, a species under threat, since its numbers have declined from the 25,000 present in the winter of 1968/69 to only between 1,000 and 6,000 in recent years. The White-tailed Eagle *Haliaeetus albicilla*, another species which has declined seriously, still nests in a few places in the reserve of Letea and along the Sfintu Gheorghe.

**Tenure** No precise information but probably largely state ownership.

**Legal status** Two large reserves covering about 55,000 ha and six refuges for the protection of the rarer species are in existence. Projects for the creation of two National Parks (the Danube Delta and the Razelm lagoon) to incorporate the present reserves have been drawn up by the Committee of Natural Monuments of the Academy of Sciences.

**Management practices** Fishing and reed-cutting for the cellulose manufacturing industry are permitted and both of some economic importance, as is shooting although it is strictly controlled.

**Threats** Increasing exploitation of reedbeds for the paper industry; drainage; disturbance of breeding colonies particularly of pelicans and herons; uncontrolled tourism; and hunting unless, as at present, kept within certain limits.

**Scientific research** The Ministry of Sylviculture, the Committee for Natural Monuments of the Academy of Sciences, the Institute of Biology, the Museum 'Grigore Antipa', the Natural History Museum of Sibiu and a number of other institutes carry out scientific research in the area. Thus the C.N.M. has made a study of the islands of Sacalin and Popina, and productivity of the delta ecosystems has been investigated by a team led by Professor N. Botnariuc.

#### **Principal reference material**

Cramp, S. and Ferguson Lees, I. J. 1963. The Birds of the Danube Delta and their Conservation. *British Birds* 56: 323-339.

Pop, E. and Salageanu, N. (eds) 1965. *Nature Reserves in Romania*. Meridiane Publishing House, Bucharest.

Curry-Lindahl, K. 1970. L'importance internationale des Zones Humides de l'Europe méridionale et surtout du Delta du Danube. *Ocotirea Naturii* 14(1): 5-20.

Botnariuc, N., Toniuc, N. and Filipascu, A. 1975. Necesitatea infiintarii parcurilor nationale in Delta Dunarii (La necessité de la création des Parcs Nationaux dans le Delta du Danube; short French summary). *Ocotirea Naturii* 19(2): 105-116.



**4. INSULA MICA A BRALEI (Braila Island)**

**Criteria for inclusion** Not assessed but listed by Project AQUA.

**Geographical location** 44°40'–45°15'N 27°50'E Lower reaches of the Danube floodplain, to the south of the town of Brăila (where two divergent main channels of the river, forming the island, are reunited).

**Area** 10,000 ha.

**Altitude** 6–12 m.

**Water depth** Maximum 5 m but very variable and depending on flood levels; mean 0.2 m.

**Wetland types** 12, 20, 25.

**Ecology** A series of lakes linked by both man-made and natural channels to the main courses of the River Danube, together with surrounding floodplains and marshes. The fresh water of the lakes has a low level of mineralization, quoted as 0.1 g/l. The whole area is noted for its importance as a refuge for pelicans *Pelecanidae*, herons *Ardeidae*, ducks *Anatidae* and for migrating species generally.

**Legal status** Part of the island totalling 4,000 ha has been designated as a protected natural reserve.

**Tenure** State ownership.

**Management practices** The area is used for hunting and probably a certain amount of livestock grazing. To a limited extent it has been developed or is capable of development as a tourist attraction.

**Threats** Drainage projects and/or conversion to pasture.

**Scientific research** Reported in 1971 to be still in its initial stages.

**Principal reference material**

None listed.

**12. TINOVUL LUCS (Luci peatland complex)**

**Criteria for inclusion** Not assessed, but listed by Project AQUA.

**Geographical location** 46°47'N 25°24'E In the Muntii Harghitei, a massif extending along the inner western face of the Carpathian mountains, c.85 km due north of Brasov.

**Area** 120 ha.

**Altitude** 1,080–1,231 m.

**Water depth** No figures available but the peat horizons vary in depth between 0.5 and 5.5 m.

**Wetland type** 22.

**Ecology** A crater lake which has become filled with an accumulation of peat. The water is oligotrophic with a pH of 4.5. The peat flora consists mainly of mosses *Sphagnum* spp., with an admixture of such species as marsh andromeda *Andromeda polifolia*, common sundew *Drosera rotundifolia* and the dwarf birch *Betula nana* (here at its southernmost limit). There are scattered stands of Scots pine

*Pinus sylvestris* and grey alder *Alnus incana* and a few other noteworthy species, including black currant *Ribes nigrum* and the senecio-like composite *Ligularia sibirica*.

**Legal status** Scientific reserve.

**Tenure** State ownership, administered by the Ministry of Forest Economy.

**Management practices** The area is said to be used for grazing.

**Threats** Grazing is threatening the unique flora.

**Scientific research** Some peatland studies have been undertaken.

**Principal reference material**

Pop, E. 1960. *Marais de tourbière du P.R.P.* Bucharest.

# SPAIN

## SUMMARY OF WETLAND SITUATION

The landscape of Spain is rugged, with impressive mountain chains dominating practically every part of the country. The climate shows great variety since Spain in effect is a bridge between temperate Europe and the African continent. The variation is least marked in the north-west (Galicia and Asturias) due to the influence of the Atlantic Ocean and the Gulf Stream, rain falling at all seasons and keeping the countryside green even in summer. The central tableland of Castilla has a continental climate with dry hot summers and cold winters, rainfall being largely confined to autumn and in late winter. The north-eastern coastal belt has a climate typical of the northern shores of the Mediterranean, with mild winters, a long, dry and warm summer and rain in autumn and spring. The south (Andalucia and Estramadura) is very dry and hot in summer with winds blowing from North Africa or the central Iberian plateau, and winters are mild. There are few natural water bodies in the interior, apart from the big rivers, the Ebro, Duero, Tajo, Guadiana and Guadalquivir, and since the flow is very dependent on rainfall, many of the smaller tributaries and streams dry out in summer. However, during the last three decades a large number of reservoirs have been built for irrigation purposes on most of the big rivers.

In the north, along the Galicia and Asturias coasts, the fjordlike 'rias bajas' are of importance to wintering and migrating waterfowl and the inshore waters are frequented by large concentrations of sea ducks in winter. Inland, the Pantano del Ebro between Santander and Burgos holds similar concentrations of diving ducks, mainly during migration seasons but also in winter, and more occasionally some Greylag and Bean Goose *Anser anser* and *A. fabalis*. However, the main wintering area of *A. fabalis* is in the central Duero basin, close to the Portuguese border in the Province of Zamora, where the Laguna de Villafáfila and Embalse del Esla are the best-known sites.

On the east coast the lagoons just south of Rosas, in Gerona Province, could well be of international importance though not yet listed as such, being the kind of wetland which has become scarce along the Spanish Mediterranean coast and therefore more vital as a staging post for migratory waterfowl. The Ebro delta, 250 km to the south, is of course precisely in that category, so it is unfortunate that so little of it has yet been given effective protection. Two-thirds of the delta are now under cultivation and there are still threats of further urbanization and establishment of marinas and suchlike developments for the tourist industry, not to mention pollution from off-shore oil-rigs. Inland, some 190 km due west of the delta and in the extreme south of Zaragoza Province, the Laguna de Gallocanta has recently become a major wintering area for ducks, coots and cranes, with more than 100,000 observed in December 1978, including some 3,000 Common Crane *Grus grus*.

Southwards along the coast the great lagoon known as La Albufera de Valencia, once a very important breeding and wintering place for waterfowl, has suffered severely from urban and industrial pollution as well as from inflow of agricultural pesticides and herbicides; although purification systems have now been made compulsory, it is still uncertain whether the former wealth of waterfowl can be

restored. The Salinas de Santa Pola y Torrevieja and nearby Pantano de Elche on the coast of Alicante Province are important for migrating and wintering ducks and waders, the Santa Pola salt pans having also on two occasions in recent years provided a nesting site for Greater Flamingo *Phoenicopterus ruber*, a species which visits similar pans at Cabo de Gata to the south-east and others to the south-west of Almeria. It also breeds regularly in the Laguna de Fuente de Piedra in Malaga Province (60 km north-west of Malaga town), the only place where it does so in the north-west Mediterranean apart from the Camargue. This lagoon is the biggest of a number of scattered lakes of a rather variable character to be found in Cadiz, Sevilla and Cordoba Provinces as well as Malaga, a feature shared by southern Spain (Andalucia) and north-west Africa. Some of these lakes, though not yet added to the list of the internationally important, are in fact of great value for two scarce and declining species, the White-headed Duck *Oxyura leucocephala* and Crested Coot *Fulica cristata*.

The most important wetland in Spain and indeed south-west Europe comprises the still largely intact ecosystems of the Marismas del Guadalquivir within the triangle Huelva-Sevilla-Sanlucar de Barrameda. The Parque Nacional de Doñana covering 35,000 ha of the marismas and of the tongue of land, from which the Park takes its name, separating the marshes from the sea, protects some of the most interesting habitats of the total area of 250,000 ha. Unfortunately, interference with the hydrology, agricultural development and the use of pesticides in surrounding areas, still threaten the Park. But there is hope that solutions of these problems can be found, in the same way as the major threat of highroad construction and of further urbanization along the coastal strip (for the purposes of tourism and recreation) now seems to have been overcome. A more intractable problem is the end-of-summer outbreaks of botulism which have caused severe losses among waterfowl in recent years.

In central Spain the Tablas de Daimiel in Ciudad Real Province and less than 30 km north-east of Ciudad Real town, the marshy floodplain where the Giguela and other tributaries join to form the Guadiana, are an important breeding area for ducks, especially Red-crested Pochard *Netta rufina*, good numbers of duck also being found in winter. An area of 1,875 ha is protected by the Parque Nacional de las Tablas de Daimiel, created in 1973, but drainage projects in the area surrounding the Park are still a threat. The great reservoirs constructed along the Guadiana and Tajo rivers have become important wintering areas for grebes and cormorants as well as for ducks, and some of them serve as roosts for wintering cranes.

Turning finally to the Spanish islands the major wetland of Mallorca (Balears), the Albufera de Alcudia, has been severely affected by urbanization projects in the vicinity, but is still visited by ducks in winter. Purple Herons *Ardea purpurea* and several other species of waterfowl breed in the reedbeds at the southern end of this site and the small salt pan complex nearby, like those in the south of Mallorca, may have importance for migrating waders. Across the western arm of the Mediterranean, almost directly south of Almeria, the Islas Chafarinas just off the Moroccan coast, but Spanish territory like Melilla 45 km to their west, harbour the biggest known breeding colony of the rare Audouin's Gull *Larus audouinii*.

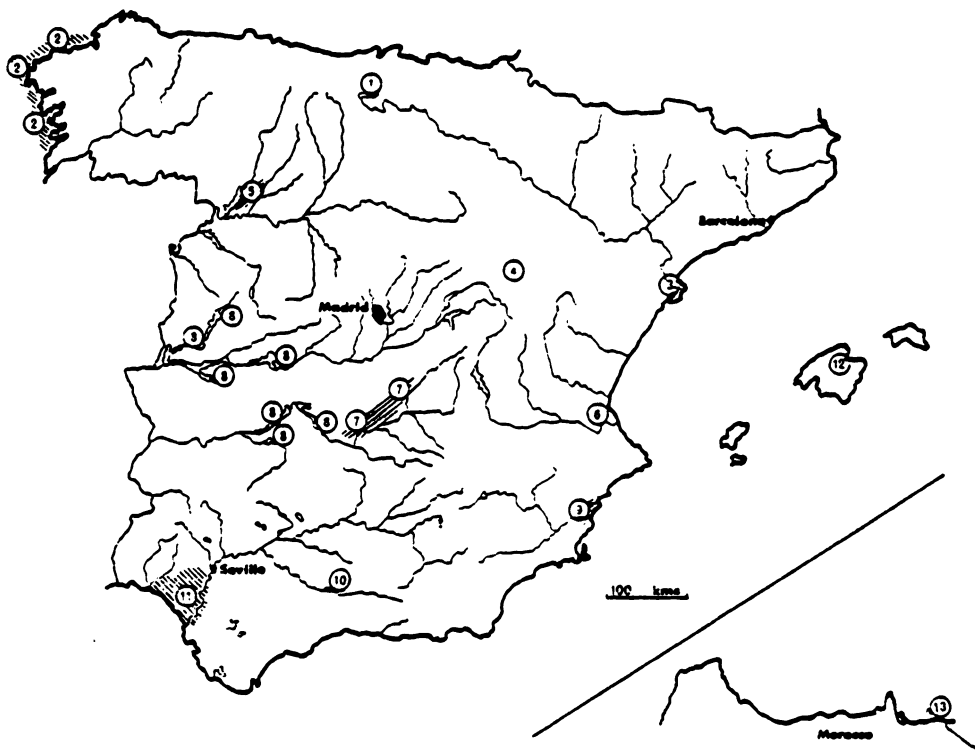
The Instituto Nacional para la Conservación de la Naturaleza (ICONA), belonging to the Ministry of Agriculture, which is responsible for conservation measures in Spain, has published a number of books on the flora and fauna and also several guide-books for the National Parks, including a waterfowl-guide (Coronado, R., Portillo F., and Saez-Royuela, R. 1973. *Guia de las Anatidas en Espana*. ICONA, Madrid).

SPAIN

**WETLANDS OF INTERNATIONAL IMPORTANCE**

	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
1.	Pantano del Ebro	43°00'N	3°58'W	No information	1b; 4a Unprotected
2.	Rias Bajas de Galicia y Cantabria	42°15'– 43°30'N	8°10'–9°15'W	100,500 ha	1a,b,c,e; 2a,c; 3c; 4a Unprotected
3.	Delta del Ebro	40°35'–50'N	0°35'–55'E	64,000 ha	1a,b,c,d,e; 2a,b,c; 3a,b,c; 4a Virtually unprotected
4.	Laguna de Gallocanta	40°58'N	1°30'W	1,500 ha	1a,b; 2a,b,c; 4a Protected
5.	Central Duero basin swamps, lagoons and reservoirs	41°25'–50'N	5°25'–6°05'W	6,500 ha	1a,d; 2a; 4a Partly protected
6.	Albufera de Valencia	39°20'N	0°22'W	10,000 ha	1a(?),b(?),e; 2a,b; 3a,b,c; 4a Unprotected
7.	Tablas de Daimiel (and associated waterbodies)	39°04'–35'N	3°20'–55'W	c.6,000 ha	1a,b,d,e; 2a,b,c; 3a,b,c; 4a Partly protected (3,828 ha of National Park and Reserves + no hunting areas)
8.	Tajo and Guadiana Reservoirs (west-central Spain)	38°50'– 40°50'N	4°20'–6°45'W	No information	1a,b,c; 2a; 3b; 4a Unprotected
9.	Pantano de Elche y Salinas de Santa Pola y Torrevieja	37°58'– 38°13'N	0°34'–45'W	2,000 ha	1a,b,c; 2a,b; 3c; 4a Unprotected
10.	Laguna de Fuente de Piedra	37°07'N	4°47'W	3,000 ha	1a,b,d,e; 2a,b; 3b,c; 4a Partly protected
11.	Marismas del Guadalquivir	36°45'– 37°15'N	5°55'–6°55'W	250,000 ha	1a,b,c,d,e; 2a,b,c; 3a,b,c; 4a 35,000 ha protected
12.	Albufera de Alcudia, Mallorca	39°45'–50'N	3°10'–25'E	1,500 ha	1a; 2a; 3c; 4a Unprotected
13.	Islas Chafarinas	35°10'N	2°24'W	No information	1a,c; 2b; 4a Unprotected

# SPAIN



## DETAILS OF LISTED AREAS

### 1. PANTANO DEL EBRO

**Criteria for inclusion** 1b; 4a.

**Geographical location** 43°00'N 3°58'W About 50 km south of Santander, to the west of the Burgos road.

**Area** No estimate given; comprises the section of the vast Embalse del Ebro which is sometimes referred to as the Embalse de las Rozas.

**Altitude** c.850 m.

**Water depth** No information.

**Wetland type** 16.

**Ecology** The reservoir has become an important wintering area for duck (mainly *Aythya* spp. and other diving ducks, of which 20,000 were counted in October 1973). Several flocks of Bean Geese *Anser fabalis* have also been reported and up to two or three thousand Greylag Geese *Anser anser* are sometimes observed during migration. The Gadwall *Anas strepera* has colonized the area and is now a fairly common breeding bird.

**Legal status** Unprotected.

**Tenure** State ownership.

**Management practices** Some areas around the reservoir are used for hunting.

**Threats** None reported and it is not known whether hunting pressure is having adverse effects.

**Scientific research** None reported.

**Principal reference material**

None listed.

## 2. RIAS BAJAS de Galicia y Cantabria

**Criteria for inclusion** 1a,b,c,e; 2a,c; 3c; 4a.

**Geographical location** 42°15'–43°30'N 8°10'–9°15'W. Fjordlike bays on the Atlantic coast between La Coruña and Vigo.

**Area** According to the MAR List 100,500 ha.

**Altitude** Sea level.

**Water depth** No information but certainly very variable in the light of the strong tidal movements of the region.

**Wetland types** 3, 5, 8.

**Ecology** The great expanses of eel-grass *Zosteraceae* exposed at low tide in the inlets along the west coast of Galicia attract numerous ducks and waders during their spring and autumn migrations and in winter. The five main sites are: the Miño estuary on the Spanish/Portuguese border, Ria de Vigo (Bahia de San Simon), Ria de Pontevedra, Ria de Arosa and Ria de Muros Noya. The commonest waterfowl are Mallard *Anas platyrhynchos*, Wigeon *A. penelope*, Oystercatcher *Haematopus ostralegus*, various *Tringa* and *Calidris* species, and Curlew *Numenius arquata*. Most prominent of the diving ducks are Common Scoter *Melanitta nigra*, wintering both on the open sea and in sheltered bays; and the Red-breasted Merganser *Mergus serrator* is also quite plentiful. Flocks of Brent Geese *Branta bernicla* are present in most winters. Particularly favoured are three sectors of the Ria de Arosa, the Bahia de la Toja in the south, the north-eastern bays near Rianjo and the Laguna de Carregal.

**Legal status** There is no information to suggest that any part of the area has legal protection.

**Tenure** Presumably state ownership.

**Management practices** Ostreiculture in several bays.

**Threats** Fishing and collecting of shell-fish at low tide cause some disturbance. The establishment of an oil refinery on the south shore of the Ria de Arosa near Cambados has been planned.

**Scientific research** No information.

**Principal reference material**

Fournier, O. and S. 1972. Anatidas, Fochas y Limicolos en las costas Cantabricas y Gallegas, Enero 1969. *Ardeola* 17/18: 79–98.

Coronado, R., del Portillo, F. and Saez-Royuela, R. 1973. *Guia de las Anatidas en España*, ICONA, Madrid.

### 3. DELTA DEL EBRO

**Criteria for inclusion** 1a,b,c,d,e; 2a,b,c; 3a,b,c; 4a.

**Geographical location** 40°35'–50'N 0°35'–55'E Mediterranean coast 70 km south-west of Tarragona.

**Area** Approximately 64,000 ha (MAR List).

**Altitude** Sea level.

**Water depth** No information.

**Wetland types** 3, 5, 7, 9, 17, 25.

**Ecology** Two thirds of the delta is now under cultivation, mostly (23,500 ha) for the production of rice. Of the rest, marshes and saline or brackish lagoons account for 5,200 ha and a mixture of level ground and dunes for 2,850 ha. In places, there are fairly extensive patches of dense reedbed and other vegetation.

The delta is still very important for wintering coots *Fulica atra* and duck especially Wigeon *Anas penelope* and Shoveler *A. clypeata* but also Mallard *A. platyrhynchos*, Teal *A. crecca* and Pochard *Aythya ferina*, in numbers up to 35,000. Flamingos *Phoenicopterus ruber* are often present in the salt pans on the south of the Los Alfaques peninsula, which also attract waders, gulls and terns. Quite a number of species stay to breed, including Purple Heron *Ardea purpurea*, Mallard, Red-crested Pochard *Netta rufina*, Coot *Fulica atra* (c.1000 pairs), Kentish Plover *Charadrius alexandrinus*, Herring Gull *Larus argentatus*, Common Tern *Sterna hirundo* and Whiskered Tern *Chlidonias hybrida*. For these and other waterfowl the most valuable localities left are now the Lagune de La Encañizada and La Tancada, the Isla de Buda and the Canal Vell.

**Legal status** Unprotected except for one or two relatively small areas.

**Tenure** Buda Island (1,300 ha) and the La Encañizada and Tancada Lakes are privately owned, though the shooting on the two lakes is under ICONA control.

**Management practices** Other than the locally controlled shooting mentioned in the previous section, apparently none.

**Threats** Existing projects for drainage of the delta may affect all areas with the exception of El Fangal and Los Alfaques, these being the largely sandy or dune areas at the northern and southern tips, respectively, of the promontory, and perhaps the Isla de Buda. Counter proposals have, however, been suggested by ICONA, which take into account the pleas of Spanish ornithologists and ecologists that at least some of the areas essential to waterfowl should be left intact. Other threats are urbanization, massive use of pesticides and the possibility of oil exploration within the delta. Offshore drilling has already taken place and there are some operational oil wells. The project for building a vast tourist complex including a marina on the Los Alfaques Peninsula was, however, halted by protests from national and international conservation bodies (March 1976.).

**Scientific research** The avifauna of the delta has been well studied. The Institutio Catalana in Barcelona has recently published a volume which deals with all the ecological aspects of the delta.

#### Principal reference material

Maluquer Maluquer, S. 1971. La avifauna del Delta del Ebro. *Ardeola* Vol. Special: 191–319 (with numerous other references).



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Anon. 1977. Els sistemes naturals del Delta de l'Ebre. Institutio Catalana, Barcelona (in Catalan).

#### 4. LAGUNA DE GALLOCANTA

**Criteria for inclusion** 1a,b; 2a,b,c; 4a.

**Geographical location** 40°58'N 1°30'W About 42 km south-south-east of Calatayud and 95 km south-west of Zaragoza, near the north-eastern end of the Guadalajara massif.

**Area** Normally c.1,500 ha but winter floods sometimes enlarge it to c.4,000 ha.

**Altitude** 990 m.

**Water depth** Shallow, with a maximum depth of 1–1.5 m.

**Wetland type** 17.

**Ecology** The Laguna de Gallocanta and one or two smaller brackish lakes in its vicinity have become one of the more important wintering areas for ducks and coots in north-eastern Spain. This has happened over the last ten years, the total number of birds now sometimes reaching 150,000, among which Coot *Fulica atra* and Pochard *Aythya ferina* predominate, followed by Red-crested Pochard *Netta rufina*. In recent years the Common Crane *Grus grus* is wintering regularly in numbers up to 3,000. There are extensive submerged meadows of Characeae (stoneworts) etc; but in summer these lagoons shrink considerably and sometimes dry out completely, becoming saltier in the process. Breeding birds include Black-necked Grebe *Podiceps nigricollis*, Whiskered Tern *Chlidonias hybrida* and Gull-billed Tern *Gelochelidon nilotica*.

**Legal status** The area was declared a restricted hunting zone in the early 1970s and a 1,400 ha reserve was created in 1978.

**Tenure** No information.

**Management practices** None reported.

**Threats** Plans were drawn up in 1973 to drain the lagoons and put the area under cultivation.

**Scientific research** Probably limited to winter waterfowl counts.

#### **Principal reference material**

Coronado, R., del Portillo, F. and Saez-Royuela, R. 1973. *Guia de las Anatas en España*. Instituto Nacional para la Conservación de la Naturaleza (ICONA), Madrid.

Aragues, A., Perez Bujaeabal, E., Lucientes, J. and Bielsa, M. A. 1974. Observaciones estivales en Gallocanta (Zaragoza). *Ardeola* 20: 229–244.

#### 5. CENTRAL DUERO BASIN swamps, lagoons and reservoirs.

**Criteria for inclusion** 1a,d; 2a; 4a.

**Geographical location** 41°25'–50'N 5°25'–6°05'W From a point nearly 40 km north of Zamora and 10 km west of Villalpando, near the village of Villafáfila, west and south to the Embalse de Esla and connected waters.

**Area** 6,500 ha (MAR List).

**Altitude** 700–800 m.

**Water depth** No information but the lagoons are certainly shallow.

**Wetland type** 16, 17.

**Ecology** The Central part of the Duero basin in Castilla Vieja was once a very important wintering area for geese and especially the Bean Goose *Anser fabalis*, but the population has been considerably reduced during the present century. However, several small to medium-sized seasonal lagoons in open marshland near Villalpando still provide feeding and resting places and, further to the west, the Esla reservoir has become an important night-roost for the Bean Geese, since the Laguna de Nava near Palencia, some 60 km to the east-north-east of Villalpando was drained. The wintering population is now between 5,000 and 10,000 and is usually augmented by flocks of Greylag Geese *A. anser* during the migration periods. Other noteworthy species in the area are Great Bustard *Otis tarda*, Little Bustard *O. tetrax*, Pin-tailed Sandgrouse *Pterocles alchata* and Black-bellied Sandgrouse *P. orientalis*.

**Legal status** A restricted hunting zone of 3,000 ha was established in 1973, and c.1,500 ha were set aside as a reserve in 1978.

**Tenure** No precise information, but much of the area is believed to be in private ownership.

**Management practices** None reported apart from the hunting restrictions.

**Threats** Agricultural development of surrounding areas.

**Scientific research** Apart from ornithological studies, none reported.

**Principal reference material**

Coronado, R., del Portillo, F. and Saez-Royuela, R. 1973. *Guia de las Anatidas en España*. ICONA, Madrid.

## 6. ALBUFERA DE VALENCIA

**Criteria for inclusion** 1a(?), b(?),e; 2a,b; 3a,b,c; 4a.

**Geographical location** 39°20'N 0°22'W About 12 km south of Valencia on the Mediterranean coast.

**Area** 10,000 ha.

**Altitude** Sea level.

**Water depth** 1–2 m.

**Wetland type** 7, 18, 25.

**Ecology** A coastal lagoon, separated from the sea by a strip of dunes, with fresh or slightly brackish water. There are some small islands and patches of reed in the lagoon. The adjoining ricefields are deliberately flooded in winter and, until 1973, the wetland complex attracted large numbers of waterfowl, duck and coot sometimes reaching a figure of 80,000. Most numerous of the ducks were Wigeon *Anas penelope*, Teal *A. crecca*, Pintail *A. acuta*, Shoveler *A. clypeata*, Red-crested Pochard *Netta rufina* and Pochard *Aythya ferina*. Breeding species included the

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Red-crested Pochard (200–400 pairs) and the Pochard and Ferruginous Duck *Aythya nyroca* (in small numbers), also several Ardeidae (some perhaps still breeding in the area), such as Night Heron *Nycticorax nycticorax*, Squacco Heron *Ardeola ralloides*, Cattle Egret *Bubulcus ibis*, Little Egret *Egretta garzetta* and Purple Heron *Ardea purpurea* (in small numbers). The Albufera is a relict of a once much larger lagoon, the 'Vedados' or artificially flooded ricefields having in fact been developed long ago from former marshlands and *Salicornia*-dominated saltings. Many of the ricefields are now in turn being replaced by orchards and thus no longer attractive to waterfowl. Another cause of decline in their numbers is heavy pollution from water carrying urban and industrial wastes into the Albufera.

**Legal status** Unprotected.

**Tenure** The Albufera is partly owned by the Municipality of Valencia and partly by two or three villages on its shores.

**Management practices** The 'Vedados' are flooded each autumn and winter and provided with food to attract large numbers of waterfowl of which the shooting is strictly regulated. Hunting rights in the Vedados belong to the small neighbouring villages but those of the main Albufera lagoon are leased from the Valencia municipality.

**Threats** Urbanization following upon an expanding tourist-industry; comprehensive drainage projects; massive use of pesticides in the rice-fields; and pollution by industrial and urban wastes.

**Scientific research** Research was reported to be in progress in 1975, with a view to halting the wildlife decline and discovering whether the water quality could be restored by installing filtration plants. The Albufera is the site of Spain's first Hydrobiological Laboratory, which has been used by many of Europe's most distinguished limnologists. Over 175 scientific papers have been published.

### Principal reference material

Luther, H. and Rzóska, J. 1971. *Project Aqua*, a source book of inland waters proposed for conservation. Published for the International Biological Programme by Blackwell Scientific Publications, Oxford and Edinburgh. Pp. 64–65.

Dafauce Ruiz, O. 1975. *La Albufera de Valencia, un estudio piloto*. Monografía 4, Ministerio de Agricultura, Instituto Nacional para la Conservación de la Naturaleza (ICONA), Madrid.

## 7, TABLAS DE DAIMIEL (and associated waterbodies)

**Criteria for inclusion** 1a,b,d,e; 2a,b,c; 3a,b,c; 4a.

**Geographical location** 39°04'–35'N 3°20'–55'W Extensive marshlands where the waters of several rivers unite to form the Guadiana about 30 km north-east of Ciudad Real and 10 km north of Daimiel; thence westwards to the Embalse de Gasset and Vicario, 8–15 km due north of Ciudad Real; and northwards to the group of lakes north-west of Alcazar.

**Area** c.6,000 ha (see under Legal status below).

**Altitude** 700 m.

**Water depth** Variable, maximum between 1 and 2m.

**Wetland type** 12, 17, 18.

**Ecology** A natural area comprising a number of ponds and lakes with brackish water, which in summer when they may dry out almost completely, become more saline. Some of the lakes are filled by the run-off from the surrounding hills, others depend on floodwaters of such rivers as the Guadiana Alto, Giguela, Riansares and Zancara. Most of them, as well as the river banks, are bordered by broad belts or patches of reeds and rushes *Phragmites*, *Cladium* and *Typha*.

On the west a shallow reservoir, the Embalse de Gasset, where hunting is not permitted, acts as a waterfowl refuge, but the particularly important feature of the area is the breeding population of over 1,000 pairs of Red-crested Pochard *Netta rufina*, very possibly the largest in Europe. Other nesting ducks include Mallard *Anas platyrhynchos*, Gadwall *A. strepera*, Garganey *A. querquedula*, Shoveler *A. clypeata*, Marbled Teal *A. angustirostris* and Pochard *Aythya ferina*, and there are also small colonies of Night Heron *Nycticorax nycticorax*, Little Egret *Egretta garzetta* and Purple Heron *Ardea purpurea*. The wetland, in general, is a favoured moulting-place of surface-feeding duck, especially Mallard, and also provides winter quarters for sometimes very large numbers of all types of waterfowl.

**Legal status** One of the most representative sectors of the complex, where the waters of the Zancara and Giguela rivers merge into the Guadiana, has been established as a 1,875 ha National Park, the Parque Nacional de Daimiel. It includes 1,487 ha of the old national hunting reserve (established in 1966) which covered 3,200 ha, the remaining 1,713 ha forming a protective buffer zone. An additional reserve of 240 ha was established in 1978 on the Laguna de Alcázar de San Juan, 48 km north-east of the National Park, and together with hunting reserves on other lakes of the Alcázar region, the hunting reserve of the Embalse de Gasset, already referred to under Ecology, a hunting reserve around the confluence of the Zancara and Giguela rivers, and the National Park and buffer zone, ensure protection or partial protection for waterfowl populations in upwards of 6,000 ha of the wetland complex.

**Tenure** Many of the ponds and lakes are privately owned.

**Management practices** In 1974, ICONA was said to be promoting a technical project aimed at restoring the original waterlevel in the National Park area and increasing the amount of wetland in state ownership, but the precise extent to which it has been implemented has not been reported.

**Threats** Some pollution is said to have been caused by small factories sited on higher ground bordering the basin, but the principal threat, which could have serious consequences if measures taken by ICONA are not successful, is the drainage of some 20,000 ha of the surrounding areas.

**Scientific research** None reported, except for the hydrological studies undertaken by ICONA and the investigation of the avifauna.

#### **Principal reference material**

Coronado, R., del Portillo, F. and Saez-Royuela, R. 1973. *Guia de las Anatidas en España*. ICONA, Madrid.

Coronado, R., Leon Jimenez, F. and Morillo Fernandez, C. 1974. *Guia del Parque Nacional de las Tablas de Daimiel*. ICONA, Madrid.

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**8. TAJO and GUADIANA RESERVOIRS** (west central Spain)

**Criteria for inclusion** 1a,b,c; 2a; 3b; 4a.

**Geographical location** 38°50'–40°50'N 4°20'–6°45'W The principal sites from north to south are:

- 1 Gabriel y Galán 40°20'N 6°10'W Cáceres Province, west of Hervás
- 2 Borbollón 40°09'N 6°33'W Cáceres: east of Hoyos
- 3 Rosarito 40°05'N 5°17'W Avila/Toledo: south of Candeleda
- 4 Castrejón 39°50'N 4°20'W Toledo: south-west of La Puebla de Montalban
- 5 Valdecañas 39°45'N 5°30'W Cáceres: west of Valdeverdeja
- 6 García Sola 29°20'N 5°00'W Badajoz: north-west of Herrera del Duque
- 7 Cijara 39°15'N 4°45'W Badajoz: extreme north-east corner of province
- 8 Orellana 38°55'N 5°20'W Badajoz: immediately east of Orellana la Vieja
- 9 Zújar 38°50'N 5°20'W Badajoz: 8 km south of No. 8

**Area** No information: dependent on rainfall, season and water level management.

**Altitude** Averaging c.700 m.

**Water depth** Varying throughout the year but usually highest after winter rains; in places quite shallow.

**Wetland type** 16.

**Ecology** Since the 1930s a great number of lakes have been created by the construction of dams on the rivers Tajo, Guadiana and their tributaries, to provide water for agriculture and energy in an extensive and formerly very dry and sparsely populated region of the Provinces of Badajoz, Cáceres and Toledo. They have become important to great numbers of wintering waterfowl, chiefly ducks and coots but also grebes, herons, in some places Cormorants *Phalacrocorax carbo* and, during migration seasons, usually some Greylag Geese *Anser anser*. The reservoirs numbered 3, 6, 7, 8 and 9 above, are also important roosting places for wintering Cranes *Grus grus*. The relatively small reservoir of Borbollón (No. 2) has a well studied colony of Cattle Egret *Bubulcus ibis* and Little Egret *Egretta garzetta*. The rivers and lakes are also of importance as feeding grounds for the small and isolated Iberian population of the Black Stork *Ciconia nigra*, which nests in this area.

**Legal status** No information, but presumably state ownership.

**Management practices** None besides the normal activities for maintaining water levels in the reservoirs.

**Threats** None reported.

**Scientific research** Some ornithological research has been undertaken on most of the reservoirs since the mid-1960s. Thus the colonial nesting Ardeidae on the Embalse de Borbollón has been studied and facilitated by the provision of a small field laboratory for the use of members of the Sociedad Española de Ornitología.

**Principal reference material**

Various publication in *Ardeola* concerning the avifauna of the area.

See also Coronado, R., del Portillo, F. and Sayez-Royuela, R. 1973. *Guía de las Anatidas en España*, ICONA, Madrid.

## 9. PANTANO DE ELCHE y SALINAS DE SANTA POLA Y TORREVIEJA

**Criteria for inclusion** 1a,b,c; 2a,b; 3c; 4a.

**Geographical location** 37°58'–38°13'N 0°34'–45'W Coastal zone between 18 and 45 km south-west of Alicante.

**Area** c. 2,000 ha.

**Altitude** Sea level.

**Water depth** Shallow; maximum of 1 to 2 m.

**Wetland types** 7, 15, 17, 18.

**Ecology** The Pantano de Elche (de El Hondo) is an eutrophic lagoon of about 1,000 ha in extent, formed by two reservoirs connected by a canal and resembling on a smaller scale, the Albufera de Valencia. To its west, marshlands covered by heavy vegetation provide a breeding place for Mallard *Anas platyrhynchos*, Red-crested Pochard *Netta rufina*, Pochard *Aythya ferina* and occasionally Marbled Teal *Anas angustirostris*. In winter the Pantano is of importance to diving duck. The Santa Pola salinas or salt pans are visited by large flocks of Greater Flamingos *Phoenicopterus ruber* and also provide feeding and resting places for numerous waders Limicolae, particularly in the migration seasons. The same probably applies to the Salinas de Torrevieja but detailed information is lacking. The great lagoon, Mar Menor, another 25 km to the south has been severely affected by tourist developments and recreational use, but sizable concentrations of waterfowl do sometimes still haunt it in winter though details are lacking.

**Legal status** Unprotected.

**Tenure** The Pantano de Elche belongs to a private association. The Salinas of Torrevieja and Santa Pola are also privately owned.

**Management practices** The Pantano de Elche is hunted under strict regulations. The Salinas of Santa Pola and Torrevieja are still in working order for salt production.

**Threats** Santa Pola has recently developed into a tourist centre and the fringes of the rapidly growing town reach almost to the Salinas. The main coastal road traverses the saltpan complex and is liable to cause disturbance and pollution.

**Scientific research** No information but waterfowl censuses, particularly directed to the flamingos, have been undertaken for some years.

**Principal reference material**

None quoted except for R. Coronado *et al.* mentioned at the end of the previous site description.

## 10. LAGUNA DE FUENTE DE PIEDRA

**Criteria for inclusion** 1a,b,d,e; 2a,b; 3b,c; 4a.

**Geographical location** 37°07'N 4°47'W Just over 17 km north-west of Antequera in the Province of Malaga.

**Area** About 3,000 ha at its maximum expanse (the MAR List "c.1,000 ha" was substantially below the normal which could probably be put at about 1,750 ha).

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**Altitude** c.500 m

**Water depth** Shallow; average less than 1 m, but in channels and suchlike places between 1 and 2.5 m at high water level. In summer the lake dries out almost completely.

**Wetland type** 17.

**Ecology** A saltlake fed by run-off from surrounding hills and bordered by halophile vegetation. It harbours the only regular breeding colony of Greater Flamingo *Phoenicopterus ruber* in Spain, although nesting is not always successful as the lake sometimes dries out before the young are capable of flight. Other breeding species include Black-winged Stilt *Himantopus himantopus*, Avocet *Recurvirostra avosetta* and Gull-billed Tern *Gelochelidon nilotica*. In winter up to 50,000 duck and coot can be present of which 10 to 15 thousand are likely to be Pochard *Aythya ferina*.

**Legal status** The area is partly protected and has recently been given the status of 'fauna refuge'.

**Tenure** The lake is privately owned.

**Management practices** A pump has been installed near the deepest part of the lake in order to try to keep sufficient water in at least a small area and thus save unfledged young flamingos in summers when all or most of the lake has become completely dry.

**Threats** Apparently none, with the possible exception of increasing use of persistent pesticides in surrounding farmlands.

**Scientific research** The Flamingo colony has been studied in some detail by the students of the University of Malaga.

**Principal reference material**

Several articles have been published in the journal *Ardeola*.

## 11. MARISMAS DEL GUADALQUIVIR

**Criteria for inclusion** 1a,b,c,d,e; 2a,b,c; 3a,b,c; 4a.

**Geographical location** 36°45'–37°15'N 5°55'–6°55'W This vast wetland is enclosed in the triangle Huelva – Sevilla – Sanlúcar de Barrameda – Huelva, the greater part extending westwards from the main channel of the Guadalquivir between Sevilla and the sea.

**Area** c.250,000 ha, according to the MAR List, of which 35,000 ha are protected in the Parque Nacional del Coto de Doñana.

**Altitude** Sea level.

**Water depth** Variable depending seasonal rainfall and flooding.

**Wetland types** 7, 8, 9, 12, 17, 20.

**Ecology** Large areas of the marshes have been drained on both banks of the Guadalquivir and converted into rice, wheat and cotton fields or cattle pastures. The remaining marshland and the 4 – 12 km – wide tongue of land, the Coto de Doñana proper, which separates it from the sea, together form an ecological entity, probably the only large almost intact ecosystem which survives in south-

west Europe. It includes the following habitat types:

1. Sandy beach with sparse vegetation on its shoreward margin.
2. Dunes and coastal slacks with a poor cover of marram grass *Ammophila arenaria* on the seaward side and coarser vegetation in the hollows.
3. Stone pine *Pinus pinea*, prickly juniper *Juniperus oxycedrus* and Phoenician juniper *J. phoenicea* woods on the slopes and in the hollows of the inner dunes.
4. *Halimium* thicket.
5. A mixture of pinewoods, *Halimium* thicket and oak *Quercus*-dominated plain, enclosing a few scattered freshwater lagoons.
6. Grasslands, bordering the marismas but usually separated from them by a belt of rushes *Juncus* spp.
7. The *Carex* – *Scirpus* zone of the marismas, flooded for part of the year by fresh water carried largely by the Madre de las Marismas, which flows parallel with the Coto Doñana dune ridge. The dominant vegetation of the marismas proper is *Carex* – *Scirpus* – *Salicornia*, a mixture of rush, sedge and glasswort.

Numerous species of Limicolae and Laridae make use of the flat islands or 'vetas', which even during the winter floods remain above water. For wintering Anatidae the most important lagoons or floodlands are those of the Marismas de Hinojos, Gallega, Las Nuevas, El Sapillo, Lucio Real and Sanlúcar, but many other sites are also used by large concentrations. The most numerous species are Gadwall *Anas strepera*, Wigeon *A. penelope* (up to 60,000), Teal *A. crecca* (up to 32,000), Pintail *A. acuta*, Shoveler *A. clypeata* (up to 22,000) and Pochard *Aythya ferina*. The number of Coots *Fulica atra* usually exceeds 100,000 and between 20,000 and 30,000 Greylag Geese *Anser anser* also winter. The duck species breeding in the marismas include Mallard *Anas platyrhynchos*, Marbled Teal *A. angustirostris*, Red-crested Pochard *Netta rufina* and Pochard *Aythya ferina*, but the rare White-headed Duck *Oxyura leucocephala* probably no longer does so. Among the rails the Purple Gallinule *Porphyrio porphyrio* is still not uncommon but the Crested Coot *Fulica cristata* seems to have become very scarce. The Greater Flamingo *Phoenicopterus ruber* is present throughout the year but nesting is only very occasional. On the other hand, important colonies of Night Heron *Nycticorax nycticorax*, Squacco Heron *Ardeola ralloides*, Cattle Egret *Bubulcus ibis*, Little Egret *Egretta garzetta*, Grey Heron *Ardea cinerea*, Spoonbill *Platalea leucorodia* and White Stork *Ciconia ciconia* are to be found in the *Quercus* – cum – *Halimium* thicket parklands.

Brief mention may perhaps be made of some of the more interesting non-aquatic fauna. Among the numerous birds pride of place goes to the endangered Spanish race of the Imperial Eagle *Aquila heliaca adalberti*, of which about 10 pairs nest in the area. The mammals include the equally endangered Spanish Lynx *Felis pardina* and a number of other carnivores such as the Red Fox *Vulpes vulpes*, badger *Meles meles*, Otter *Lutra lutra*, Small-spotted Genet *Genetta genetta*, the Mongoose *Mungos widdringtonii* (= *Herpestes ichneumon*) and Wild Cat *Felis silvestris*. Three herbivores, the Wild Boar *Sus scrofa*, Fallow Deer *Dama dama* and Red Deer *Cervus elaphus* are very abundant.

**Legal status** The Parque Nacional de Doñana was created in 1969 and comprises 35,000 ha. The Biological Reserve of the Doñana, comprising 6,000 ha within the Park, is controlled by the Consejo Superior de Investigaciones Científicas, which is responsible to the Ministry of Education.

**Tenure** Outside the two state-owned areas just mentioned, most of the wetlands are private property or belong to Communes situated on the borders of the Marismas.



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**Management practices** An outbreak of Botulism in the summer of 1973, resulted in the death of approximately 30,000 aquatic birds. To reduce the impact of further outbreaks (of which there have been several), wells have been drilled to provide sufficient fresh water to attract the birds away from the shallow stagnant pools where the risk of botulism at the end of a dry hot summer is high. The Park is also to be made more accessible to the public than in the past and the management plan provides for the creation of several new ponds with observation posts or hides from which visitors will be able to watch a representative sample of the avifauna. Similarly, a carefully planned road system in a limited part of the park should permit wildlife to be viewed without adverse consequences to the fragile ecosystems.

**Threats** Plans for further urbanization and for the construction of a highway from Huelva to Cadiz along the coastal strip having, it is hoped, been finally abandoned, a major threat has been removed but renewed mining activities in the Sierra Morena range to the north could pollute the Guadiamar river which flows through the marismas. Meanwhile, the risk of rainfall run-off from nearby cultivation being contaminated by pesticides remains high. Irrigation projects using fresh water from the subsoil or indeed its extraction to supply drinking water to Matalascañas, the nearest seaside resort, could seriously lower the water table of the marshes and Santa Olalla and Dulce lagoons (which are close to Matalascañas).

**Scientific research** The Biological Station of Doñana, of which the central office is situated in Sevilla, has been carrying out field studies since the 1950s. A field laboratory was established in the reserve itself in 1972. There is also a small field station linked with the reserve in one of the best areas in the marismas, the privately owned estate of Las Nuevas.

### Principal reference material

Valverde, J. A. 1958. An ecological sketch of the Coto Doñana. *British Birds* 51: 1.

Valverde, J. A. 1967. *Estructura de una Comunidad de Vertebrados Terrestres*. Monografías de ciencia moderna No. 76, Consejo Superior de Investigaciones Científicas, Madrid.

Fernandez, J. A. 1975. *Guía del Parque Nacional de Doñana*. ICONA, Madrid.

## 12. ALBUFERA DE ALCUDIA (Mallorca)

**Criteria for inclusion** 1a; 2a; 3c; 4a.

**Geographical location** 39°45'–50'N 3°10'–25'E North-east coastland of Mallorca, 8 km south-east of Puerto de Alcudia.

**Area** 1,500 ha (MAR List 1965) but probably subsequently reduced by drainage for urbanization projects along the dunes separating the lagoon from the sea.

**Altitude** Sea level.

**Water depth** No information, but probably between 1 and 2 m.

**Wetland types** 7, 18.

**Ecology** A coastal lagoon and lake, bordered on the sea side by dunes, and containing large areas of tall reeds and relatively little open water. Notable waterfowl species nesting here include the Little Bittern *Ixobrychus minutus* and the

Purple Heron *Ardea purpurea*. The site is of considerable importance to wintering duck and coot and almost certainly a stopping-place on migration for large numbers of these and other species associated with wetlands, although detailed observations are lacking. The only other wetland of importance on the island is the group of salinas towards the southern tip in the neighbourhood of the Bahía de la Rápita.

**Legal status** None.

**Tenure** No information.

**Management practices** No information.

**Threats** Part of the area between the lake and the sea has been developed for the tourist industry and such development could easily spread round its shores and seriously impair the natural values of the site.

**Scientific research** None reported.

**Principal reference material**

None quoted.

# SWEDEN

## SUMMARY OF WETLAND SITUATION

The wetlands of Sweden are of very various types, for example coastal marshes, rivers, lakes, fens, mires and peatbogs; and they cover approximately 20% of the national territory. The pressures on many of these sites are increasing, particularly along the coasts but also inland, where much swampy forest is being drained to increase timber production or to eliminate excess water in neighbouring agricultural areas. The possibility of draining arms of the sea or lakes, for the purpose of facilitating exploitation of nutrient rich sediments, has recently aroused much interest. The excavation of mires to extract peat for agricultural or horticultural purposes continues incessantly and peat could again become important as fuel in the not too distant future.

Sweden became a party to the Ramsar Convention in 1974, after signing without reservations as to ratification. Twenty wetlands have so far been entered on the Convention List. Earlier (1973), more than sixty sites had been included in a List of Wetlands of Nordic Importance and earlier still (1971) Project AQUA listed 27 sites of high limnological importance. Of the total of 87 Swedish sites covered by these lists, the majority as well as being of great botanical and zoological interest, are important breeding and feeding places of waterfowl and stopping places for food and rest of birds on migration.

Having regard to future economic and ecological needs, the Swedish Government in 1977 ordered a survey of all shallow waters, mires, moist grasslands and groundwater forest. This survey was to be carried out by the Swedish Environment Protection Board (EPB) under the authority of the Ministry of Agriculture and to comprise two stages. Stage I dealt with existing knowledge of wetlands and aimed to fill in the most important gaps. The data would be computerized and evaluated and a report was due to appear in 1979. Stage II would then comprise studies of various aspects of land use, conservation, recreation, water-management and scientific research and was expected to last for at least five years (i.e. till 1984). The final report would serve as a basis for long-term management of the wetland natural resource. No recent report has been received as to the progress of this admirable project.

## WETLANDS OF INTERNATIONAL IMPORTANCE

### \*Nominated for inclusion in the Ramsar Convention list

	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
<b>A. Wetlands included in the Ramsar Convention List</b>					
*1.	Taavavuoma	68°30'N	20°45'E	8,810 ha	2a; 4a Unprotected
*2.	Sjaunja – Kaitum complex	67°17'N	19°49'E	175,000 ha	1a,c,d,e; 2a; 3b,c; 4a Partly protected
*3.	Laidaure	67°07'N	17°45'E	3,400 ha	1d; 2a,b; 4a,b Partly protected

	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criterial Conservation status</i>
*4.	Persöfjärden	65°46'N	22°08'E	3,400 ha	1a,d; 2a; 4a,b Unprotected
*5.	Gammelstadviken	65°38'N	22°00'E	446 ha	1a,d; 2a; 4a Protected (Nature Reserve)
*6.	Tjälmejaure – Laisdalen	66°15'N	16°11'E	9,700 ha	1c,d,e; 2a; 3c; 4a,b Partly protected
*7.	Tärnäsjön	65°52'– 66°04'N	15°28'–29'E	12,200 ha	1d; 2a,b Protected (Nature Reserve)
*8.	Ännsjön	63°15'–16'N	12°30'–33'E	2,900 ha (total lake area c. 10,000)	1d; 2a,b Unprotected
*9.	Hjälstaviken	59°40'N	17°23'E	902 ha	1a,d,e; 2a; 3a,b,c; 4a Protected
*10.	Kvismaren	59°10'N	15°23'E	890 ha	1d,e; 2a,b; 3a; 4a,b Unprotected
*11.	Tåkern	58°21'N	14°49'E	5,600 ha	Criteria unassessed Partly protected
*12.	Hornborgasjön	58°19'N	13°33'E	6,600 ha	1a,d,e; 2a,b; 3a Partly protected
*13.	Rone Ytterholme, Laus Holmar and Skenholmen islands	57°06', 16' and 48'N	18°27'– 19°02'E	c.414 ha	1a,b; 4a Partly protected
*14.	Södviken	57°02'N	16°55'E	840 ha	1a; 2a; 3c; 4a,b Partly protected
*15.	Ottenby	56°12'N	16°24'E	1,070 ha	1a,b,e; 2a; 3a,b,c; 4a,b Protected (Nature Reserve)
*16.	Kävsjön and Store Mosse	57°18'N	13°57'E	7,450 ha	1a,d; 2a; 3b; 4a,b Partly protected (6,700 ha Nature Reserve)
*17.	Helga Å (lower lakes)	56°00'–04'N	14°08'–13'E	5,145 ha	1a Partly protected
*18.	Klingavälsån – Krankesjön	55°37'N	13°38'E	4,000 ha	1b; 2a; 3b; 4a,b Protected (two Nature Reserves)
*19.	Getterön	57°08'N	12°14'E	300 ha	1a,c,d; 3a,c; 4a Protected (Nature Reserve)
*20.	Falsterbo – Foteviken area	55°25'N	12°55'E	5,550 ha	1b,e; 2a,b; 3a,b,c; 4a Partly protected (4 Nature Reserves)
<b>B. Wetlands included in the Project AQUA List (Wetland Criteria not assessed)</b>					
21.	Torneträsk	68°11'–28'N	18°35'– 20°05'E	c.31,370 ha	Partly protected (Abisko national Park)
22.	Vuolep Njakajaure (Nedre Laksjön)	68°21'N	18°49'E	13 ha	Protected

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	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
23.	Abiskojaure	68°17'N	18°44'E	260 ha	Protected
24.	Kuoblatjakkojaure	68°10'N	18°50'E	10 ha	No information
25.	Latnajaure	68°12'N	18°49'E	73 ha	No information
26.	Rissajaure	68°08'N	18°50'E	24 ha	No information
27.	Kilpisjärvi incl. Finnish border rivers Könkämä, Mjonio and Torne	65°52'– 69°03'N	20°50'– 25°10'E	c.6,000 ha (lake) 500 km (rivers)	No information
28.	Vuoijatätno, incl. Salohaure, Vastenjaure and Virihaure	67°20'N	16°30'E	Virihaure only 10,800 ha	Protected (National Park)
29.	Vindelälven river system	63°45'– 66°30'N	15°45'– 20°00'E	Catchment area 12,655 sq. km	Unprotected
30.	Ovre Oldsjön	63°46'N	13°31'E	550 ha	Unprotected
31.	Öregrund archipelago	60°10'–32'N	18°25'– 19°00'E	No information	Unprotected
32.	Andersvedjedjupet	59°51'N	18°55'E	27 ha	Unprotected
33.	Gräsvarpet	59°52'N	18°55'E	10 ha	Unprotected
34.	Sandängsfjärden	59°52'N	18°55'E	No information	No information
35.	Lake Erken	59°49'–59'N	18°29'–40'E	2,286 ha	Unprotected
36.	Utalsviken	59°49'N	18°51'E	No information	Unprotected
37.	Landsort Deep	58°40'N	18°20'E	c.300 sq. km of open sea	Unprotected
38.	Gullmar Fjord	58°15'–29'N	11°25'–42'E	5,100 ha	No information
39.	Lake Hummelin	57°22'N	16°15'E	540 ha	Possibly now protected
40.	Skärhultsjön	57°10'N	14°31'E	36 ha	Unprotected
41.	Lake Frejen	57°08'N	14°37'E	30 ha	Unprotected
42.	Lake Straken	57°06'N	14°36'E	810 ha	Unprotected
43.	Lake Fiolen	57°05'N	14°32'E	160 ha	Unprotected
44.	Gotland 'Träsk' (calcareous lakes)	57°00'–57'N	18°00'– 19°20'E	c.2,500 ha	Unprotected

**C. Other wetlands listed as internationally important in the Oversikt over viktige vatmarker i Norden**  
(Wetland Criteria not assessed: sites not shown in map)

45.	Pirttimysvuoma	68°16'N	20°42'E	c.7,500 ha	Protected
46.	Ripakaisenvuoma	67°47'N	21°45'E	c.10,000 ha	Protected
47.	Marsivagge – Gautsträsk	65°58'N	16°13'E	c.700 ha	Unprotected
48.	Osträsket	64°54'N	21°03'E	c.200 ha	Protected
49.	Innerviksfjärdarna and Avikkärret	64°42'N	21°07'E	c.300 ha	Protected
50.	Blahammarsmyren	63°17'N	12°05'E	c.1,200 ha	Protected
51.	Stornäset	62°27'N	17°30'E	30 ha	Protected
52.	Mingen	62°14'N	17°27'E	240 ha	Protected
53.	Sässman – Langtjärn	61°23'N	15°52'E	c.600 ha	Protected
54.	Alsjön	61°17'N	17°03'E	c.130 ha	Protected

	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
55.	Hovran	60°17'N	16°04'E	c.700 ha	Protected
56.	Tisjöområdet	60°11'N	16°56'E	c.3,000 ha	Protected
57.	Tämnaren	60°10'N	17°20'E	3,900 ha	Protected
58.	Askövik	59°30'N	16°30'E	c.300 ha	Protected
59.	Panken – Arnofjorden	59°24'N	13°49'E	1,400 ha	Protected
60.	Kilsviken – Arasviken	59°05'N	14°05'E	1,500 ha	Partly protected
61.	Östen	58°33'N	13°54'E	c.600 ha	Protected
62.	Hästefjorden	58°25'N	12°10'E	c.6,000 ha	Partly protected
63.	Stigsfjorden – Kalvöfjorden	58°05'N	11°40'E	c.4,000 ha	Protected
64.	Breviks Kile	58°01'N	11°34'E	c.300 ha	Protected
65.	Odmals Kile	57°56'N	11°45'E	c.300 ha	Protected
66.	Nordre Älvs Fjord	57°48'N	11°45'E	c.1,200 ha	Partly protected
67.	Kungsbackafjorden	57°24'N	12°06'E	c.1,500 ha	Partly protected
68.	Laholmsbukten	56°30'N	12°50'E	c.7,500 ha	Protected
69.	Malmö – Lommabukten	55°34'–44'N	13°00'E	c.800 ha	Protected
70.	Ystad – Svarte	55°26'N	13°45'E	c.150 ha	Protected
71.	Sölvesborgsviken	56°02'N	14°35'E	c.500 ha	Partly protected
72.	Torhamns Udde	56°04'N	15°50'E	c.30 ha	Protected
73.	Storsund	57°34'N	18°47'E	c.100 ha	Protected
74.	Stockviken	57°00'N	18°21'E	c.200 ha	Protected
75.	Misterhults and Vastrums Yttre Skärgård	57°35'N	16°45'E	c.11,000 ha	Partly protected
76.	Petgårde Tråk	56°57'N	16°51'E	c.100 ha	Protected
77.	Örarevet – Svartö	56°28'N	16°08'E	c.170 ha	Protected
78.	Skatelövsfjorden	56°45'N	14°36'E	c.1,500 ha	Protected
79.	Draven	57°10'N	13°38'E	c.500 ha	Protected
80.	Svenskundsviken	58°35'N	15°25'E	c.1,000 ha	Protected
81.	Roxens Sydsida	58°29'N	15°34'E	330 ha	Temporarily protected (1971/74)
82.	St. Annas Ytterskärgård	58°20'N	17°00'E	c.8,000 ha	Partly protected
83.	Hartsö – Enskärs skärgård	58°41'N	17°29'E	c.4,500 ha	Protected
84.	Källskären – Hävringe, incl. Oxelösunds Skärgård	58°38'N	17°15'E	c.10,000 ha	Partly protected
85.	Ledkärsviken	60°31'N	17°42'E	200 ha	Protected
86.	Kallrigafjärden	60°21'N	18°15'E	c.700 ha	Protected
87.	Stockholms Yttre Skärgård	58°47'– 59°50'N	18°03'– 19°20'E	c.24,000 ha	Partly protected

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## DETAILS OF LISTED AREAS

### 1. TAAVAVUOMA

**Criteria for inclusion** 2a; 4a.

**Geographical location** 68°30'N 20°45'E Eastern Swedish Lappland, about 30 km from the border with Norway to the west, 40 km from the border with Finland to the north and 85 km north-north-east of Kiruna, Norbotten Iån (District).

**Area** 8,810 ha.

**Altitude** 900–1,00 m.

**Water depth** No exact information; mainly shallow lakes and marshes.

**Wetland types** 13, 22, 23.

**Ecology** A depression in one of the northernmost plateau regions of Lappland, forming an extensive area of marshes, streams, meres and lakes. It lies within the catchment of the Lainio river, one of the two larger tributaries of the Torne. Its arctic and sub-arctic peatlands and lakes are of considerable botanical and zoological interest. Particularly high concentrations of birds are found at Taavätno and the other lakes of the plateau area to the south around Sautso mountain.

Duck species breeding in the area include Wigeon *Anas penelope*, Teal *A. crecca*, Pintail *A. acuta*, Tufted Duck *Aythya fuligula*, Scaup *A. marila*, Common Scoter *Melanitta nigra*, Velvet Scoter *M. fusca*, Long-tailed Duck *Clangula hyemalis* and Red-breasted Merganser *Mergus serrator*. The Limicoline species which nest include Ringed Plover *Charadrius hiaticula*, Golden Plover *Pluvialis apricaria*, Dunlin *Calidris alpina*, Red-necked Phalarope *Phalaropus lobatus*, Wood Sandpiper *Tringa glareola* and Ruff *Philomachus pugnax*. Noteworthy passerines are the Red-throated Pipit *Anthus cervinus* and Arctic Redpoll *Acanthis hornemanni*. Other birds quite frequently observed are Whooper Swan *Cygnus cygnus*, Bean Goose *Anser fabalis*, Lesser White-fronted Goose *A. erythropus* and Hen Harrier *Circus cyaneus*.

The wolf *Canis lupus*, rated as a Vulnerable species in the Red Data Book, survived here until 1960.

**Legal status** The wetland has no legal protection and is partly occupied by an ESRO (European Space Research Organization) rocket range.

**Tenure** State ownership.

**Management practices** None reported.

**Threats** No particular ones have been noted.

**Scientific research** Still inadequate.

#### Principal reference material

Report on the avifauna (Fältbiologerna, Göteborg 1973, mimeogr.).

### 2. SJAUNJA – KAITUM complex

**Criteria for inclusion** 1a,c,d,e; 2a; 3b,c; 4a.

**Geographical location** 67°17'N 19°49'E West Norrbotten Iån (District), about 50 km south-west of Kiruna.



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**Area** 175,000 ha.

**Altitude** No precise details: ranging from c.200 to c.800 m.

**Water depth** Quoted as 'shallow'; no details.

**Wetland types** 21, 22.

**Ecology** This is Europe's most extensive mire outside the Soviet Union. The adjacent mountain slopes, morainic ridges and indeed the whole of the Sjaunja – Kaitum catchment form a virgin wilderness with a wide range of habitats and probably support a greater number of vertebrates than any other Swedish mountain region. The wetland is characterized by a mixture of open marshes, shallow lakes and birch woods. Primeval forests of pine *Pinus* sp. are found on the morainic ridges and of fir *Abies* sp. elsewhere.

The remote upper valley of the Kaitum river harbours an unusual and abundant avifauna. In the wetland region generally the breeding species include Whooper Swan *Cygnus cygnus*, Bean Goose *Anser fabalis*, Pintail *Anas acuta*, White-tailed Eagle *Haliaeetus albicilla*, Golden Eagle *Aquila chrysaetos*, Gyrfalcon *Falco rusticolus*, Peregrine Falcon *F. peregrinus*, Broad-billed Sandpiper *Limicola falcinellus*, Spotted Redshank *Tringa erythropus*, Great Snipe *Gallinago media* (and possibly Jack Snipe *Lymnocyptes minimus*), Short-eared Owl *Asio flammeus*, Red-throated Pipit *Anthus cervinus* and Rustic and Little Buntings *Emberiza rustica* and *E. pusilla*.

The area has an important population of Brown Bear *Ursus arctos*. The Wolf *Canis lupus*, rated as a Vulnerable species in the Red Data Book, occurs sporadically.

**Legal status** Lower-lying sectors are included in an area where birds are protected by a partial hunting prohibition. Establishment of a large Nature Reserve by the Provincial Agency was advocated by the Environment Protection Board in 1968 but does not seem to have been implemented.

**Management practices** No information.

**Threats** Plans in the 1960s for hydroelectric exploitation of the upper Kaitum river were scrapped by a special Parliamentary Resolution. Some disturbance occurs from snowmobiles in spring. Prospecting for minerals in the area continues.

**Scientific research** Largely confined to avifaunal studies.

**Principal reference material**

Curry-Lindahl, K. 1971. Sjaunja och Kaitum. Reports of the Environment Protection Board. Botanical Survey and draft Wildlife Management Plan.

**3. LAIDAURE (or Laitaure)**

**Criteria for inclusion** 1d; 2a,b; 4a,b.

**Geographical location** 67°07'N 17°45'E Norrbotten län, 86 km north-west of Jokkmokk, on the south-eastern border of Sarek National Park.

**Area** 3,400 ha (of which 1,700 ha are water).

**Altitude** No precise information: between c.500 and c.1,000 m.

**Water depth** No information.

**Wetland types** 13, 19.

**Ecology** A beautiful lake landscape lying between the mountainous region of the Sarek National Park and a zone of coniferous forests. The rapidly-growing sub-alpine Laitaure delta at the mouth of the Rapa river is the most important site for birds. Breeding species present include Mallard *Anas platyrhynchos*, Wigeon *A. penelope*, Teal *A. crecca*, Pintail *A. acuta*, Tufted Duck *Aythya fuligula*, Scaup *A. marila* and Goldeneye *Bucephala clangula*. The Lesser White-fronted Goose *Anser erythropus* is frequently observed flying over.

The Kvikkjokk and Anok delta lakes to the immediate south have an earlier date for the break-up of ice than the Laitaure, so the latter is less important as a resting place during the spring migration but conversely is of the greatest importance to moulting duck. At its eastern end, where the river leaves the lake, great concentrations of Whooper Swan *Cygnus cygnus* occasionally occur during migration seasons and are probably the densest populations of the swan to be found anywhere in Sweden.

The nearby Sarek National Park has a considerable population of larger mammals including Wolf *Canis lupus*, Brown Bear *Ursus arctos* and Elk *Alces alces*.

**Legal status** Part of the area is protected by the Swedish Society for the Conservation of Nature.

**Tenure** Partly state and partly private ownership, the latter including the Swedish Nature Conservation Society's sector.

**Management practices** None reported.

**Threats** Some disturbance to birds by canoeists in the delta area in spring.

**Scientific research** No information.

**Principal reference material**

Bird inventory report to the Environment Protection Board.

**4. PERSÖFJÄRDEN**

**Criteria for inclusion** 1a,d; 2a; 4a,b.

**Geographical location** 65°46'N 22°08'E In Norrbotten län, about 30 km to the north of Lulea, at the head of the Gulf of Bothnia.

**Area** 3,400 ha.

**Altitude** Sea level.

**Water depth** No precise information: generally shallow.

**Wetland type** 18.

**Ecology** A shallow lake, 13 km in length, adjacent to a shallow sea bay, from which it has been separated by an uplift of the land surface. Extensive reedbeds and lakeshore meadows surround the lake, the reeds and willows *Salix* sp. having increased since 1936 when the water level was lowered. Before this happened the lake was well-known for its wealth of birds and fish, but although fish largely disappeared with lower water levels, the avifauna was enriched by new species. The lake outlets have now become choked and the present plan is to accept this natural rise in the water level.

Bird species of importance include the Red-necked Phalarope *Phalaropus lob-*

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*atus*, for which this is the only inland lake breeding-place in Norrbotten except for one or two in the mountains. Other probable breeding species include Slavonian Grebe *Podiceps auritus*, Spotted Crake *Porzana porzana*, Jack Snipe *Lymnocyptes minimus*, Marsh Harrier *Circus aeruginosus* and Little Gull *Larus minutus*. It is an area of great importance as a resting place during migration and flocks of about 100 Bean Geese *Anser fabalis* and numerous Ruffs *Philomachus pugnax* have been observed. The avifauna of Gammelstadsviken, next on the list, is very similar.

**Legal status** Unprotected and not being considered for Reserve status in the immediate future.

**Tenure** Private ownership.

**Management practices** Restoration of the former lake level, which has already started through natural processes, will probably be the main management aim.

**Threats** Desiccation brought about by the lower water level and vegetational succession.

**Scientific research** No information.

### Principal reference material

No information.

## 5. GAMMELSTADSVIKEN

**Criteria for inclusion** 1a,d; 2a; 4a.

**Geographical location** 65°38'N 22°00'E To the immediate north-west of Lulea, Norrbotten län, at the head of the Gulf of Bothnia.

**Area** 446 ha.

**Altitude** Sea level.

**Water depth** Average 1 m.

**Wetland type** 18.

**Ecology** A shallow bay about 4 km long close to Lulea and with a character more akin to that of a northerly eutrophic lake, having become overgrown with vegetation, the flora and fauna being representative of northern regions, including many breeding birds.

All Swedish Anatidae, except for the Gadwall *Anas strepera* breed here with a wide range of waders such as Little Ringed Plover *Charadrius dubius*, Lapwing *Vanellus vanellus*, Redshank *Tringa totanus*, Greenshank *T. nebularia*, Wood Sandpiper *T. glareola*, Ruff *Philomachus pugnax*, Curlew *Numenius arquata*, Common Snipe *Gallinago gallinago* and occasionally Jack Snipe *Lymnocyptes minimus*. Other breeding birds include Great Crested, Red-necked and Slavonian Grebes *Podiceps cristatus*, *griseus* and *auritus*, Coot *Fulica atra* and Little Gull *Larus minutus*, perhaps also Temminck's Stint *Calidris temminckii*, Hen Harrier *Circus cyaneus* and Short-eared Owl *Asio flammeus*. Other notable species visiting the bay on their spring and autumn migrations include Smew *Mergus albellus*, Marsh Harrier *Circus aeruginosus*, Broad-billed Sandpiper *Limicola falcinellus*, Curlew-Sandpiper *Calidris ferruginea*, Spotted Redshank *Tringa erythropus* and Black-tailed Godwit *Limosa limosa*.

**Legal status** Nature Reserve since 1969.

**Tenure** Owned by the Local Authority.

**Management practices** None.

**Threats** Urbanization of the surrounding area.

**Scientific research** No information.

**Principal reference material**

No information.

## 6. TJÅLMEJAURE and LAISDALEN

**Criteria for inclusion** 1c,d,e; 2a; 3c; 4a,b.

**Geographical location** 66°15'N 16°11'E South-west corner of Norrbotten län, close to the Peljekajse National Park (to the north) and the Norwegian border (to the west).

**Area** 9,700 ha.

**Altitude** No precise details; but between c.800 and c.1,000 m.

**Water depth** No details available, but known to have shallow shores in some areas.

**Wetland types** 13, 19.

**Ecology** Two mountain valleys converge just before reaching Lake Yraf and their rivers combine to form a common delta. The more southerly valley contains a series of lakes – Bosjaujaure, Tjålmejaure, Gavajaure – with wide level shores very suitable as breeding and resting places for waterfowl. Ten species of duck are known to nest, as do a variety of other birds such as the Broad-billed Sandpiper *Limicola falcinellus*, Purple Sandpiper *Calidris maritima*, Great Snipe *Gallinago media*, Snowy Owl *Nyctea scandiaca* and Red-throated Pipit *Anthus cervinus*. The Lesser White-fronted Goose *Anser erythropus*, however, of which there used to be several breeding pairs, has almost disappeared from the area.

The lower valley, Laisdalen, forming part of the complex, is considerably narrower and one of the richest Swedish valleys in animal species. The marshy zone along the river is characterized by rich meadows and birch *Betula* woods. A thin scatter of pines accentuates the primeval nature of the woodland and is important for some elements of the avifauna, notably the rich breeding population of raptors including Osprey *Pandion haliaetus*, Rough-legged Buzzard *Buteo lagopus*, Golden Eagle *Aquila chrysaetos* and Merlin *Falco columbarius*, and others such as Capercaillie *Tetrao urogallus*, Waxwing *Bombycilla garrulus* and Siberian Jay *Perisoreus infaustus*. Good nesting-places, for grouse *Lagopus* spp. and duck, are plentiful and the breeding range of several species has been noted as extending further into the mountains in this valley than anywhere else in Sweden.

The larger mammals of Laisdalen include Brown Bear *Ursus arctos*, Pine Marten *Martes martes*, Wolverine *Gulo gulo* and Lynx *Lynx lynx*. The Wolf *Canis lupus* was last recorded in 1962.

**Legal status** Recent protective measures include the creation of Vindelfjällen Nature Reserve in the Tärnasjön area and well to the south but scheduled to be extended to Tjålmejaure – Laisdalen. The Yraf Delta is already established as a

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separate reserve and bird protection measures apply generally to a large part of the area.

**Tenure** State ownership.

**Management practices** No information.

**Threats** None reported.

**Scientific research** No information.

**Principal reference material**

No information.

## 7. TÄRNASJÖN

**Criteria for inclusion** 1d; 2a,b.

**Geographical location** 65°52'–66°04'N 15°28'–29'E About 40 km south-west of Ammarnäs in Vasterbotten län.

**Area** 12,200 ha (The MAR List figure was 5,900 ha, half of it described as deep water, but Project AQUA quoted the water area as only 1,700 ha).

**Altitude** 603 m.

**Water depth** Variable: in places shallow, elsewhere quite deep.

**Wetland types** 13, 19, 21.

**Ecology** A long narrow lake of considerable geological interest occupying a stretch of the upper Ume river system. Its southern end lies in an area of long parallel moraine ridges, with drumlins forming an archipelago. The marshy shores of this sector, bordered by reedbeds and some *Betula* birchwoods, are very irregular and flood in spring.

The Tarna river enters the lake at its northern end, forming a delta which has been very little disturbed. The Laivajaure area north-west of the delta is of particular botanical interest as containing the southernmost and probably best developed 'palsa' mire in Sweden. Most of the shores of the lake are composed of morainic drifts and boulders.

The lake and especially the marshy areas of the drumlin islands in the south are an important nesting-place of ducks and waders. There are 10 breeding species of duck, chiefly Wigeon *Anas penelope*, Teal *A. crecca*, Scaup *Aythya marila* and the two scoters *Melanitta fusca* and *M. nigra*, and about a dozen species of waders, including Red-necked Phalarope *Phalaropus lobatus*, Ruff *Philomachus pugnax* and Whimbrel *Numenius phaeopus*. There are also breeding populations of Lesser White-fronted Goose *Anser erythropus*, Great Snipe *Gallinago media* and various birds of prey.

Mammals include occasional Brown Bear *Ursus arctos*. The European Beaver *Castor fiber* has been introduced but remains rare. The fish fauna is good.

**Legal status** The Vindelfjällen area, which includes Tärnasjön, has recently been declared a Nature Reserve, but some legal stages remain to be completed.

**Tenure** State ownership.

**Management practices** Fishing is allowed in the lake.

**Threats** Most of the lakes and mires in this area have been subjected to water

regulation for hydroelectric schemes. Tärnasjön has so far escaped this, a freedom from disturbance which constitutes its special value.

**Scientific research** Botanico-zoological investigations were carried out in 1963. Long-term studies of breeding passerine birds have been undertaken at Ammarnäs.

**Principal reference material**

Inventory reports to the Environment Protection Board.

## 8. ÅNNSJÖN

**Criteria for inclusion** 1d; 2a,b.

**Geographical location** 63°15'–16°N 12°30'–33'E Jamtland Iån, about 80 km due west of the Storsjön and 20 km from the nearest point on the Norwegian border where the road and railway to Trondheim cross it.

**Area** 2,900 ha (The MAR List figure was 10,000 ha, less than half of it described as deep water, but Project AQUA quoted the water area as 5,700 ha).

**Altitude** 525 m.

**Water depth** Generally shallow, less than 2 m with large areas below 1 m in normal summer conditions. Somewhat uncertain and conflicting reports indicate a maximum of 34 m in either the south-east or the north-east of the lake.

**Wetland types** 12, 13, 18, 19, 21.

**Ecology** A very shallow oligotrophic lake on the upper waters of the Indalsälven drainage system, surrounded by extensive mires. The latter are of considerable botanical interest as showing some oceanic influence from the west and being rich in species. The lake itself has 35 species of vascular plants, making it notably richer than the series of lakes downstream. Two of the best areas are the Handöl delta on the west, where two rivers meet, and the Harra delta on the north. The lake itself is more or less oval in shape, about half its shore boggy, the only sandy section, about 2 km long in the east, forming a high narrow ridge on its landward side. Some sections of shore elsewhere have eroded peat in steps 3 to 4 m high.

The mire, delta areas and shallower open waters are important for both migrating and breeding birds. Those known to nest include Wigeon *Anas penelope*, Pintail *A. acuta*, the scoters *Melanitta fusca* and *M. nigra*, and Long-tailed Duck *Clangula hyemalis*. The Red-throated Diver *Gavia stellatus* and occasionally the Lesser White-fronted Goose *Anser erythropus* are other breeding species but the Bean Goose *A. fabalis* no longer does so. The 14 species of wader regularly nesting include the Broad-billed Sandpiper *Limicola falcinellus*, Temminck's Stint *Calidris temminckii*, Red-necked Phalarope *Phalaropus lobatus* and Curlew *Numenius arquata*.

**Legal status** No protection has been given.

**Tenure** Numerous riparian owners, presumably mainly private.

**Management practices** The lake is used for fishing and recreation.

**Threats** A threat to use the lake and regulate its water for generating hydroelectric power appears to have been averted.

**Scientific research** Limnological studies were carried out in August 1964 and August 1966.

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**Principal reference material**

Persson, C. 1943. *Fåglar vid Ånnsjön*.

**9. HJÄLSTAVIKEN**

**Criteria for inclusion** 1a,d,e; 2a; 3a,b,c; 4a.

**Geographical location** 59°40'N 17°23'E Uppsala län, 20 km south of Uppsala itself and 17 km east of Enköping.

**Area** 902 ha (Project MAR only referred to 220 ha of reedswamps and shallow waters).

**Altitude** No precise information: only slightly above sea level.

**Water depth** Shallow.

**Wetland type** 18.

**Ecology** A shallow enclosed bay of Lake Mälaren surrounded by hummocky wet meadows merging into drier pastures and fields on the outer margin. On one side of the bay the shores rise steeply and produce a montane landscape of exposed rocks and coniferous woods. Elsewhere there are two patches of hardwood trees bordering the bay and the water surface itself is a mosaic of open water and patches of reeds *Phragmites*, rushes and reedmace *Typha*, with a 200 to 300 m – wide belt of reedbed bordering the shore.

This is one of Sweden's best known and frequented bird reserves due both to the variety of species and to ease of access. It has served as a base from which the Mute Swan *Cygnus olor* has colonized central Sweden. Other important species are Bittern *Botaurus stellaris* (first breeding record 1948), Marsh Harrier *Circus aeruginosus*, Spotted Crake *Porzana porzana* and possibly Little Crake *P. parva*, and decreasing numbers of Gadwall *Anas strepera*. Other breeding species include Slavonian Grebe *Podiceps auritus*, Tufted Duck *Aythya fuligula*, Pochard *A. ferina*, Osprey *Pandion haliaetus* and Water Rail *Rallus aquaticus*. Migrating waders include Black-tailed Godwit *Limosa limosa*, Great Snipe *Gallinago media* and Jack Snipe *Lymnocyptes minimus*. Large flocks of swans, geese, ducks and cranes pass through on migration, mainly during spring.

**Legal status** Nature Reserve since 1948.

**Tenure** Partly private and partly state ownership.

**Management practices** The pastures are kept grazed. A system of nature trails has been developed.

**Threats** Heavy applications of fertilizers to arable sectors of the surrounding farmland, the effects of which have recently been under study and found to be potentially adverse.

**Scientific research** Ornithological studies. Recent studies of the hydrology and vegetation have also been undertaken.

**Principal reference material**

Several reports have been published in journals but no details have been supplied.

**10. KVISMAREN**

**Criteria for inclusion** 1d,e; 2a,b; 3a; 4a,b.

**Geographical location** 59°10'N 15°23'E To the south of Örebro and the Hjälmarén, about 140 km west of Stockholm.

**Area** 890 ha of which about 90 ha are under cultivation.

**Altitude** Less than 100 m.

**Water depth** Shallow.

**Wetland type** 18.

**Ecology** Most of the Kvismaren valley is fertile level farmland, but where the two lakes, East and West Kvismaren, were drained in the 1880s there is still an area covered by reeds, interspersed with thickets of willow *Salix* sp., and surrounded by swampy meadows, low-lying pasture and a little arable land, with several patches of dense woodland round its borders. Strict hydrological management is maintained to protect the surrounding fields, the only open water being in drainage canals with one exception – a small area diked in 1959, which now forms a bird biotope management area.

This wetland is especially noted for the presence of geese, ducks, Whooper Swans *Cygnus cygnus* and waders, which visit the area and its surroundings during the spring migration, at which time large parts are flooded. Those staying to breed include Bittern *Botaurus stellaris*, Marsh Harrier *Circus aeruginosus*, Corncrake *Crex crex* and Spotted and Little Crakes *Porzana porzana* and *P. parva*. In the 1950s and early 1960s the Hen Harrier *Circus cyaneus*, Black-tailed Godwit *Limosa limosa*, Short-eared and Long-eared Owls *Asio flammeus* and *A. otus* also nested. Several Golden Eagle *Aquila chrysaetos* are observed each winter.

**Legal status** Plans were in an advanced state for the creation of a Nature Reserve as long ago as 1974, but never seem to have been implemented.

**Tenure** Mainly private ownership.

**Management practices** Grazing and control of the water regime within the bird biotope management area.

**Threats** Decrease in grazing; increased drainage and cultivation.

**Scientific research** A bird-ringing station has been operated since 1960. Other studies have covered the effects of pesticides and other chemicals.

**Principal reference material**

Annual reports from the Bird Ringing Station.

**11. TÄKERN**

**Criteria for inclusion** Not assessed.

**Geographical location** 58°21'N 14°49'E To the east of Vattern lake and about 40 km west of Linköping, in Östergötland län.

**Area** 5,600 ha (a 250 m wide strip being land, the remainder shallow water).

**Altitude** Sea level.



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**Water depth** Average around 0.8 m.

**Wetland type** 18.

**Ecology** Tåkern lies to the east of Lake Vattern in an area of exposed Cambrio-Silurian rocks and cultivated plains. Its water level was lowered in the 19th century and this favoured its development as a habitat for aquatic birds, although this may now have passed its peak unless management practices reverse the trend. About one-third of the water surface is covered in reedbeds of *Phragmites*, between which the submerged meadows of water milfoil *Myriophyllum* and stoneworts *Chara* spp. provide food for the ducks, etc. These meadows also at one time supported the introduced Canadian pondweed *Elodea*, but have deteriorated in quality over recent decades.

Breeding birds include all five European species of grebe Podicipitidae, the Bittern *Botaurus stellaris*, Mute Swan *Cygnus olor*, 10 – 15 pairs of Marsh Harrier *Circus aeruginosus*, Moorhen *Gallinula chloropus* and Coot *Fulica atra*. The Little Crake *Porzana parva* has also been recorded as breeding, but is scarce. Six species of wader nest, including Little Ringed Plover *Charadrius dubius* and Dunlin *Calidris alpina*. Large numbers of duck, mainly Mallard *Anas platyrhynchos* and Wigeon *A. penelope*, and of waders visit the area during spring and autumn migrations.

**Legal status** Two small sections are at present protected by law but it is planned to designate the whole area as a Nature Reserve in the near future.

**Tenure** Mainly private ownership.

**Management practices** Some improvements have been made in water regulation but further measures will probably be necessary.

**Scientific research** Avifaunal studies and some limno-botanical studies. A bird ringing station has been in operation for some years.

**Principal reference material**

Ohrn, B. 1968. *Fågelsjöär i mosaiknatur*.

Annual reports of the Bird Ringing Station at Tåkern (mimeogr.).

## 12. HORNBORGASJÖN

**Criteria for inclusion** 1a,d,e; 2a,b;3a.

**Geographical location** 58°19'N 13°33'E Between lakes Vanern and Vattern in Skåraborg Iån.

**Area** 6.600 ha

**Altitude** 119 m.

**Water depth** In summer the maximum is 0.8 m.

**Wetland type** 18.

**Ecology** Shallow lake basin in which the water level has been lowered on five occasions during the period 1802–1933, the ancient maximum water depth being 3 m. The lake dried out completely during the summers of 1933–1954 but a 1,200 ha sector in the north was enclosed by dikes in 1954. By 1968 almost the entire lake was overgrown with reeds and willows *Salix*, only 80 ha of open water

remaining. Since then large-scale attempts have been made to extirpate reeds, in order to restore some of the former avifaunal diversity.

Breeding birds include several pairs of Black-necked Grebe *Podiceps nigricollis*, about 20 pairs of Marsh Harrier *Circus aeruginosus*, Hen-Harrier *Circus cyaneus*, Spotted Crane *Porzana porzana* and Corncrake *Crex crex*. Ducks are numerous, the chief species being Mallard *Anas platyrhynchos*, Teal *A. crecca* and Shoveler *A. clypeata*. Other nesting species are Water Rail *Rallus aquaticus*, Moorhen *Gallinula chloropus*, Lapwing *Vanellus vanellus* and Common Snipe *Gallinago gallinago*.

The area is especially famous for the large numbers (4,000 – 7,000) of Cranes *Grus grus* resting here during April – May, some staying on to breed. Other important migrants include Whooper Swans *Cygnus cygnus*, Bean Geese *Anser fabalis* and Wigeon *Anas penelope*.

**Legal status** Under investigation since 1965 as a possible bird reserve, following many years of dispute over various drainage schemes, the authorizations for some of which have now been cancelled.

**Tenure** Partly private and partly state ownership.

**Management practices** Proposals to raise the water level by 1.5 m and to clear a 900 ha area await a decision in the Ministry of Agriculture. Access has to be partly restricted during the time the cranes are present as they attract large numbers of visitors. Some potatoes are grown as food for cranes.

**Threats** Reduction of the amount of open water and gradual desiccation as a result of the natural vegetational succession.

**Scientific research** Avifaunal studies during the 1920s; more recent limnological research, some of it directed towards developing methods of eliminating reedbeds, stands of sedge *Carex* with thick root layers, and willows.

#### Principal reference material

Committee Report entitled *Hornborgasjön utredningen*: 3 vols., covering summary, limnological aspects and ornithological aspects. Environment Protection Board, 1973. PM 280.

Many other published papers on birds and limnology.

### 13. RONE YTTERHOLME, LAUS HOLMAR and SKENHOLMEN

**Criteria for inclusion** 1a,b;4a.

**Geographical location** 57°06', 16' and 48'N 18°27'–19°02'E Small islands in the Baltic sea, off the east coast of Gotland.

**Area** 414 ha (total land area).

**Altitude** Sea level and just above.

**Water depth** Not applicable.

**Wetland type** 10.

**Ecology** Three small limestone islands, with a level surface covered by gravelly soil. The islands have been used to graze sheep for many years and have a short grassy sward with hardly any trees or bushes.

Tens of thousands of Barnacle Geese *Branta leucopsis* graze on the islands

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during their migrations between breeding-places on the shores of the Arctic Ocean and wintering-grounds in western Europe. They are sometimes present throughout April and May and for a relatively short period in September. Other migrants include Brent Goose *Branta bernicla* and Greylag Goose *Anser Anser*. The islands are also an important breeding-place for duck, gulls and waders.

**Legal status** Rone Ytterholme comprises two islands of equal size, one of which, Grötlingbo Bolme, is a Nature Reserve. Laus Holmar is a bird sanctuary.

**Tenure** Rone Ytterholme is privately owned, Laus Holmar and Skenholmen state-owned.

**Management practices** Skenholmen is used as a target by the military, but not during the periods of the goose migration, so the use is on the whole compatible with and even favourable to nature conservation, since the military regulations forbidding access also serve to protect the geese. Use of the islands as sheep pasture is also reasonably compatible with the presence of the geese.

**Threats** Possible overgrazing by sheep; any kind of disturbance other than the present degree of usage could disrupt the bird communities.

**Scientific research** None reported.

**Principal reference material** No information.

## 14. SÖDVIKEN

**Criteria for inclusion** 1a;2a;3c;4a,b.

**Geographical location** 57°02'N 16°55'E On the north-east coast of the island of Öland, between Persnäs and Föra townships.

**Area** 840 ha, partly covered by water.

**Altitude** Sea level.

**Water depth** Shallow.

**Wetland type** 11.

**Ecology** A shallow bay on the north-east coast of Öland, located in the central part of a 15 km-long stretch of low and irregular shoreline. The bay contains a number of low grassy islands, sandbanks and open marshy areas and backs onto low-lying coastal meadows.

This is one of the richest bird haunts in Sweden, an excellent breeding and resting area for waders such as Avocet *Recurvirostra avosetta*, Kentish Plover *Charadrius alexandrinus*, Dunlin *Calidris alpina*, Ruff *Philomachus pugnax* and Black-tailed Godwit *Limosa limosa*. Shelduck *Tadorna tadorna* and Little Tern *Sterna albifrons* also nest here and it is particularly noted as the major breeding ground on Öland of the Eider *Somateria mollissima*. It is visited during migration seasons by large numbers of waders from the Arctic region.

**Legal status** The landward side of the bay is already a protected area, the central and north-western part being designated as a Nature Reserve, which it is planned to extend over the whole area.

**Tenure** Private ownership.

**Management practices** The surrounding meadows are grazed by sheep. The region is closed to visitors for part of the year.

**Threats** Disturbance by visitors remains a potential threat.

**Scientific research** None reported.

**Principal reference material** No information.

## 15. OTTENBY

**Criteria for inclusion** 1a,b,e;2a;3a,b,c;4a,b.

**Geographical location** 56°12'N 16°24'E At the southern tip of the island of Öland.

**Area** 1,070 ha (quoted elsewhere as 995 ha).

**Altitude** Slightly above sea level.

**Water depth** Not applicable.

**Wetland type** 11.

**Ecology** Level pasture extending to the southernmost point of Öland, from the dry stone wall enclosing the 17th century deer park. The Ottenby Bird Station and a lighthouse are situated on the promontory, which is girdled by the open sea, its shores a mixture of sandy beaches and sandspits, shingle banks and half-submerged boulders, and small sheltered coves. The favoured feeding ground of waders is a thick belt of seaweed, a score or two metres in width, washed up on the shore. The Ottenby Lund, an isolated but sizable stand of birch *Betula*, aspen *Populus tremuloides* and oak *Quercus*, is in the centre of the area, adjoining the Park.

The promontory is of importance to flocks of migrants, especially ducks and waders, virtually throughout the year, and a few species stay to nest, notably the Avocet *Recurvirostra avosetta*, for which this is one of the few breeding places in Sweden.

**Legal status** Designated as a Nature Reserve.

**Tenure** State ownership.

**Management practices** These are well established and include grazing of sheep and wild deer and forest management of the Park. The numerous visitors are restricted to footpaths.

**Threats** The number of visitors could become excessive (in 1974 it totalled 200,000) but so far damage has been avoided by appropriate controls.

**Scientific research** Studies of bird migration and bird ringing at Ottenby Bird Station, together with associated studies, including the census of breeding waders. Reports date back to a visit by the Swedish naturalist Linnaeus in June 1741, when he recorded the birds and plants.

**Principal reference material**

Edelstam, C. (ed.) 1972. The visible migration of birds at Ottenby, Sweden. *Vår Fågelvärld* suppl. 7.

Several other reports in *Vår Fågelvärld* 1948–1975.

Larsson, A. 1974. Ottenby naturreservat, vegetation och markanvändning. *Medd. Ekol. Bot. Lunds universitet* 2: 6.

**16. KÄVSJÖN and STORE MOSSE**

**Criteria for inclusion** 1a,d; 2a; 3b; 4a,b.

**Geographical location** 57°18'N 13°57'E Småland, southern Sweden, just to the north-west of Värnamo and about 60 km south of Jonköping.

**Area** 7,450 ha (quoted as c.10,000 ha in the MAR List and 6,700 ha in the World Directory of National Parks).

**Altitude** 169 – 171 m.

**Water depth** Swampy areas of shallow standing water.

**Wetland types** 21, 22.

**Ecology** The largest raised bog area in Sweden and the most extensive mire complex after the Sjaunja – Kaitum complex (listed area No. 2) in Norrland. Kävsjön and a couple of small meres are the only remaining open waters, although several of the bogs are the result of draining former lakes. The wetland as a whole is a mosaic of raised bog, fen and open water, interspersed with patches of Scots pine *Pinus sylvestris* forest and treeless areas of dwarf shrubs, which are of particular botanical interest.

Kävsjön has a remarkable avifauna of both northern and southern species. The swamps hold the densest population of cranes *Grus grus* in Sweden (two or three dozen pairs), as well as Red-throated Divers *Gavia stellata* and Golden Plovers *Pluvialis apricaria*. Other breeding species include the Black-throated Diver *Gavia arctica*, Red-necked Grebe *Podiceps grisegena*, numerous Mallard *Anas platyrhynchos*, Wigeon *A. penelope*, Garganey *A. querquedula*, Pintail *A. acuta*, Shoveler *A. clypeata*, Water Rail *Rallus aquaticus*, Spotted Crane *Porzana porzana*, Dunlin *Calidris alpina* and Short-eared Owl *Asio flammeus*. Nests of the Whooper Swan *Cygnus cygnus* and the Jack Snipe *Lymnocyptes minimus*, which were not thought to breed outside Lappland, have also been found. Many more waterfowl visit the area on migration, including especially Whooper Swan *Cygnus cygnus*, Greylag Goose *Anser anser*, Bean Goose *A. fabalis* and Pintail *Anas acuta*.

**Legal status** Protected as a nature reserve where exploitation is prohibited except for limited hunting, fishing and public access.

**Tenure** State ownership.

**Management practices** To what extent plans for rehabilitating Kävsjön, organizing grazing by livestock and other measures have been realized, is uncertain.

**Threats** None specified.

**Scientific research** Studies were undertaken in connection with possible rehabilitation measures.

**Principal reference material**

Committee Reports on restoration, including results of botanical, ornithological, limnological and hydrological investigations. (Arbetsgruppen för Kävsjön restaurering). Jonköping, 1974.

**17. HALGA Å (lower lakes)**

**Criteria for inclusion** 1a.

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**Geographical location** 56°00'–04'N 14°08'–13'E Sector of the river to the immediate north and south of Kristianstad, the chief town of the Iån of that name near the southern tip of Sweden.

**Area** 5,145 ha.

**Altitude** No precise information; but probably averaging about 50 m.

**Water depth** No information.

**Wetland type** 12.

**Ecology** The Helga Å is one of the larger rivers of Skåne, flowing through a series of former lake beds in a flat arable valley. Some of the lakes still remain undrained, including Araslövsjön, and these are surrounded by open, hummocky but fairly wet meadows, of which the Haslöv meadow is one of the most important.

The wetlands of particular importance for waterfowl are those of the lower reaches of the river. During the spring and autumn migration they are frequented by thousands of Anatidae, particularly Bean Geese *Anser fabalis* which graze the fields around Araslövsjön and Yngsjön in March – April and October – November. Since Canada Geese *Branta canadensis* became established in Sweden numbers of them up to nearly a thousand have been wintering on the southern border of the lakes.

Noteworthy breeding birds of the Helga river valley include the Marsh Harrier *Circus aeruginosus*, Spotted Crake *Porzana porzana*, Corncrake *Crex crex*, Dunlin *Calidris alpina schinzii* (20 – 30 pairs), Ruff *Philomachus pugnax*, Black-tailed Godwit *Limosa limosa* (c.50 pairs), Black-headed Gull *Larus ridibundus* (colony of 2,000 – 3,000 pairs), and Black Tern *Chlidonias niger* (c.50 pairs). There are also large populations of several duck species.

**Legal status** Partly protected.

**Tenure** Partly private and partly Local Authority ownership.

**Management practices** Grazing of the meadowlands by livestock. Other large scale rehabilitation measures, launched in the early 1970s, included extensive reed-cutting.

**Threats** Expansion of urban areas; pollution; decline of grazing. None of them has yet become very serious.

**Scientific research** No information, other than the ornithological and rehabilitation studies indicated by the titles mentioned below.

**Principal reference material**

Bengtsson, S. 1963. Hammarsjöns hachfågelfauna (Breeding bird fauna of the Hammarsjön). *Skånes Natur*.

Lennerstedt, J. 1968. Hammarsjön-Araslövsjön. *Meddel. fran Sk. O. F.*

Bjork, S. 1971. Araslövsjön och Hammarsjön. Forslag til restaureringsatgärden (Restoration plan). *Limn. Inst. Lunds University* (mimeogr.).

## 18. KLINGAVÄLSÅN – KRANKESJÖN

**Criteria for inclusion** 1b; 2a; 3b; 4a,b.

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**Geographical location** 55°37'N 13°38'E About 40 km east of Malmö, Malmöhus län, in the extreme south of Sweden.

**Area** 4,000 ha.

**Altitude** No precise information: approx. 50 m.

**Water depth** Mainly shallow but no details supplied.

**Wetland types** 12, 18.

**Ecology** The area includes the valley of the Klingavälsån, where the open hummocky ground along the riverside (flooded in spring) is very unusual in Sweden, and also the Karup and Vomb meadowlands and the Sovdesjön and Krankesjön lakes. Drainage operations during the period 1938–43 caused many changes, particularly to the Vomb meadows, but the area has been protected since 1970 and the damage may be reversible. The water level in the Krankesjön has been reduced since 1892, and reeds and other emergent macrophytes have completely colonized the exposed banks on the south-east and south-west.

Large numbers of geese, duck and waders (Limicolae) visit the wetland during migration, sometimes stopping over for the winter or summer. Particularly big flocks of Bean Goose *Anser fabalis* and White-fronted Goose *A. albifrons* were for example observed in 1970.

Apart from duck, the commoner breeding species are Great Crested Grebe *Podiceps cristatus* (but no longer other grebes), Coot *Fulica atra*, Lapwing *Vanellus vanellus*, Curlew *Numenius arquata*, Black-tailed Godwit *Limosa limosa* (irregular), Black Tern *Chlidonias niger* (irregular), Skylark *Alauda arvensis*, Meadow Pipit *Anthus pratensis* and Reed Bunting *Emberiza schoeniclus*. Nesting duck, mainly concentrated on Krankesjön, include Shelduck *Tadorna tadorna* (irregular), Mallard *Anas platyrhynchos*, Garganey *A. querquedula*, Shoveler *A. clypeata*, Tufted Duck *Aythya fuligula* and Pochard *A. ferina*.

**Legal status** The Vomb meadows have been protected since 1923, the Klingavälsån valley since 1968.

**Tenure** Mostly private ownership.

**Management practices** Grazing by livestock and artificial flooding of the Vomb meadows are among the measures taken to maintain or restore the wetland.

**Threats** None reported.

**Scientific research** The avifauna of Krankesjön has been well studied. The Stensoffa zoo-ecological research station of the University of Lund is in the neighbourhood and has organized various other faunal studies.

**Principal reference material**

Bengtsson, S. 1972. Vombs ängar-vegetation, fågelliv, markanvändning samt synpunkter på restaurering och skötsel (mimeo.).

Larsson, T. 1972. Fågelinventering. Vombs och Karups ängar, Klingavälsåns NR. *Env. Prot. Board* (mimeo.).

## 19. GETTERÖN

**Criteria for inclusion** 1a,c,d; 3a,c; 4a

**Geographical location** 57°08'N 12°14'E On the Kattegat shore of the west coast, Halland län, about 62 km south of Göteborg and just north of Varberg.

**Area** 300 ha, of which 180 ha are land.

**Altitude** Sea level.

**Water depth** No information.

**Wetland types** 5, 7.

**Ecology** A bay on the shores of the Kattegat which has become partly enclosed and desalinated following embankment construction in the 1930s. It has become important as a wintering-place for big numbers of Brent Geese *Branta bernicla* and as a resting place during spring and autumn migration for even greater numbers of ducks, geese and waders. Breeding species include Shelduck *Tadorna tadorna*, Avocet *Recurvirostra avosetta*, Dunlin *Calidris alpina*, Ruff *Philomachus pugnax*, Black-tailed Godwit *Limosa limosa* and Short-eared Owl *Asio flammeus*.

**Legal status** Designated as a Nature Reserve in 1970.

**Tenure** Mainly private and Local Authority ownership.

**Management practices** Facilities for birdwatchers include an observation tower.

**Threats** Two projects which could have serious consequences for the integrity of the area were under discussion by the Local Authority in 1977, namely extension of a neighbouring airfield and refuse dumping in the bay, but the final outcome has not been reported.

**Scientific research** Bird census and bird ringing work has been undertaken for many years.

**Principal reference material**

Pehrsson, O. *et al.* 1973. *Getteröns fågelreservat*. Report to the Env. Protection Board No. PN 423 (mimeo.).

## 20. FALSTERBO – FOTEVIKEN

**Criteria for inclusion** 1b, e; 2a, b; 3a, b, c; 4a.

**Geographical location** 55°25'N 12°55'E The extreme south-western tip of Sweden, 30 km south of Malmö and less than 25 km from the nearest point to the Danish coast.

**Area** 5,550 ha.

**Altitude** Sea level and slightly above.

**Water depth** Mostly shallow; no precise details.

**Wetland types** 5, 7, 21, 22

**Ecology** The Falsterbo peninsula juts out into the Öresund, the strait between Denmark and Sweden. The area of interest extends from Maklappen on the south to the little island of Dynan off the north of the peninsula near Klagshamn and comprises shallow coastal waters, sandbanks, lagoons and beaches backed by meadows, used for grazing although affected by salt spray, and damp moorland and mires further inland.



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The plant communities of the beach, dunes and sandbanks are dominated by the small-reed *Calamagrostis arenaria*, while the meadows have stands of sedges *Scirpus* spp., arrow-grass *Triglochin*, glasswort *Salicornia*, seablite *Suaeda*, *Aster*, the meadow-grass *Puccinellia*, plantain *Plantago*, rush *Juncus* and sea milkwort *Glaux*. Where the pasture becomes impoverished an abundant growth of tufted vetch *Vicia cracca* replaces it. Dominant plants of the Skånörs Ljung moorland of the interior are heathers *Erica* and *Calluna* spp.

The peninsula is chiefly famed as a classic site for observing bird migration. However, the coastal strip is also an important breeding-place of Limicolae which, at Foteviken, include Avocet *Recurvirostra avosetta*, Kentish Plover *Charadrius alexandrinus* and Lapwing *Vanellus vanellus*, and also of Sandwich Tern *Sterna sandvicensis*, all species which are rare in Scandinavia but found here regularly. The area is, in addition, an important roosting-place for large numbers of ducks and waders and a moulting and wintering area for the Mute Swan *Cygnus olor*.

**Legal status** Parts of the area are already Nature Reserves (Måkläppen, Skånörs Ljung, the Hammars lake promontory and the Eskilstorp islets) and additional reserves are planned (and may by now have been established) along the west and south coastal strips.

**Tenure** Partly private and partly Local Authority ownership.

**Management practices** Some of the meadows are grazed and one section is occupied by a golf course.

**Threats** Disturbance and dune erosion by bathers; urbanization; sand excavation; oil and other pollution; and a decline in the numbers of livestock grazing the meadows.

**Scientific research** Falsterbo Bird Station and botanical research account for most of the work so far undertaken.

### Principal reference material

Swedish Society for Nature Conservation, 1972. Guidebook.

Ulfstrand, S. *et al.* 1974. *Visible bird migration at Falsterbo Station*. Misc. report of Falsterbo Bird Station. 289 pp.

## 21. TORNETRÄSK

**Criteria for inclusion** Not assessed.

**Geographical location** 68°11'–28'N 18°35'–20°05'E About 80 km north-west of Kiruna, Lappland (Norrbotten län) and at its northern end within 6 km of the Norwegian border and c.45 km from Narvik.

**Area** c.31,730 ha.

**Altitude** 342 m.

**Water depth** Maximum 169 m.

**Wetland type** 19.

**Ecology** A very large and elongated lake basin of glacial origin, situated near the Atlantic/Baltic watershed. The waters are extremely oligotrophic.

The nearby Abisko National Park is noted for its plentiful bird life and other

wildlife. Mammals present in the area include Blue Hare *Lepus timidus*, Wolf *Canis lupus*, Weasel *Mustela nivalis* and Otter *Lutra lutra*. The vegetation consists chiefly of subalpine dwarf birch *Betula nana*, dwarf willow *Salix herbacea* and bog or mire communities dominated by cotton grass *Eriophorum vaginatum*, the crowberry *Empetrum hermaphroditum* and marsh andromeda *Andromeda polifolia*.

**Legal status** Some small sections of the lake lie within the Abisko National Park.

**Tenure** State ownership.

**Management practices** Recreational activities and fishing are allowed and by now some of the water from the lake is very probably used for power generation.

**Threats** Interference with water levels for the purpose of generating electricity is therefore probably the main threat to the integrity of the area.

**Scientific research** The lake has been described as a 'Subarctic Laboratory' and a very large number of limnological studies have been undertaken. The nearby Abisko Research Station has been the base for much of the work.

#### **Principal reference material**

Over 1,300 papers deal with the Torneträsk area, 150 of them concerned with limnological aspects.

Sandberg, G. 1961 (with 1964 supplement). Naturvetenskaplig litteratur rörande Torneträskomradet. Naturvetenskapliga stationen Abisko (mimeo.).

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## SUMMARY OF WETLAND SITUATION

Several important waterbodies are situated on the Swiss borders. Thus the River Rhine having formed the boundary with Liechtenstein over a length of about 25 km and with Austria over a length of about 30 km, passes through the Bodensee (the northern shore of which is the territory of the Federal Republic of Germany) and then forms the Swiss/German border for the final 75 km of its course in Switzerland, which ends a short distance downstream of Basel. Or again the border with Italy twice transects the Lago di Lugano and also the northern end of the Lago Maggiore. And, thirdly, some 60 km of the southern shore of Lac Léman is French territory.

Two at least of the great lakes just mentioned, together with the Lac de Neuchâtel, are of special international importance as wintering or moulting places for very large numbers of waterfowl, as demonstrated by data collected over 25 winters. For example, in January 1978 about 110,000 waterfowl (not counting Laridae) were present on Lac Léman alone, the most numerous being Great Crested Grebe *Podiceps cristatus* (12,400), Black-necked Grebe *P. nigricollis* (3,200), Little Grebe *Tachybaptus ruficollis* (1,286), Tufted Duck *Aythya fuligula* (46,000), Pochard *A. ferina* (16,200), Goldeneye *Bucephala clangula* (3,000), Goosander *Mergus merganser* (849) and Coot *Fulica atra* (19,000).

Numbers of diving duck wintering in Switzerland have gone up ever since the spectacular increase of the Zebra Mussel (*Dreissena polymorpha*) in the Swiss lakes. The concentration areas for wintering and migrating waterfowl include shallow reservoirs in the Canton Aargau (Stausee Klingnau and Stausee Holderbank) and in Canton Bern (Stausee Niederried). Eutrophication of the big lakes is quite heavy and the pressures of urban development and of recreational activities, including boating, are increasing and need to be curbed.

Switzerland ratified the Ramsar Convention on 16 January 1976, but so far has entered only one wetland on the Convention List, namely 'Fanel Bay and Le Chablais' (or 'Réserve de Cudrefin') at the north-eastern end of the Lac de Neuchâtel and shared by Cantons Neuchâtel, Bern and Vaud.

The large lakes already mentioned and many other low-lying waterbodies are also of great limnological interest, and this also applies to several of the higher lakes in the Swiss mountains, most of them oligotrophic and not remarkable as haunts of waterfowl. Seven of the 20 sites listed by Project AQUA are in fact situated at 1,000 metres or more above sea level.

Lastly, the smaller wetlands, though relatively few and not listed below, deserve special mention for their value as feeding and resting places of migrant birds, as well as breeding places. Particularly noteworthy is the Creux de Terre nature reserve between Orbe and Chavornay, Canton Vaud, a most important staging-post on the Neuchâtel/Léman flyway. The reserve is only 23 ha (negotiations now in progress could increase this to 40 ha or even, with a buffer zone, to 156 ha) but has an exceptional record for the number of species of waterfowl and other birds recorded and offers excellent opportunities for biological research and education.

**References**

Leuzinger, H. 1976. Inventar der Schweizer Wasservogelgebiete von internationaler und nationaler Bedeutung. *Orn. Beobacht.* 73: 147–194.

This reference covers the first eleven sites (Nos. 1.1 to 6.3) in the list which follows and is therefore not quoted in full in the Detailed Descriptions.

**WETLANDS OF INTERNATIONAL IMPORTANCE****\*Nominated for inclusion in the Ramsar Convention list****A. Especially as waterfowl habitat**

	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
1.	Bodensee (Lake Constance)	47°28'–41'N	8°52'–9°35'E	53,880 ha	Not assessed, but see below
1.1	Luxburg (Egnach)-Uttwil/ Kesswil shoreline (Thurgau)	47°32'–36'N	9°19'–23'E	7 km shoreline	1a,b,e; 2b; 4a Unprotected
1.2	Uttwil/Kesswil- Münsterlingen/ Bottighofen shoreline (Thurgau)	47°32'–37'N	9°13'–19'E	10 km shoreline	1a,b; 4c Unprotected
1.3	Untersee-ende und Hochrhein/ Biber (Thurgau/ Schaffhausen)	47°37'–43'N	8°49'–55'E	c.450 ha	1a,b,d,e; 2a; 3a,b; 4a,c Partly Protected
1.4	Konstanzer Bucht (Thurgau)	47°38'–40'N	9°11'–13'E	400 ha	1a,b; 2a,3c; 4a,c Shooting prohibited German shore is a Landscape Reserve
1.5	Ermatinger Becken, Untersee (Thurgau)	47°39'–41'N	9°05'–11'E	c.800 ha	1a,b,d,e; 2a; 3a,b,c; 4a,c Protected on German shore only
2.	Lac de Neuchâtel	46°47'– 47°00'N	6°38'–7°04'E	23,930 ha	Not assessed, but see below
*2.1	Fanel Bay and Le Chablais (Neuchâtel, Bern, Vaud)	46°57'–59'N	7°01'–05'E	c.870 ha	1b; 3a, c; 4a Protected
3.	Stausee Klingnau (Aargau)	47°34'N	8°15'E	170 ha	1b; 3a,b,c; 4a Partly protected
4.	Stausee Holderbank (Aargau)	47°25'–28'N	8°08'E	80 ha	1a Unprotected
5.	Stausee Niederried (Bern)	49°59'– 47°00'N	7°14'–16'E	154 ha	1a; 3c Protected (Nature Reserve)
6.	Lac Léman (Genève, Vaud)	46°13'–32'N	6°09'–56'E	58,275 ha	Not assessed, but see below. Some protected areas, e.g. Les Grangettes nature reserve

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	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
6.1	Lakeshore, from Boiron to Aubonne and Fleur d'Eau to Brassu (Celigny) rivermouths	46°29'N 46°22'–27'N	6°24'–29'E 6°13'–20'E	9 km 17 km	1a,b; 3a; 4a Unprotected
6.2	Petit Lac (Genève)	46°13'–18'N	6°09'–16'E	19 km shoreline	1a,b; 3a; 4a No shooting; partly protected (150 ha Nature Reserve)
<b>B. For their limnological interest†</b>					
7.	Märjelsee (Wallis)	46°27'N	8°07'E	c.50–100 ha	Unprotected
8	Lago di Muzzano (Ticino)	46°00'N	8°56'E	24 ha	Protected
9.	Lauerzersee (Schwyz)	47°02'N	8°36'E	310 ha	Partly protected
10.	Walensee (Glarus, St. Gallen)	47°07'N	9°13'E	2,423 ha	Very limited protection
11.	Silsensee (Graubunden)	46°26'N	9°44'E	414 ha	Partly protected
12.	Silvaplannersee (Graubunden)	46°27'N	9°48'E	320 ha	Partly protected
13.	Lago di Ritom (Ticino)	46°32'N	8°41'E	148 ha	Unprotected
14.	Lago di Cadango (Ticino)	46°33'N	8°41'E	10 ha	Unprotected
15.	Lago Tom (Ticino)	46°33'N	8°43'E	26 ha	Unprotected
16.	Lago di Lugano (Ticino) (see Italy site No. 18)	46°01'N	9°02'E	4,890 ha	Partly protected
17.	Hallwilersee (Schwyz)	47°17'N	8°13'E	1,029 ha	Partly protected
18.	Baldeggersee (Luzern)	47°12'N	8°16'E	524 ha	Protected
19.	Vierwaldstättersee (Uri, Schwyz, Unterwalden, Luzern)	46°53'– 47°05'N	8°17'–38'E	11,379 ha	Unprotected
20.	Zürichsee (Zürich, Schwyz, St. Gallen)	47°12'–23'N	8°33'–57'E	8,852 ha	Very limited protection
21.	Lac Brenet (Vaud)	46°08'N	6°20'E	67 ha	Partly protected
22.	Agerisee (Zug)	47°08'N	8°37'E	724 ha	Partly protected
23.	Thunersee (Bern)	46°39'–46'N	7°38'–50'E	4,780 ha	Partly protected
24.	Brienzersee (Bern)	46°43'N	7°57'E	2,918 ha	Partly protected

†Wetland criteria not assessed

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## DETAILS OF LISTED AREAS

### 1. BODENSEE

#### 1.1 Luxburg (Egnach) to Uttwil/Kesswil shoreline

**Criteria for inclusion** 1a,b,e; 2b; 4a

**Geographical location** 47°32'–36'N 9°19'–23'E Southern shore of the Bodensee on either side of Romanshorn, Canton Thurgau.

**Area** About 7 km of shoreline.

**Altitude** 400 m.

**Water depth** Maximum 40 m; average 10 m.

**Wetland type** 18.

**Ecology** Open water but with some reedbeds, especially in the Luxburger Bucht. The water level varies seasonally by a metre or two. A favourable area for migrating and wintering waterfowl, particularly since the great increase in the Zebra Mussel (*Dreissena polymorpha*) population. Since 1969/70 the number of Anatidae frequenting the area in the period from December to March has often exceeded 10,000, the most numerous species being Tufted Duck *Aythya fuligula* (maximum 10,570, December 1973). It is also an important moulting place for Black-necked Grebe *Podiceps nigricollis* (maximum 125, September 1973) and provides some suitable habitats for migrant waders Limicolae.

**Legal status** The only protection given is a ban on shooting in the small harbour of Romanshorn.

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**Tenure** Ownership of the open water is vested in the public authorities; the adjacent shores are mostly privately owned.

**Management practices** None at present, but landscape protection in the Luxburger Bucht would be desirable and throughout the area zones for recreational use and for wildfowl sanctuaries should be demarcated, the shooting ban extended to the latter and enforced, with no access to visitors between mid-July and mid-April.

**Threats** Increasing disturbance by tourists and camping. Drainage and in-filling operations.

**Scientific research** No information.

**Principal reference material**

Jacoby, H., Knötzsch, G. and Schuster, S. 1970. Die Vögel des Bodensee-gebietes. *Orn. Beob.* 67 Beiheft.

Leuzinger, H. 1976 (see Summary).

**1. BODENSEE (continued)**

**1.2 Uttwil Kesswil to Münsterlingen/Bottighofen shoreline**

**Criteria for inclusion** 1a,b; 4c

**Geographical location** 47°32'–36'N 9°19'–23'E Southern shore of Bodensee between Konstanz and Romanshorn, Canton Thurgau.

**Area** About 10 km of shoreline.

**Altitude** 400 m.

**Water depth** Maximum 40 m; average 10 m.

**Wetland type** 18.

**Ecology** Open water along a shore which has relatively few buildings and some natural reed-swamps. The eutrophication has not reached such an advanced stage as elsewhere on the Swiss side of the lake. Important resting place for migrating and wintering waterfowl especially since the increase in Zebra Mussel (*Dreissena polymorpha*) populations, which has led to concentrations of 15,000 or more birds. The most numerous species are Tufted Duck *Aythya fuligula* (maximum 7,620, December 1973) and Pochard *A. ferina* (3,740, October 1970). The area is also known as a regular wintering place for Black-throated Diver *Gavia arctica* and as a refuge for autumnal gatherings of Red-crested Pochard *Netta rufina* (maximum 900, October 1968), following upon the deterioration of the Ermatinger Becken site (No. 1.5 below).

**Legal status** Unprotected.

**Tenure** The open water area is in public ownership, the adjacent shore mostly private.

**Management practices** None off-shore; lakeshore is farmland, consisting mainly of meadows and orchards with a few small settlements and scattered buildings.

**Threats** No specific threats except for the pressure caused by the development of more intensive agriculture and of recreation facilities.

**Scientific research** No information.

**Principal reference material**

Jacoby, H., Knötzsch, G. and Schuster, S. 1970. Die Vögel des Bodensee; gebietes. *Orn. Beob.* 67 Beiheft.

Leuzinger, H. 1976. (See Summary).

**1. BODENSEE (continued)****1.3 Untersee-Ende und Hochrein/Biber**

**Criteria for inclusion** 1a,b,d,e; 2a; 3a,b; 4a,c.

**Geographical location** 47°37'–43'N 8°49'–55'E From Stein-am-Rhein at the western exit of the Untersee upstream to Mammern on the Swiss and Kattenhorn on the German shore, downstream to the confluence of the river Biber and up that river to Bibernmühle/Ramsen, Cantons of Thurgau and Schaffhausen.

**Area** c.450 ha.

**Altitude** 400 m.

**Water depth** Maximum about 8 m; average 3 m.

**Wetland types** 13, 18.

**Ecology** Fresh eutrophic lake, with a strong current through it, and thence down the river; high productivity and large beds of submerged vegetation dominated by stonewort Characeae, naiads Najadetum intermediae and horned pondweed Zannichellietum palustris. The main littoral communities are hair-grass Deschampsietum rhenanae, shore-weed/spike-rush Littorello-Eleocharitetum and reed-swamp. The Rhine outlet from the Bodensee is not yet regulated and remains quite natural, water level varying greatly. The resulting mudflats, gravel bars, sandy islands and shallows constitute an array of biotopes, each with its own specific features, and hence an avifauna rich in species and numbers. The flora is also of great interest, with some rare species such as the scorpion grass *Myosotis rehsteineri*. A notable feature of the great concentrations of waterfowl especially in winter (40,000–50,000 birds in January/February) is the gathering of Goldeneye *Bucephala clangula* (average in January over 5 years 1967/71 was 1,693, the maximum 2,870). The most numerous species are Little Grebe *Tachybaptus ruficollis*, Mallard *Anas platyrhynchos*, Teal *A. crecca*, Tufted Duck *Aythya fuligula* (up to 11,915, February 1974) and Pochard *A. ferina* (up to 13,700, January 1973). The Red-crested Pochard *Netta rufina* is often present during migration in numbers between 100 and 200, flocks of 40 to 70 having stayed to winter since 1972/73 and a few remaining to breed.

**Legal status** Two small nature reserves (Hosen and Insel Ward) have been established near Stein am Rhein and there are several others on the German side dating from 1961.

**Tenure** No information.

**Management practices** None reported but suggestions include: additional reserves in reed-swamps near Eschenz, Grosse Werd and Bibernmühle; a shooting ban in the Eschenz district and thence eastward to the Mammern jetty and also along both banks of the Rhine; and the exclusion of boating from the Eschenzer Bucht and the vicinity of the Werd islands.

**Threats** Water level control in the Bodensee, combined with the dredging of the



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Rhine riverbed, is liable to destroy the food resources of *Bucephala clangula* and other waterfowl.

**Scientific research** The ecology of wintering waterfowl, especially *Bucephala clangula* and *Tachybaptus ruficollis*, has been studied. Some research has been made into the interesting chemical and physical characteristics of the area and, in particular, the biogenesis of the chalk sinter rocks.

### Principal reference material

Leuzinger, H. 1962. Einwirkungen des Polarwinters 1962/63 auf den Bestand des Zwergtauchers in der deutschen Schweiz und im Grenzgebiet am Untersee. *Orn. Beob.* 63: 2–18.

Luther, H. and Rzóška, J. 1971. *Project Aqua* a source book of inland waters proposed for conservation. IBP Handbook No. 21 published for the International Biological Programme by Blackwell Scientific Publications, Oxford and Edinburgh. Pp. 84–85 (numerous limnological papers listed).

Leuzinger, H. 1972. Zur Ökologie der schellente am wichtigsten Überwinterungsplatz des nördlichen Alpenvorlandes. *Orn. Beob.* 69: 207–235.

Leuzinger, H. 1976. (See Summary).

## 1. BODENSEE (continued)

### 1.4 Konstanzer Bucht

**Criteria for inclusion** 1a,b; 2a; 3c; 4a,c.

**Geographical location** 47°38'–40'N 9°11'–13'E The bay to the east of Konstanz as far as Bottighofen on the Swiss shore and the tip of the peninsula on the German side, Canton Thurgau.

**Area** 400 ha.

**Altitude** 400 m.

**Water depth** Maximum 40 m; average 20 m.

**Wetland type** 18

**Ecology** Shallow bay with more or less exposed gravel-banks, depending on water level; normally remains free of ice throughout the winter being close to the Rhine outflow. The flora has a mixture of alpine/boreal-continental features and thermophile sub-Atlantic/sub-Mediterranean features. The bay is one of the most important wintering places of waterfowl in the northern foothills of the Alps, as elsewhere in the Bodensee numbers (up to 38,000 birds) having been built up by the Zebra Mussel (*Dreissena polymorpha*) population explosion. The more numerous species are Little Grebe *Tachybaptus ruficollis*, Cormorant *Phalacrocorax carbo*, Tufted Duck *Aythya fuligula* (maximum 7,000, February 1974), Pochard *A. ferina* (up to 20,000, November 1972) and Goldeneye *Bucephala clangula*. Gadwall *Anas strepera* have been recorded in the past but in smallish numbers (140, December 1969).

**Legal status** Shooting is prohibited on about 200 ha of the Swiss part of the bay and there is a landscape reserve on the German side ("Bodenseeufer", 2,077 ha).

**Tenure** No information.

**Management practices** None reported.

**Threats** The increase of boating, even in winter, has proved to have adverse effects, calling for some solution of the problem of providing for training needs for competitive yachting without causing environmental damage. In-filling or dumping of rubbish in the bay is another menace which should be banned.

**Scientific research** Studies involving phytosociology and ornithology.

**Principal reference material**

Hölzinger, J., Knötzsch, G., Schuster, S. and Westermann, K. 1972. Wetlands (Feuchtgebiete) in Baden-Württemberg mit internationaler and nationaler Bedeutung für Wasservögel. *Anz. orn. Ges. Bayern* 11: 70–110.

Lang, G. 1973. Die Vegetation des westlichen Bodenseegebietes. Pflanzensoziologie Band 17, Gustav Fischer Verlag, Jena.

Leuzinger, H. 1976. (See Summary).

**1. BODENSEE (continued)**

**1.5 Ermatinger Becken, Untersee**

**Criteria for inclusion** 1a,b,d,e; 2a; 3a,b,c; 4a,c.

**Geographical location** Eastern end of the Untersee, including the Wollmatinger Ried and reedbeds of the Reichenauer Damm, on the German side, and the reed-swamp between Ermatingen and Gottlieben on the Swiss side, Canton Thurgau.

**Area** Wollmatinger Ried c.300 ha, open water c.400 ha and reed-swamp along the Swiss shore c.100 ha, total c.800 ha or 500 ha for Swiss list purposes (i.e. excluding Wollmatinger Ried).

**Altitude** 400 m.

**Water depth** Maximum 3 m.

**Wetland type** 18.

**Ecology** Shallow fresh water with plant communities dominated by stoneworts Characeae and naiads Najadetum intermediae. Shining and horned pondweeds Potamogetum lucentis and Zannichellietum palustris are characteristic of the sublittoral zone, shore-weed/spike-rush Littorello-Eleocharitetum and tufted sedge Caricetum elatae of the eu-littoral zone.

This is an important breeding area for Great Crested Grebe *Podiceps cristatus* (100–200 pairs), Black-necked Grebe *P. nigricollis* (20–30 pairs), Red-crested Pochard *Netta rufina* (30–50 pairs), Black-headed Gull *Larus ridibundus* (500 pairs) and Common Tern *Sterna hirundo* (30–50 pairs). It is used by *Netta rufina*, Pochard *Aythya ferina* and various dabbling ducks for moulting and is of great importance for migrant and wintering waterfowl. Before stoneworts *Chara* spp. disappeared from much of the area up to 50,000 duck were recorded in autumn, now only about 15,000 to 20,000, mainly Gadwall *Anas strepera* (2,000, 1972), Teal *A. crecca* (4,000, October 1962), Pochard *Aythya ferina* (11,700, November 1970) and *Netta rufina* (920, October 1972, as against the average of 3,200 in the Octobers of 1957–61). The basin is a good stopping-place for migrant waders Limicolae, especially in autumn, and between 50 and 100 Curlew *Numenius arquata* regularly winter.

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**Legal status** The Wollmatinger Ried Nature Reserve has had legal protection since 1938 and in 1968 was awarded the Europa Reservat Diploma. The open water and Swiss shore are not yet protected.

**Tenure** No information.

**Management practices** Only applied in the Wollmatinger Ried Nature Reserve. Much more needs to be done to check eutrophication. The enlargement of the existing reserve and creation of new nature reserves would be desirable.

**Threats** Water level regulation in the Bodensee, canalization of the Upper Rhine and construction of a commercial harbour at Konstanz would all be serious threats. Open bogs and reed-swamps are endangered by in-filling, urbanization, recreational activities, and the construction of jetties and landing stages. Changes in land use and agricultural practices can also have adverse effects. Hunting pressure is severe and needs to be limited by the associations concerned (the *Gemeinschaftliche Wasserjagd* and *Konstanzer Wasserjagd*).

**Scientific research** Research programmes on ornithology and phytosociology have been undertaken by the 'Anstalt für Bodensee-forschung Konstanz-Staad', 'Vogelwarte Radolfzell', Department of Zoology of the University of Freiburg and the Department of Botany of the *Landessammlungen für Naturkunde in Karlsruhe*, and under the sponsorship of the *Internationale Gewässerschutzkommission für den Bodensee*. There have also been many short term investigations by other institutes and private individuals.

### Principal reference material

Szjij, J. 1965. Ökologische Untersuchungen an Entenvogeln des Ermatinger Beckens. *Vogelwarte* 23: 24–71.

Jacoby, H. Knötzsch, G. and Schuster, S. 1970. Die Vögel des Bodenseegebietes. *Orn. Beob.* 67 Beiheft.

Luther, H. and Rzóška, J. 1971. (See previous description).

Holzinger, J., Knötzsch, G. Schuster, S. and Westermann, K. 1972. Wetlands (Feuchtgebiete) in Baden-Württemberg mit internationaler und nationaler Bedeutung für Wasservögel. *Anz. orn. Ges. Bayern* 11: 70–110.

Lang, G. 1973. *Die Vegetation des westlichen Bodenseegebietes*. Pflanzensoziologie Band 17, Gustav Fischer Verlag, Jena.

Leuzinger, H. 1976. (See general references at end of introductory Summary).

## 2. LAC DE NEUCHÂTEL

### 2.1 Fanel Bay and Le Chablais

**Criteria for inclusion** 1b; 3a,c; 4a.

**Geographical location** 46°57'–59'N 7°01'–05'E The Fanel and Chablais are situated at the eastern end of Lake Neuchâtel between Cudrefin and Zihl kanal, Cantons of Neuchâtel, Bern and Vaud.

**Area** About 870 ha (open water 470 ha, reed-swamp 125 ha, woods and farmland 275 ha).

**Altitude** 430 m.

**Water depth** Up to 3 m.

**Wetland type** 18.

**Ecology** Shallow bay of eutrophic lake with a relatively stable water level. A large part of the surface is covered with reed-swamp, but there is a good variety of habitats, which together with the periodically flooded low-lying and open farmland surrounding the area, make it one of the most attractive in Switzerland. Breeding waterfowl include Great Crested Grebe *Podiceps cristatus* (c.200 pairs), up to 5 pairs of Goosander *Mergus merganser*, Black-headed Gull *Larus ridibundus* (2,000 pairs), two or three pairs each of Herring Gull *Larus argentatus* and Common Gull *L. canus*, and Common Tern *Sterna hirundo* (180 pairs). In winter *Podiceps cristatus* numbers may build up to as high as 5,500 and as many as 180 Cormorants *Phalacrocorax carbo* have been observed. The Fanel is also the only regular wintering ground in Switzerland of the Bean Goose *Anser fabalis* and is a moulting-place for upwards of 330 *Mergus merganser*.

**Legal status** The major part of the area is completely protected by cantonal law under the name of the Réserve de Cudrefin. Small areas are open for recreational purposes, but the use of motorboats is prohibited. The reedbeds are totally protected.

**Tenure** Mostly the property of Cantons Bern and Vaud.

**Management practices** Artificial islands, dams and rafts have been installed to provide nesting and resting places. Additional measures to preserve habitat diversity and prevent increasing encroachment by herbage into open water areas would be desirable, including maintenance of an open shoreline and mudflats to suit the needs of Limicolae. All measures taken should be designed to cause the minimum of disturbance.

**Threats** Lowering of the water level and drainage of the reed-swamps. Water pollution.

**Scientific research** Numbers of breeding and wintering waterfowl are recorded annually.

#### **Principal reference material**

Joss, H. 1969. Aus der Geschichte des Fanel-Reservates. *Orn. Beob.* 66: 55–58.

Manuel, F. *et al.* 1970. Réserve de Cudrefin. Special publication of the 'Commission de la Réserve de Cudrefin', Neuchâtel 1970.

Leuzinger, H. 1976. (See Summary).

### **3. STAUSEE KLINGNAU**

**Criteria for inclusion** 1b; 3a,b,c; 4a.

**Geographical location** 47°34'N 8°15'E Hydroelectric impoundment situated near the confluence of the River Aare and the Rhine, Canton Aargau, 45 km east of Basel.

**Area** 170 ha.

**Altitude** 320 m.

**Water depth** Maximum 9 m; average 3 m.

**Wetland type 15.**

**Ecology** Man-made wetland comprising a storage reservoir with a relatively stable water level (varying by no more than 10 cm). The silt-laden shores are covered by shallow water and only sparse vegetation but there is a rich supply of invertebrates. For example, high oxygen content of the water and the abundant floating detritus of plants provide favourable conditions for great numbers of Chironomid larvae, freshwater shrimps *Gammarus* sp. and *Tubifex* worms. Many waterfowl visit the reservoir on migration and even more (about 5,000 on average and over 10,000 at peak periods) stay to winter. However, due to silting the numbers of Tufted Duck *Aythya fuligula* and Pochard *A. ferina* have considerably declined since the early 1940s. This has been off-set by an increase of dabbling ducks (up to 3,150 Mallard *Anas platyrhynchos*, 1,879 Teal *A. crecca* and 215 Pintail *A. acuta* have been counted). In mid-winter between 250 and 400 Goldeneye *Bucephala clangula* and 80 to 120 Goosander *Mergus merganser* have been recorded. The lake also provides quite a valuable moulting-place for duck and roosting-place for waders and is one of the few breeding places in Switzerland of the Common Tern *Sterna hirundo* (up to 9 pairs recorded).

**Legal status** The Schweizerische Bund für Naturschutz has taken a lease on 83 ha of the water surface and 71 ha of adjacent farmland and woodland in the Klingnau and Leuggern municipalities, so that about 75 percent of the total surface of the impoundment is free from hunting. In July 1970, the citizens of the third commune involved decided against suspending shooting but whether they subsequently changed their minds has not been reported.

**Tenure** The reservoir is the property of Canton Aargau.

**Management practices** Possible changes to its size and shape are under continuous study and if the results suggest that they should be made, it is to be hoped that appropriate management practices will be discussed with and implemented by the hydroelectricity authorities. They could well include measures to check or halt the steady growth of sedimentation and the development of over-luxuriant vegetation. Existing management includes the maintenance of nesting and resting-places on islands in the reservoir.

**Threats** Total protection of the entire reservoir and its surrounding would be desirable. Unrestricted boating presents a threat, particularly during the waterfowl moulting season, and subject to legitimate needs of professional fishermen should be limited to the main channel of the river Aare.

**Scientific research** As indicated in the next section.

**Principal reference material**

Willi, P. 1970. Zugverhalten, Aktivität, Nahrung und Nahrungserwerb auf dem Klingnauer Stausee häufig auftretender Anatiden, insbesondere von Krickente, Tafelente und Reiherente. *Orn. Beob.* 67: 141-217.

Willi, P. 1973. Phänologie der selteren Wasservögel auf dem Klingnauer Stausee. *Orn. Beob.* 70: 27-48.

Leuzinger, H. 1976. (see Summary).

**4. STAUSEE HOLDERBANK**

**Criteria for inclusion 1a.**

**Geographical location** 47°25'–28'N 8°08'E Hydroelectric impoundment on Aare river between Aarau and Brugg. The important area is located between the bridge over the Aa tributary near Wildegg and the barrage 6 km downstream near Schinznach-Bad, Canton Aargau, 28 km west-north-west of Zürich.

**Area** c.80 ha.

**Altitude** 350 m.

**Water depth** Maximum 9 m; average 5 m.

**Wetland type** 15.

**Ecology** A man-made wetland comprising a small storage reservoir which has not significantly enlarged the river channel. The water level is relatively stable. It is used by a remarkable diversity and abundance of migrating and wintering waterfowl, the most numerous species being Tufted Duck *Aythya fuligula* (highest count 3,986 in January 1960) and Pochard *A. ferina* (averaging 1,300, with a maximum of 3,360, in January counts of the years 1967/71).

**Legal status** Unprotected.

**Tenure** The reservoir is owned by the Canton Aargau.

**Management practices** None at present.

**Scientific research** Ornithological data are collected regularly.

**Principal reference material**

Frey, W. and Baltzer, W. 1970. Die Vogelwelt in Aarestau Holderbank 1952–1968. *Die Vögel der Heimat* 40: 138–149.

Leuzinger, H. 1976. (See Summary).

## 5. STAUSEE NIEDERRIED

**Criteria for inclusion** 1a; 3c.

**Geographical location** 46°59'–47°00'N 7°14'–16'E Hydroelectric impoundment just below the confluence of the Rivers Aare and Saane, about 13 km west-north-west of Bern and in the Bern Canton.

**Area** 154 ha.

**Altitude** 464 m.

**Water depth** Maximum 6–8 m; average 4 m. The water level rises c.0.6 m in winter.

**Wetland type** 15.

**Ecology** A water-storage reservoir built about 60 years ago and now bordered by some quite extensive reed-swamps and willow thickets. One of the marshes backed by a high sandstone cliff is scenically attractive and provides suitable nesting sites not only for waterfowl but also for birds of prey and a pair or two of Ravens *Corvus corax*. Large numbers of waterfowl winter from January to March (ranging from an average of 5,000 to a maximum of 8,500). Pochard *Aythya ferina* are particularly numerous (averaging 2,260 in January of the years 1967/71, maximum 4,492), followed by Tufted Duck *A. fuligula* (average 1,625, maximum 5,066),

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Mallard *Anas platyrhynchos*, Teal *A. crecca* and Little Grebe *Tachybaptus ruficollis* (average 110, maximum 185).

**Legal status** Shooting has been prohibited since 1956, the area being formally established as a Nature Reserve in 1966. The use of boats is restricted from 1 December to 31 March. A Cantonal reserve in the vicinity, known as the 'Otigenau', also provides habitat protection although hunting is allowed.

**Tenure** Most of the area belongs to the Bernische Kraftwerke (BKW), the remainder being in private ownership.

**Management practices** As indicated under Legal Status.

**Scientific research** The wintering waterfowl population is carefully monitored.

**Principal reference material**

Leuzinger, H. 1976. (See Summary).

**6. LAC LEMAN (Lake of Geneva)**

**6.1. Lakeshores between Boiron and Aubonne rivermouths and between Fleur d'Eau (Rolle) and Brassu (Celigny) rivermouths**

**Criteria for inclusion** 1a,b; 3a; 4a.

**Geographical location** a) 46°29'N 6°29'E b) 46°22'–27'N 6°13'–20'E Part of the north-western shore of the lake between Morges and Coppet, Canton Vaud.

**Area** Two sectors: a) from the mouth of the Boiron to the mouth of the Aubonne: about 9 km; b) from Fleur d'Eau (between Rolle and Bursinel) to the mouth of the Brassu stream near Celigny: about 17 km.

**Altitude** 327 m.

**Water depth** Nil to maximum of 30 m; average 3–9 m.

**Wetland type** 18.

**Ecology** The whole of Lac Léman is important for migrating and wintering waterfowl, particularly grebes Podicipitidae (including many moulting Black-necked Grebes *Podiceps nigricollis*) and diving ducks. Depending on conditions (wind, disturbance, food-availability) the birds move readily from one place to another or from foreshore out into the lake; but the two stretches of shore specified under Area are the ones most likely to harbour large concentrations. Thus sector (a) held a maximum of 11,473 waterfowl and sector (b) a maximum of 32,190, in January 1968, the latter figure including 20,150 Tufted Duck *Aythya fuligula* and large numbers of Little Grebe *Tachybaptus ruficollis*, Black-necked Grebe *Podiceps nigricollis*, Pochard *Aythya ferina* and Goldeneye *Bucephala clangula*. The shoreline of these sectors is more or less unspoiled, houses and gardens are scattered and the only densely built-up area, yachts and other boats are confined to the bay of Nyon.

**Legal status** Unprotected.

**Tenure** The open water belongs to the public authorities; the shores are mostly privately owned.

**Management practices** None.

**Threats** Disturbance, urban spread, for example around La Dullive below Gland,

and construction of more boat harbours; also generally throughout the lake, eutrophication, industrial and urban pollution and over-fishing.

**Scientific research** A number of studies of the flora, birds, fish and limnology of the lake have been undertaken.

**Principal reference material**

Leuzinger, H. 1976. (See Summary).

## 6. LAC LEMAN (continued)

### 6.2 Petit Lac

**Criteria for inclusion** 1a,b; 3a; 4a.

**Geographical location** 46°13'–18'N 6°09'–16'E Geneva end of Lac Léman, south of a line from Versoix rivermouth to Hermance on the south-western shore near the French border, Canton Genève.

**Area** Two sectors: on the western or right-hand shore from mouth of the river Versoix to Pointe de Sécheron, Genève: about 7 km; b) on left-hand shore from Hermance to Port Noir, Genève: about 12 km.

**Altitude** 372 m.

**Water depth** Nil to a maximum of 12 m.

**Wetland type** 18.

**Ecology** (See also previous description of site 6.1). The bottom of the lake consists of gravel and limestone. The only small reedbeds and undeveloped shore are round the Pointe-à-la Bise near Collonge, most of the rest being taken up by housing, public and private gardens and jetties. Nonetheless, large numbers of wintering and migrating waterfowl, especially diving ducks and grebes, tend to concentrate almost anywhere just off-shore, although the biggest flocks are normally found along the western or right-hand shore of the Petit Lac, where in January 1973 no less than 18,545 birds were counted. Species included Little Grebe *Tachybaptus ruficollis*, Black-necked Grebe *Podiceps nigricollis*, Tufted Duck *Aythya fuligula*, Pochard *A. ferina* and Goldeneye *Bucephala clangula*.

**Legal status** Since 1974/75 shooting is no longer permitted within the boundaries of Canton Genève. A Nature Reserve of 150 ha has been established at Pointe-à-la-Bise.

**Tenure** The open water belongs to the public authorities; the shores are mostly privately owned.

**Threats** Frequent disturbance by boats is the only serious threat.

**Scientific research** None reported.

**Principal reference material**

Géroudet, P. 1969. Enfin la réserve de la Pointe-à-la-Bise est mieux protégée. *Nos Oiseaux* 30: 73.

Leuzinger, H. 1976. (See Summary).



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7. MÄRJELENSEE

**Criteria for inclusion** Not assessed.

**Geographical location** 46°27'N 8°07'E East of the Aletsch Glacier and about 13 km north-east of Brig, Canton Wallis (Valais).

**Area** Variable (see under Ecology) but usually 50–100 ha.

**Altitude** 2,300 m.

**Water depth** Variable.

**Wetland type** 19.

**Ecology** This lake has been formed by a glacial barrier (the Aletsch Glacier) which impounds a small tributary of the Rhône. It is the only large natural glacial lake in Central Europe, and is characterized by extremes of temperature and nutrient status. Its size and depth constantly vary according to the effectiveness of the ice barrier.

**Legal status** Legal protection of the site has been advocated but not yet implemented.

**Tenure** Ownership is vested in the Canton.

**Management practices** None.

**Threats** Possible use of the lake for generating hydro-electric power; increased tourism.

**Scientific research** Some limnological studies have been undertaken.

**Principal reference material**

Luetschg, O. 1915. Der Märjelensee und seine Abflussverhältnisse. *Ann. schweiz. Landeshydr.* I.

von Srbik, R. 1942. Vom Aletschgletscher und vom Märjelensee. *Die Alpen* 18: 285.

8. LAGO DI MUZZANO

**Criteria for inclusion** Not assessed.

**Geographical location** 46°00'N 8°56'E Less than 3 km to the south-west of Lugano, Canton Ticino (Tessin).

**Area** 24 ha.

**Altitude** 337 m.

**Water depth** Maximum 3 m; mean 2.3 m.

**Wetland type** 18.

**Ecology** Morainic lake enclosed by lateral moraines originally derived from the Adula and other Ticino glaciers. Already small in size, it is in the process of being in-filled by natural sedimentation. The only known site in Switzerland in which the water chestnut *Trapa natans* is found, of a variety distinguished by the name *muzzanensis*. The water is highly eutrophic.

**Legal status** Protected by the Schweizerische Bund für Naturschutz.

**Management practices** The lake is used for recreational purposes and as a drainage channel for waste waters.

**Threats** None reported, though the sedimentation and uses mentioned above are likely to have adverse effects in the long term.

**Scientific research** A few limnological studies have been undertaken.

**Principal reference material**

Amberg, O. 1903. Biologische Notiz über den Lago de Muzzano. *Forschungs. Biol. Station Plön*, 10.

## 9. LAUERZERSEE

**Criteria for inclusion** Not assessed.

**Geographical location** 47°02'N 8°36'E North of the eastern end of the Lake of Lucerne, Vierwaldstättersee (Site No. 19), about 3 km west of Schwyz, in the Canton of that name.

**Area** 310 ha.

**Altitude** 447 m.

**Water depth** Maximum 13 m; mean 7 m.

**Wetland type** 20.

**Ecology** A mesotrophic lake basin impounded by a rock fall. The surrounding area is bog and is of considerable botanical interest.

**Legal status** Some protective measures have been applied to the site, but have not been specified.

**Tenure** Owned by Canton Schwyz.

**Management practices** Used for recreational purposes.

**Threats** None reported.

**Scientific research** Despite its considerable limnological interest, only a few studies of this site have been published.

**Principal reference material**

Pitard, E. 1897. Sur le plancton du lac de Lowerz. *Arch. Sci. Phys. Nat.* 3,4.

Odermatt, J. M. 1969. Limnologische Charakterisierung des Lauerzersees. *Schweiz. Z. Hydrol.* 32: 1-75.

## 10. WALENSEE

**Criteria for inclusion** Not assessed.

**Geographical location** 47°07'N 9°13'E Extending westwards from the immediate vicinity of Walenstadt and about 70 km east-south-east of Zürich; most of the lake is in Canton St. Gallen but the western half of the southern shore belongs to Canton Glarus.

**Area** 2,423 ha.

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**Altitude** 419 m.

**Water depth** Maximum 151 m; mean 103 m.

**Wetland type** 19.

**Ecology** A deep oligotrophic lake formed in an old valley which was crossed and deepened by one branch of the Rhine glacier. It was originally connected to the Zürich See but is now separated and impounded by boulder and gravel deposits from the Rhine and the river Linth.

**Legal status** Some very limited measures for plant protection have been taken by the St. Gallen authorities on the northern shore, but the site is otherwise totally unprotected.

**Tenure** Ownership shared by the two Cantons in which the lake is situated.

**Management practices** Used for recreation and fishing; the banks are largely occupied by homesteads.

**Threats** Water quality is threatened by increasing discharge of industrial and domestic effluents into the lake; intensive development of tourism is another disturbing factor.

**Scientific research** Chemo-physical and biological investigations have been undertaken.

**Principal reference material**

Huber-Pestalozzi, G. 1946. Der Walensee und sein Plankton. *Schweiz. Z. Hydrol.* 10/11, 2/3: 123.

Dietlicher, K. 1974. Die Wassergüte des Zürich- und Walensees. *Gass-Wasser-Abwasser* 54: 553–592.

## 11. SILSERSEE

**Criteria for inclusion** Not assessed.

**Geographical location** 46°26'N 9°44'E The most distant of the three large lakes in the valley running south-west from St. Moritz, Canton Graubunden, and c. 10 km from the town.

**Area** 414 ha.

**Altitude** 1,797 m.

**Water depth** Maximum 71 m; mean 34.54 m.

**Wetland type** 19.

**Ecology** A large very markedly oligotrophic alpine lake and as such of great limnological interest. It occupies a glacier-eroded basin, being impounded and bordered by gravel banks brought down from the mountains by streams.

**Legal status** Some unspecified measures have been applied by the local Communes to this lake and its surroundings, including the neighbouring Silverplanersee (No. 12 on the list).

**Tenure** Owned by Canton Graubunden.

**Management practices** Provision for recreational activities.

**Threats** Use of water for generating electricity; destruction of the natural shoreline by increasing lakeside settlement; and eutrophication caused by nutrients in the growing amount of waste discharged into the lake.

**Scientific research** A considerable number of papers have been published although no regular series of limnological studies have been undertaken.

**Principal reference material**

Bosli-Pavoni, M. 1971. Ergebnisse der limnologischen Untersuchungen der Oberegadiner Seen. *Schweiz Z. Hydrol.* 33: 386–409.

### 13. LAGO DI RITOM

**Criteria for inclusion** Not assessed.

**Geographical location** 46°32'N 8°41'E About 9 km east of Airolo at the foot of the St Gotthard pass, Canton Ticino (Tessin).

**Area** 148 ha.

**Altitude** 1,850 m.

**Water depth** Maximum 69 m.

**Wetland type** 20.

**Ecology** A meromictic lake formed within a local glacial erosion channel, which has become dammed. It is of considerable limnological interest because of the presence of sulphur bacteria *Chromatium okenii* and *Vibrio desulfuricans*. The development of these is probably favoured by the presence of gypsum-bearing rocks in the lake basin.

**Legal status** Unprotected.

**Tenure** Owned by Canton Ticino.

**Management practices** Concerned only with development of tourism.

**Threats** Possible use for hydro-electric power generation.

**Scientific research** Dating back to 1917, but recently (1973/75) a more thorough investigation of the lake has been carried out under the auspices of Bern University. A number of new publications, particularly on the lake's biology and chemistry, has consequently been added to the list of earlier ones, published in Project AQUA (Luther & Rzóska 1971) and from which the references in the following section have been selected; but no details have been received.

**Principal reference material**

Collet, L. W. and Mellet, R. 1919. Les eaux du lac Ritom. *Bull. Soc. Vaudoise Sci. Nat.* 51: 104.

Borner, L. 1920. Die Crustaceen-fauna des Ritomsees und seines Delta. *Festschr. Zschokke.*

Dueggeli, M. 1924. Bakteriologische Untersuchungen am Ritomsee. *Schweiz. Z. Hydrol.* 2: 65.

Borner, L. 1928. Die Bodenfauna des Ritomsees und seines Deltas vor der Absenkung. *Schweiz. Z. Hydrol.* 4 H.1/2: 121–162; 4 H.3/4: 1–30 (Festschr. Zschokke).

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## 17. HALLWILERSEE

**Criteria for inclusion** Not assessed.

**Geographical location** 47°17'N 8°13'E To the immediate east of Reinach, c.25 km north of Luzern, in Cantons Luzern and Aargau.

**Area** 1,029 ha.

**Altitude** 449 m.

**Water depth** Maximum 48 m; mean 20.6 m.

**Wetland type** 18.

**Ecology** A lake which is now highly eutrophic due to the effects of domestic sewage effluent. This sewage is at present collected in a ring main, treated in a filter-plant shared by several towns and villages, and then discharged into the lake. The chemical and physical changes resulting from this process are of limnological interest.

**Legal status** Some parts of the lake are protected by the Canton Aargau authorities.

**Tenure** The lake is owned by the Cantons in which it is situated.

**Management practices** The lake is used for recreational purposes and there is also some commercial fishing.

**Threats** Pressures exercised by increased urbanization of the shoreline and the development of tourism.

**Scientific research** This lake has been thoroughly investigated; the two most recent of the references mentioned in the Project AQUA volume (Luther & Rzóska 1971) are given in the next section.

### Principal reference material

Ambühl, H. 1960. Die Nährstoffzufuhr zum Hallwilersee. *Schweiz. Z. Hydrol.* 22: 563–597.

Bachofen, R. 1960. Stoffhaushalt und Sedimentation im Baldegger- und Hallwilersee. Diss. Univ. Zurich.

## 18. BALDEGGERSEE

**Criteria for inclusion** Not assessed.

**Geographical location** 47°12'N 8°16'E To the south of the Hallwilersee (site No. 17) and therefore closer (c.15 km) to Luzern, in the Canton of that name.

**Area** 524 ha.

**Altitude** 463 m.

**Water depth** Maximum 66 m; mean 34 m.

**Wetland type** 18.

**Ecology** A glacial lake basin formed by erosion and impounded by glacial moraines left by the Reuss glacier during the Würm period. The water is highly eutrophic but plans had been completed by 1970 to deal with this eutrophication

and if and to the extent that they have been implemented should have produced changes that would be of great limnological interest. Unfortunately no details of the outcome have yet been received.

**Legal status** The total lake surface is protected by the Schweiz Bund für Naturschutz.

**Tenure** Owned by the Schweiz Bund für Naturschutz.

**Management practices** The lake is used as a receptacle for domestic sewage, as indicated by its very eutrophic water, but a commercial fishery still operates.

**Threats** Unchecked eutrophication.

**Scientific research** Many limnological studies have been undertaken and monitoring has continued though no details are available. PO<sub>4</sub>-P increased at a rate of 7.8% per annum in the period 1958–1974.

#### Principal reference material

Birrer, A. and Adam, F. 1943. Biologisch-chemische Studie am Baldeggersee. *Mitt. naturf. Ges. Luzern* L4: 21–98.

### 19. VIERWALDSTÄTTERSEE (Lake of Lucerne)

**Criteria for inclusion** Not assessed.

**Geographical location** 46°53'–47°05'N 8°38'E Extending to the east of Luzern, with numerous arms and bays, for a maximum distance of c.50 km, in Cantons Luzern, Unterwalden, Uri and Schwyz.

**Area** 11,379 ha.

**Altitude** 434 m.

**Water depth** Maximum 214 m; mean 104 m.

**Wetland types** 18, 19, 20.

**Ecology** A lake consisting of a number of separate basins carved out by ice of the Reuss glacier system. Although now linked as a single water-body, the basins are in fact partially separated from each other by underwater moraines. The whole complex is deeply incised in what are now the Alpine foothills and its limnological interest lies in the fact that the different lake basins vary in character from oligotrophic to mesotrophic, the circulation of matter being limited by the basin morphology. Sewage has an important influence locally and changes in trophic degree are observable in several places.

**Legal status** Unprotected but proposals for creating reserves or applying controls in various parts of the lake complex may have been partly implemented, though no details are available.

**Tenure** Ownership is vested in the Cantons in which the lake is situated.

**Management practices** Only those connected with the use of the lake for fishing, recreation and sewage disposal.

**Threats** Increasing urbanization and consequent eutrophication by domestic and industrial effluents.

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**Scientific research** Mainly undertaken under the auspices of the Swiss Federal Institute for water research and water pollution control.

**Principal reference material** A large number of publications were listed in the Project AQUA volume (Luther & Rzóska 1971), the most recent of them dated 1968. Three more recent ones are:-

Stadelmann, P. 1971. Stickstoffkreislauf und Primärproduktion im Vierwaldstättersee und im Rotsee. *Schweiz. Z. Hydrol.* 33: 1-65.

Bloesch, J. 1974. Sedimentation und Phosphorhaushalt im Vierwaldstättersee und Rotsee. *Schweiz Z. Hydrol.* 36: 73-181.

Ambühl, H. 1975. Forschung am Vierwaldstättersee und die jüngste Entwicklung schweizerischer Seen. *Gas-Wasser-Abwasser* 55: 5-15.

## 20. ZÜRICHSEE

**Criteria for inclusion** Not assessed.

**Geographical location** 47°12'-23'N 8°33'-57'E Stretching south and east of the city of Zürich for a distance of c.40 km, in Cantons Zürich, Schwyz and St. Gallen.

**Area** 8,852 ha.

**Altitude** 406 m.

**Water depth** Maximum 143 m; mean 44 m.

**Wetland types** 18, 20.

**Ecology** Situated in a glacial erosion trough and impounded by a terminal moraine, supplemented by gravel deposits brought down by the River Sihl, this lake has also been deepened by tectonic movements. It is now eutrophic to mesotrophic in character, having had a rapid development from its formerly oligotrophic state. This change has been largely attributable to the ever greater influx of population and industry into the surrounding countryside.

**Legal status** A small area around Pfäffikon, in Canton Schwyz on the south bank opposite Rapperswil, is the only area which has any protection.

**Tenure** Ownership is vested in the Cantons in which the lake is situated.

**Management practices** Only those connected with the use of the lake to supply drinking water and for fishing, recreation and sewage disposal.

**Threats** Increasing pollution by domestic and industrial sewage and algal growth on the shores, which may well make the lake unusable as a source for drinking water.

**Scientific research** One of the most intensively investigated lakes in the world. The development and changes in its chemistry, biology and sedimentation have been monitored in great detail.

**Principal reference material** A large number of studies of the Zürichsee have been published, a dozen of the 46 then traced being listed in the Project AQUA volume (Luther & Rzóska 1971). Three of the more recent are:-

Thomas, E. A. 1971. Oligotrophierung des Zürichsees. *Viertj. Naturf. Ges. Zürich* 109: 103-142.

Thomas, E. A. 1973. Phosphorus and Eutrophication. *Env. Phosph. Handbook* 585–611.

Zimmermann, U. 1975. Limnologische Untersuchungen am Trinkwasser-speicher Zürichsee. *Gas-Wasser-Abwasser* 55: 472–480.

## 21. LAC BRENET

**Criteria for inclusion** Not assessed.

**Geographical location** 46°41'N 6°20'E Just to the north-east of the Lac de Joux and 6 km south-west of Vallorbe in Canton Vaud.

**Area** 67 ha.

**Altitude** 1,005 m.

**Water depth** Maximum 20 m.

**Wetland type** 19.

**Ecology** An oligotrophic mountain lake lying in a synclinal valley and separated from the very much larger Lac de Joux by a lowering of water levels. It is a typical lake of the Jura region, being fed by an underground river, the Orbe, which reappears as a spring on the lake surface although its main stream does not emerge until a short distance above Vallorbe. The surroundings of Lac Brenet include a small area of marshy ground, with an interesting flora and avifauna.

**Legal status** The surrounding bog is partly protected and total protection for the lake has long been advocated and may by now have been accorded.

**Tenure** Owned by the Canton.

**Management practices** Connected only with the use of the lake for recreation, fishing and drinking water supply.

**Threats** Excessive extraction of water for human consumption would change the natural hydrographic conditions. The siting of one or two homesteads and a camping site close to the lakeshore could give rise to disturbances, including an increased flow of nutrients into the lake and gradual eutrophication, which could totally destroy its character and the landscape generally.

**Scientific research** The chemistry and biology of the lake have been studied in some detail, but most of the relevant publications date back to the 1890s.

### Principal reference material

Bosset, E. 1962. Le Lac de Joux. Etude hydrologique du bassin, recherche de mai 1953 à avril 1957. *Schweiz Z. Hydrol.* 24(1): 90–151.

## 22. AGERISEE

**Criteria for inclusion** Not assessed.

**Geographical location** 47°08'N 8°37'E About 26 km slightly east of due south of Zürich and less than 10 km north of Schwyz, in Canton Zug.

**Area** 724 ha.

**Altitude** 724 m.



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**Water depth** Maximum 82 m; mean 49.3 m.

**Wetland type** 19.

**Ecology** A small lake in the Alpine foothills lying in a valley formed by the Reuss glacier. The retreating glacier left a terminal moraine, behind which a lake considerably bigger than the present one was formed. A mountain stream flowing into the lake eventually, by creating a delta, divided it into two. The stream continued to flow into the lower section of the lake and the outflow finally carved through the terminal moraine. Thus the present Agerisee is in fact only the upper part of what was once a much larger lake. Its waters are still oligotrophic but there is a danger of increasing eutrophication.

**Legal status** The lake itself is unprotected but motor-boating is prohibited and some areas along the shore have been given protection.

**Tenure** Owned by Canton Zug.

**Management practices** The lake is much used for recreation. Until recently domestic sewage was disposed of directly into the lake but a treatment plant has now been installed.

**Threats** Growth in the numbers of homesteads and holiday chalets around the shores, has led to an increasing risk of eutrophication.

**Scientific research** Most of the studies undertaken (the earliest in the 1900s but most of them much more recently) have dealt with chemical and limnological topics.

**Principal reference material**

Eschmann, H. 1963. Berichte über die Untersuchungen des Zuger und Agerisees zuhanden der Konkordatskommission 1960 und 1961. 1962: *Petri Heil* 2.

Eschmann, H. 1964. Das Wasser des Zuger und Agerisees und seine Eignung zur Trinkwasserbereitung. *Monatsbulletin SVGW*. 44: 9–14, 38–44.

**23. THUNERSEE**

**Criteria for inclusion** Not assessed.

**Geographical location** 46°39'–46°N 7°38'–50'E Extending south and east of Thun (25 km south-east of Bern) for a distance of nearly 20 km, entirely within Canton Bern.

**Area** 4,780 ha.

**Altitude** 558 m.

**Water depth** Maximum 217 m; mean 135 m.

**Wetland types** 19, 20.

**Ecology** This lake has oligotrophic to mesotrophic waters and, together with nearby Brienersee (Site No. 24) and more distant Walensee (Site 10), is among the cleanest lakes in the alpine foothills. Much of its water in summer flows down from the Brienersee and is therefore considerably warmer, forming a deep epilimnion with which the productive layer does not coincide. The lake valley is particularly deep, due to a combination of tectonic movement and the presence of a terminal moraine derived from the Aare Glacier.

**Legal status** The shoreline around the upper end of the lake is protected.

**Tenure** Owned by Canton Bern but the protected shores at the upper end are the property of Thunersee/Brienzersee Uferschutzverband (Shore Protection Society).

**Management practices** Some abstraction of drinking water; otherwise connected with fishing and recreational activities. A special drainage channel for carrying waste water assists the purification process.

**Threats** Increased shoreline settlement could lead to increasing eutrophication.

**Scientific research** One of the earliest studies (of the water temperature) dates back to 1820 and a considerable amount of work has been done in more recent times on the biology, ecology and physiology of the lake.

#### **Principal reference material**

Luther, H. and Rzóska, J. 1971. *Project AQUA* a source book of inland waters proposed for conservation. IBP Handbook No. 21. Published for the International Biological Programme by Blackwell Scientific Publications, Oxford and Edinburgh. Pp. 79–80 (includes several references).

## **24. BRIENZERSEE**

**Criteria for inclusion** Not assessed.

**Geographical location** 46°43'N 7°57'E Extending from a point 2 km upstream from Interlaken in a north-easterly direction to just beyond Brienz, a total distance of 15 km and all within Canton Bern.

**Area** 2,918 ha.

**Altitude** 564 m.

**Water depth** Maximum 261 m; mean 176 m.

**Wetland type** 19.

**Ecology** In the same valley as the Thunersee (Site 23) and separated from it only by the gravel deposits brought down by the river Lütschine. The valley is that carved out by the river Aare and its ancient glaciers but is particularly deep because of tectonic movements. The water is oligotrophic with primary production limited by the turbidity of much of the inflowing water, which is derived from the existing glaciers of the Finsteraarhorn and Grimsel around the source of the Aare.

**Legal status** For some years the only protected area was round the Giessbach falls (due to their association with Sherlock Holmes), but it was hoped that the whole of the southern shoreline would eventually be protected. To what extent this has been achieved has not been reported.

**Tenure** Owned by Canton Bern.

**Management practices** Connected only with the use of the lake for fishing and recreational purposes.

**Threats** Considerable danger of eutrophication from domestic sewage and run-off from farmlands which may be polluted by fertilizers or toxic chemicals.

**Scientific research** Many of the studies undertaken have dealt jointly with Brien-

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zersee and Thunersee. The older ones are listed in the Project AQUA volume (Luther and Rzóska 1971) and from them two are selected and a third added in the next section.

**Principal reference material**

Hofer, F. 1952. Ueber die Energieverhältnisse des Brienersees. *Beitr. z. Geol. d. Schweiz-Hydrologie* No. 7.

Hydegger, P. 1957. Vergleichende limnologische Untersuchungen an sieben Schweizer Seen. *Beitr. z. Geol. d. Schweiz -Hydrologie* No. 9.

Matter, A. *et al.* 1973. Reflexionsseismische Untersuchungen des Brienersees. *Ecologiae Geol. Helv.* 66: 71–82.

# SYRIA

## SUMMARY OF WETLAND SITUATION

The Jebel el Ansariye, at its highest point 1,385 m above the sea, separates the coastal strip and its temperate and humid climate from the dry steppe and open desert country of the greater part of eastern Syria, where a marked continental climate prevails, with high summer temperatures and relatively cold winters (many nights with frost). Rainfall is fairly regular in the west but the average annual precipitation in the country as a whole is under 250 mm. Cultivation tends to be concentrated in the coastal strip and along the banks of the Euphrates and its tributaries in the north-east. A major dam, work on which started in 1968, will greatly increase the irrigated area in the valley, the Bahret Assad Lake thus created, about 70 km west of El Raqqa, covering about 63,000 ha.

There can be little doubt that the Euphrates valley running here north-west to south-east provides a favourable route for migrating waterfowl but information from the area is scarce. Old channels of the river offer suitable feeding and roosting areas, and are frequented by Mallard *Anas platyrhynchos*, Tufted Duck *Aythya fuligula*, Pochard *A. ferina* and Coot *Fulica atra*, but none of them apparently reach very high densities. Along the eastern foot of the Jebel el Ansariye, the course of the Asi (Orontes) river meanders through a flat valley and winter flooding occurs regularly. But in summer only some marshes with stagnant pools are left and even these are said for the most part to have been drained in recent years, though precise information is lacking. Still further east there are several shallow basins fed by the small streams which run down from the hilltops in winter. The pools thus formed tend to dry out in summer or turn into disconnected salt lakes. The city of Aleppo is in one such basin and the Sabkat al Jabboul to its south-east, which has become a large shallow salt-lake, seems to be a wintering area for White-fronted Goose *Anser albifrons* (2,000, December 1972) Greater Flamingo *Phoenicopterus ruber* (1,600, December 1971) and the Crane *Grus grus* (155, December 1972).

Finally, four sites were nominated by the Government for Project AQUA rating, as of limnological interest, two in the Orontes valley, one in the north-east near the Iraq border and the fourth in the extreme south-west in the vicinity of Der'a, but there is insufficient information to assess their international importance.

### References

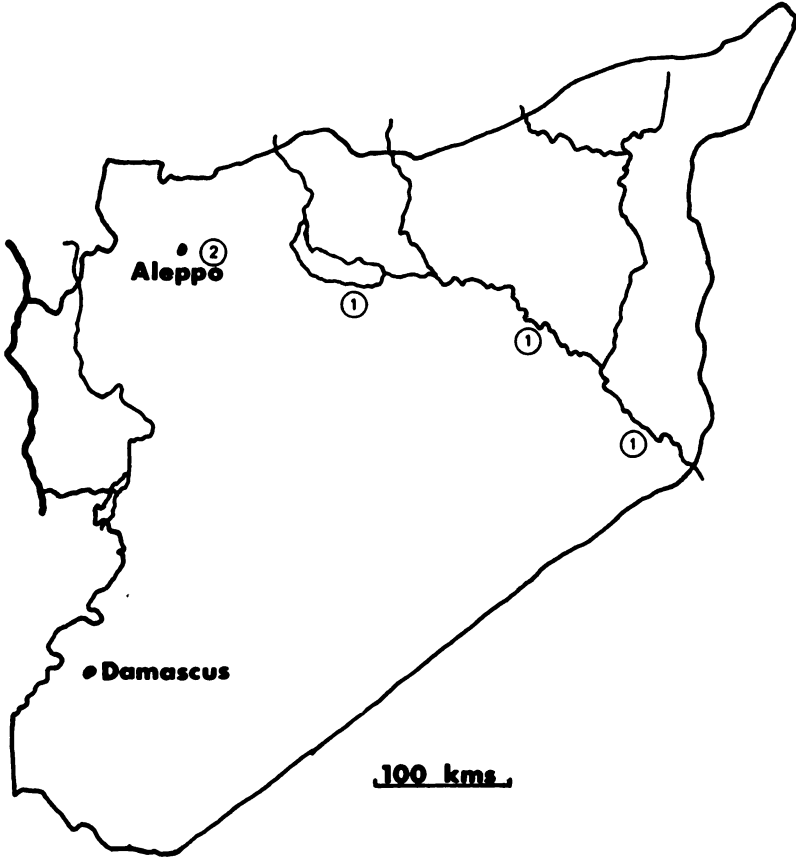
- Dijksen, L. J. and Koning, F. J. 1972. Report in I.W.R.B. Mission to Syria, December 1971. *I.W.R.B. Bulletin* 33: 34-37.
- Koning, F. J. and Dijksen, L. J. 1973. Report on I.W.R.B. Mission to Iraq and Syria, December 1972. *I.W.R.B. Bulletin* 35: 62.

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**WETLANDS OF INTERNATIONAL IMPORTANCE**

	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
1.	Euphrates River valley	34°29'– 36°49'N	38°02'– 40°56'E	over c.500 km in length	1a(?),e; 2a,b Unprotected
2.	Sabkat al Jabboul	36°05'N	37°30'E	maximum c.37,500 ha	1a,e; 2a,b; 3c(?) Unprotected

**SYRIA**



# TUNISIA

## SUMMARY OF WETLAND SITUATION

The wetlands of Tunisia are of outstanding importance to huge numbers of migrating and wintering waterfowl. Numbers present in winter can increase considerably when severe cold spells affect the northern parts of the Mediterranean.

The Garaet Ichkeul to the south-west of Bizerte is comparable in importance to the Camargue in France and the Marismas del Guadalquivir in Spain. The group of wetlands in the vicinity of Tunis (Lac de Tunis, Sebkhet Ariana, Sebkhet es Sedjoui) is also extremely rich in waterfowl. The salt lakes in several parts of the country provide favourable habitat for large numbers of flamingos *Phoenicopterus ruber* and, in some years, depending on the amount of winter rainfall, they find conditions suitable for nesting in one or more of four sites – Sebkhet Sidi el Hani, Chott el Fedjadj, Sebkhet el Hamma and Chot Djerid.

Two rare and declining species which are regularly observed on certain Tunisian wetlands (notably the Lac de Tunis and Sebkhet el Djem) are the Marbled Teal *Anas angustirostris* and the White-headed Duck *Oxyura leucocephala*.

The Kneis Islands, off the coast half-way between Sfax and Gabès, and the coast itself are in the only area of the Western Mediterranean which is markedly tidal and as such of great importance as a feeding, roosting and breeding place for waders Limicolae and for gulls and terns Laridae.

Tunisia acceded to the Ramsar Convention on 26 June 1980 and the Garaet Ichkeul (or Garat-el-Ichkeul) is reported to have been nominated for the Convention list.

## WETLANDS OF INTERNATIONAL IMPORTANCE

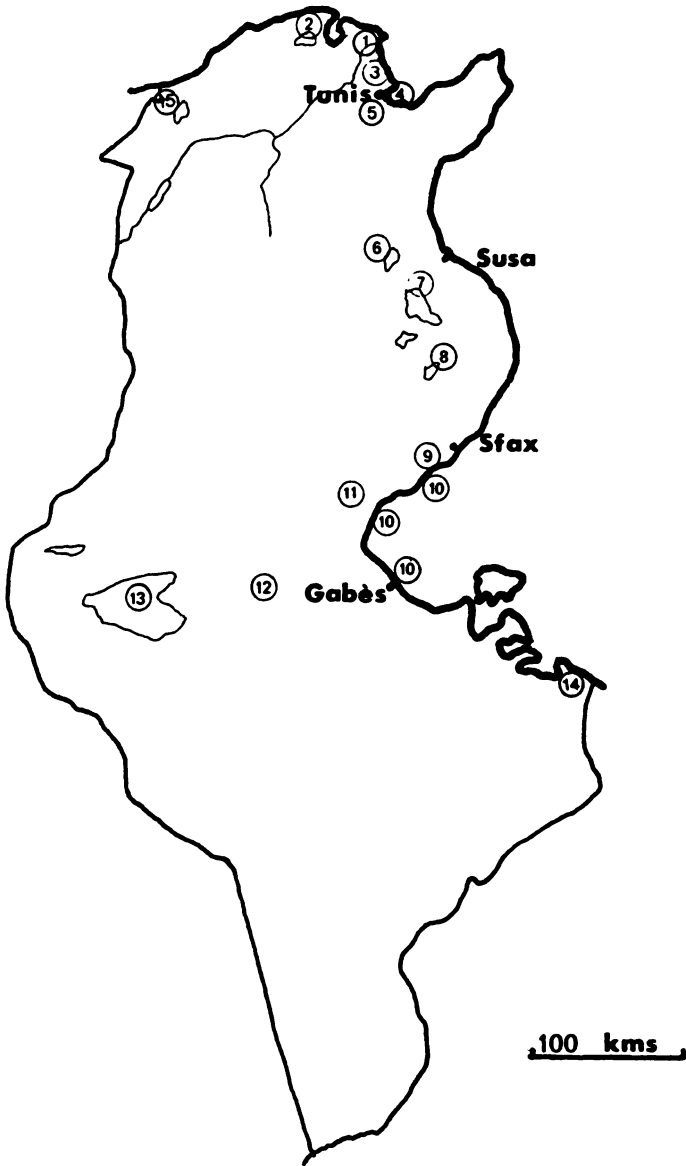
### \*Nominated for inclusion in the Ramsar Convention list

	Locality	Latitude	Longitude	Size	Wetland criteria/ Conservation status
1.	Medjerda Estuary	c.37°10'N	10°11'–13'E	c.7,500 ha	1a,b; 2a; 4a Unprotected
*2	Garaet Ichkeul	37°10'–13'N	9°38'–41'E	12,000 ha	1a,b,c,d,e; 2a,b; 3a,b,c; 4a Status of Ramsar Convention site not yet defined
3	Sebkhet Ariana	36°54'–57'N	10°15'–18'E	2,500 ha	1a,b,e; 2a; 3a; 4a Unprotected: a wetland complex with sites 4 and 5.
4.	Lac de Tunis/Lac de Radès (El Bahira)	36°49'–53'N	10°14'–18'E	4,500 ha	1a,b,c,d,e; 2a,b; 3a,b,c; 4a Protected
5.	Sebkhet es Sedjoui	c.36°48'N	10°12'E	c.2,600 ha	1a,b,e; 2a; 3a,c; 4a Unprotected
6.	Sebkha Kelbia	35°50'N	10°17'E	13,000 ha	1a,b,c,d,e; 2a,b; 3c; 4a Unprotected

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	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
7.	Sebkhet Sidi el Hani	35°24'–41'N	10°18'–33'E	c.25,000 ha	1a; 2a; 4a Unprotected
8.	Sebkhet el Djem	35°10'N	10°45'E	c.3,000 ha	1a,b,c; 2a; 4a,b Unprotected
9.	Salines de Thyna	34°39'N	10°44'E	500 ha	1b; 2a,b; 3c; 4a Ecological entity with Sfax-Gabès coast and Kneis Islands (No. 10)
10.	Kneis Islands and Sfax-Gabès coastline	33°52'– 34°45'N	10°00'–43'E	c.3,700 ha	1b,d,e; 2a,b,c; 3c; 4a,b Unprotected
11.	Sebkhet Sidi Mansour and S. en Noual	34°15'–25'N	9°39'–58'E	3,000 ha & 11,000 ha	1a,c; 2a; 4a,b Unprotected
12.	Chott el Fedjadj and Sebkhet el Hamma	33°52'– 34°02'N	9°36'–57'E	c.50,000 ha	1a; 2a,b; 4a,b Unprotected
13.	Chott Djerid	33°24'– 34°01'N	7°48'–9°00'E	c.700,000 ha	1a,e; 2a; 4a Unprotected
14.	Bahiret el Biban	33°13'–19'N	10°54'– 11°24'E	c.30,000 ha	1b,e; 2a; 4a Unprotected
15.	Dar Fatma	36°48'N	8°45'E	c.3 ha	Not assessed Unprotected

# TUNISIA



## DETAILS OF LISTED AREAS

### 1. MEDJERDA ESTUARY

**Criteria for inclusion** 1a,b; 2a; 4a.

**Geographical location** 37°10'N 10°11'-13'E On the north-east coast c.35 km north of Tunis.



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**Area** c.7,500 ha.

**Altitude** Sea level.

**Water depth** Shallow.

**Wetland type** 9.

**Ecology** The only major delta in Tunisia. The marshland, partly reclaimed, and the brackish lagoons are important passage and wintering areas for ducks Anatiidae, notably Wigeon *Anas penelope*, Teal *A. crecca* and Pintail *A. acuta*, and limicoline waders, mainly sandpipers of the genus *Calidris*, *Tringa* spp. and Bar-tailed Godwit *Limosa lapponica*.

**Legal status** Unprotected.

**Tenure** Mainly state-ownership.

**Management practices** None.

**Threats** Reclamation of marshland for agriculture. Development of coastal areas for tourism.

**Scientific research** None reported other than as indicated below.

### Principal reference material

Smart, M. 1975. Recensement des oiseaux d'eau en Tunisie, janvier 1975. (Mimeo.). See also the author's earlier reports of mid-winter counts in Tunisia e.g. *I.W.R.B. Bulletin* 37: 82-85.

Kacem, S. 1977. Report on Tunisia. *I.W.R.B. Bulletin* 43/44: 36-38.

## 2. GARAET ICHKEUL

**Criteria for inclusion** 1a,b,c,d,e; 2a,b; 3a,b,c; 4a.

**Geographical location** 37°10'-13'N 9°38'-41'E About 25 km south-west of Bizerte.

**Area** 12,000 ha (MAR List).

**Altitude** Sea level.

**Water depth** Maximum c.5 m; average unknown but certainly quite shallow.

**Wetland type** 18.

**Ecology** Lake Ichkeul is the most important single wetland in North Africa. A large eutrophic freshwater lake surrounded by marshland vegetation, which is dominated by common reed *Phragmites communis*, lesser reedmace *Typha angustifolia* and bulrush *Scirpus lacustris*. It has an outlet to the sea on the west of the gulf which stretches inland from Bizerte. This is one of the last remaining freshwater lakes once scattered along the whole length of the North African coastlands, and together with a group of five lakes in north-eastern Algeria the only ones that have not been drained. Its importance for wintering waterfowl is comparable to that of the Camargue in France and the Marisnas del Guadalquivir in Spain. The mid-winter population of ducks and coots usually reaches 150,000 to 200,000 (380,000 in November 1973). Greylag Goose *Anser anser* numbers vary between 5,000 to 7,000. Individual species can be present in impressive numbers, including Wigeon *Anas penelope* (39,000, November 1972), Pochard *Aythya ferina* (120,000,

Nov. 1972) and Coot *Fulica atra* (36,000, January 1973), particularly during severe weather to the north of the Mediterranean. The Garaet Ichkeul was at one time a nesting-place for many species of herons Ardeidae and ducks Anatidae, notably the now scarce Marbled Teal *Anas angustirostris* and White-headed Duck *Oxyura leucocephala*, and would become so again if disturbance could be eliminated.

**Legal status** Only the neighbouring Djebel Ichkeul is at present protected; hunting is still allowed on and around the lake. Plans for a National Park comprising c.10,000 ha (1,300 ha mountain, 8,700 ha lake and marshes) were drawn up some years ago but are not known to have been implemented. However, in June 1980 the site was reported to have been nominated for inclusion in the Ramsar Convention list, thus confirming at least partial protection of this major wetland.

**Tenure** Mountain and lake are in public ownership; the marshland bordering the lake is privately owned.

**Management practices** None reported.

**Threats** Plans to dam the principal wadis (Ghezala, Joumine and Sedjenane) feeding Lake Ichkeul, in order to provide water for irrigation, would seriously affect the waterfowl habitat; the existing reedbeds and marshes would disappear and salinity would increase. It is doubtful whether any suitable waterfowl habitat would reestablish itself once the water level of the lake has been lowered.

**Scientific research** Surveys of wintering waterfowl have been carried out, mainly in winter in association with I.W.R.B.

#### **Principal reference material**

Johnson, A. R. and Hafner, H. 1972. Dénombrements de sauvagine en automne 1971 sur des zones humides de Tunisie et d'Algérie. (Mimeo.; in *I.W.R.B. Bulletin* 33: 51–62).

Hovette, C. and Kowalski, H. 1972. Dénombrements de la sauvagine dans le Maghreb, janvier/fevrier 1972. (Mimeo.; summary in *I.W.R.B. Bulletin* 34: 42&58).

Goldschmidt, B. von and Hafner, H. 1973. Dénombrements de la sauvagine en Tunisie et dans le nord-est de l'Algérie. (Mimeo.; summary in *I.W.R.B. Bulletin* 35: 38–46).

### **3. SEBKHET ARIANA**

**Criteria for inclusion** 1a,b,e; 2a; 3a,b,c; 4a.

**Geographical location** 36°54'–57'N 10°15'–18'E About 10 km north-east of Tunis and about 6 km to the north of the Lac de Tunis, close to the site of ancient Carthage.

**Area** 2,500 ha.

**Altitude** Sea level.

**Water depth** No precise information available, but known to be shallow.

**Wetland type** 17.

**Ecology** With the Lacs de Tunis and Radès (El Bahira) forms a wetland complex in the environs of Tunis. It is a large salt-lake separated from the sea by a ridge

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of dunes, and its water level varies according to rainfall, drying out completely in summer. Its importance, therefore, is for migrating and wintering waterfowl, especially Shelduck *Tadorna tadorna*, Avocet *Recurvirostra avosetta*, Dunlin *Calidris alpina*, Sanderling *C. alba* and Redshank *Tringa totanus*. Several hundred Greater Flamingos *Phoenicopterus ruber* are often present and the Crane *Grus grus* uses the lake as a roosting-place.

**Legal status** Unprotected.

**Tenure** State-ownership.

**Management practices** None reported.

**Threats** Some shooting. Tourist developments along the beaches between lake and sea.

**Scientific research** Surveys of wintering waterfowl have been carried out since the mid-sixties, in association with the I.W.R.B.

### Principal reference material

See under next description (Site No. 4).

## 4. LAC DE TUNIS/LAC DE RADES (El Bahira)

**Criteria for inclusion** 1a,b,c,d,e; 2a,b; 3a,b,c; 4a.

**Geographical location** 36°49'–53'N 10°14'–18'E Immediately east of the city of Tunis and now transected by the motorway to the port of La Goulette at the entrance to the lake. The southern half of the lake is now called the Lac de Radès after the large town at its south-eastern corner.

**Area** 4,500 ha.

**Altitude** Sea level.

**Water depth** Shallow; maximum 2 m.

**Wetland type** 17.

**Ecology** Highly eutrophic brackish lake, its outlet to the sea choked by sea-lettuce *Ulva* and calcified tubes of *Mercurella enigmatica*. The little island of Chikli in the north-west corner of the lake still has breeding colonies of Little Egret *Egretta garzetta* and Herring Gull *Larus argentatus*; some Mallard *Anas platyrhynchos* also nest and at one time Marbled Teal *A. angustirostris*. Despite its urban surroundings the lake is of great importance to migrating and wintering waterfowl, including Cormorant *Phalacrocorax carbo* (1,000–1,500), Flamingo *Phoenicopterus ruber* (often over 6,000), Pintail *Anas acuta* (1,300, Feb. 1972), Shoveler *A. clypeata* (6,200, Jan. 1973), Pochard *Aythya ferina* (3,200, Jan. 1973), Coot *Fulica atra* (13,800, Jan. 1973) and Avocet *Recurvirostra avosetta* (c.2,000, Nov. 1971). Of particular interest is the presence of significant numbers of White-headed Duck *Oxyura leucocephala* in winter (666, Jan. 1973). All these waterfowl tend to move freely to the Sebkhet Ariana to the north and Sebkhet es Sedjoumi, to the south-west, the three wetlands thus forming an ecological unit.

**Legal status** The lake has been declared a National Reserve.

**Tenure** State ownership.

**Management practices** Commercial fishing takes place.

**Threats** Partially processed sewage flows into the lake and the steps so far taken to purify the inflow have been inadequate. Attempts are being made, in association with the Swedish University of Lund, to improve the oxygen content of the water. Hunting pressure is high, notwithstanding the fact that the lake is a reserve.

**Scientific research** Studies concerning hydrology and micro-organisms. Counts of wintering waterfowl have been carried out since 1962. There is a permanent bird-ringing station at Radès, mainly catching Limicolae.

**Principal reference material**

Instop, Salambo and Khasedine, M.M.S.C. Reports. No dates or details.

Johnson, A. R. and Hafner, H. 1972. Dénombrement de sauvagine en automne 1971 sur des zones humides de Tunisie et d'Algérie. (Mimeo; summary in *I.W.R.B. Bulletin* 33: 51–62).

Houvette, C. and Kowalski, H. 1972. Dénombrements de la sauvagine dans le Maghreb, janvier/fevrier 1972. (Mimeo.; summary in *I.W.R.B. Bulletin* 34: 42–58).

Goldschmidt, B. von and Hafner, H. 1973. Dénombrements de la sauvagine en Tunisie et dans le nord-est de l'Algérie. (Mimeo.; summarized in *I.W.R.B. Bulletin* 35: 38–46).

Smart, M. Recensement des oiseaux d'eau en Tunisie, janvier 1975. (Mimeo.; *I.W.R.B.*)

**5. SEBKHET ES SEDJOURI**

**Criteria for inclusion** 1a,b,e; 2a; 3a,c; 4a.

**Geographical location** 36°48'N 10°12'E Immediately to the south-west of Tunis and separated by no more than a 2 km wide strip of the central city from the Lac de Radès section of El Bahira.

**Area** c.2,600 ha.

**Altitude** Sea level.

**Water depth** Very shallow; less than 1m.

**Wetland type** 17.

**Ecology** A salt-lake of great importance to migrating and wintering waterfowl, including Flamingo *Phoenicopterus ruber* (often in large numbers, e.g. 25,000, November 1973), Shelduck *Tadorna tadorna*, Avocet *Recurvirostra avosetta*, Dunlin *Calidris alpina*, Little Stint *C. minuta*, and Redshank *Tringa totanus*. The lake dries out in summer except that at its northern end there is a considerable discharge of organic matter by sewage outlets from the Bardo and Melassine suburbs, which makes it an attractive feeding area for dabbling ducks and waders, as well as for salt-loving species like *Phoenicopterus ruber* and *Tadorna tadorna*.

**Legal status** Unprotected.

**Tenure** State ownership.

**Management practices** None.

**Threats** Because of the proximity to the capital city, hunting pressure is heavier than in most Tunisian wetlands.

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**Scientific research** Surveys of wintering waterfowl in association with I.W.R.B.

**Principal reference material**

As for Listed Area No. 4.

**6. SEBKHA KELBIA**

**Criteria for inclusion** 1a,b,c,d,e; 2a; 3c; 4a.

**Geographical location** 35°50'N 10°17'E About 20 km north-east of Kairouan and 20 due west of the coast just to the north of Susa (Sousse).

**Area** 13,000 ha.

**Altitude** Slightly above sea level.

**Water depth** Shallow.

**Wetland type** 18.

**Ecology** One of the few fresh-water areas in Central Tunisia that hardly ever dries out. Eutrophic with dense emergent vegetation. The lake is fed by the Merguellil, Zeroud and, to a lesser extent, Nebhana wadis, which can cause serious damage when in flood. Waterfowl species that still attempt to breed include Shelduck *Tadorna tadorna*, Marbled Teal *Anas angustirostris* and Black-winged Stilt *Himantopus himantopus*.

The international importance of the site stems mainly from the numbers of waterfowl present during the migration seasons and winter, e.g. in January 1973 *T. tadorna* (1,800), Wigeon *Anas penelope* (23,000), Pintail *A. acuta* (14,000), and Shoveler *A. clypeata* (10,600). Up to 7,000 Greater Flamingos *Phoenicopterus ruber* (November 1971) have been observed and wintering Cranes *Grus grus* are numerous.

**Legal status** Unprotected.

**Tenure** State ownership.

**Management practices** The flow of the Oued Nebhana into the lake is now controlled by a dam.

**Threats** There are several schemes for controlling and using the water of Merguellil and Zeroud and for avoiding possible flood damage from these sources. But reduction of the water supply, when the lake basin is already said to be receiving a substantial load of silt from the inflows, seems likely to increase the natural tendency towards eventual desiccation. Although hunting pressure was thought to be only slight in 1968, there is some evidence that several species, for example *Anas angustirostris*, have suffered from local egg-collecting.

**Scientific research** Surveys of wintering aquatic birds have been carried out since mid-1960s, in association with the I.W.R.B.

**Principal reference material**

Johnson, A. R. and Hafner, H. 1972. Dénombrement de sauvagine en automne sur des zones humides de Tunisie et d'Algérie. Mimeo.; summarized in *I.W.R.B. Bulletin* 33: 51-62.

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Maghreb, janvier/fevrier 1972. Mimeo.; summarized in *I.W.R.B. Bulletin* 34: 42-58.

Goldschmidt, B. von and Hafner, H. 1973. Dénombrements de la sauvagine en Tunisie et dans le nord-est de l'Algérie, janvier 1973. Mimeo.; summarized in *I.W.R.B. Bulletin* 35: 38-46.

Smart, M. 1974. Mid-winter counts in Tunisia 1973/1974. *I.W.R.B. Bulletin* No. 37: 82-85.

## 7. SEBKHET SIDI-EL-HANI

**Criteria for inclusion** 1a; 2a; 4a.

**Geographical location** 35°24'-41'N 10°18'-33'E About 25 km east-south-east of Kairouan and extending to within 45 km of the east coast at Mahdia.

**Area** 25,000 ha.

**Altitude** Almost sea level.

**Water depth** Shallow; depending on the amount of rainfall. The north-western end of the lake had a depth of 0.6 m in January 1973.

**Wetland type** 17.

**Ecology** Salt-lake of great size, often with very extensive mudflats at its southern end. The Greater Flamingo *Phoenicopterus ruber* seems to be a regular breeding bird on islands in the middle of the lake (c.10,000 pairs, 1972).

**Legal status** Unprotected.

**Tenure** State ownership.

**Management practices** None.

**Threats** Egg-collecting by local villagers.

**Scientific research** Surveys of the flamingo colony have been carried out by the Club de Bagueage d'Oiseaux de Radès and staff members of the Biological Station, Tour du Valat, Camargue, France.

### Principal reference material

Goldschmidt, B. von and Hafner, H. 1973. Dénombrements de la sauvagine en Tunisie et dans le nord-est de l'Algérie, janvier 1973. Mimeo.; summarized in *I.W.R.B. Bulletin* 35: 38-46.

Smart, M. 1975. Recensement des Oiseaux en Tunisie, janvier 1975. Mimeo.; I.W.R.B.

## 8. SEBKHET EL DJEM

**Criteria for inclusion** 1a,b,c; 2a; 4a,b.

**Geographical location** 35°10'N 10°45'E About 50 km north-north-west of Sfax.

**Area** c.3,000 ha, varying very much according to rainfall.

**Altitude** Sea level.

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**Water depth** Shallow.

**Wetland type** 17.

**Ecology** Important as a wintering place of Pochard *Aythya ferina* (over 10,000, January 1973) and Coot *Fulica atra* (33,000, November 1971). The White-headed Duck *Oxyura leucocephala* can also be quite numerous (349, January 1973), and is known to have stayed to nest on occasion, and Greater Flamingos *Phoenicopterus ruber* visit the area in numbers up to 10,000. In favourable years breeding colonies of Avocet *Recurvirostra avosetta*, Black-winged Stilt *Himantopus himantopus*, Collard Pratincole *Glareola pratincola*, Slender-billed Gull *Larus genei* and Gull-billed Tern *Gelochelidon nilotica* have been recorded.

**Legal status** Unprotected.

**Tenure** State ownership.

**Management practices** None.

**Threats** Egg collecting by local villagers.

**Scientific research** I.W.R.B. winter waterfowl surveys in November 1971 and January 1973, carried out by staff of the Biological Station of Tour du Valat in the Camargue, and in subsequent years by I.W.R.B. missions.

**Principal reference material**

As for Site No. 6.

## 9. SALINES DE THYNA

**Criteria for inclusion** 1b; 2a,b; 3c; 4a.

**Geographical location** 34°39'N 10°44'E A short distance along the coast to the south of Sfax.

**Area** c.500 ha.

**Altitude** Sea level.

**Water depth** Shallow; maximum 3 m.

**Wetland type** 7.

**Ecology** The salt pans together with the coast between Sfax and Gabès and the Kneïs islands (lying just off and about half way along this stretch of coast) form an ecological unit. Being very close to the sea, the pans provide a high tide resting place for many species of waterfowl, but particularly waders such as Avocet *Recurvirostra avosetta*, Dunlin *Calidris alpina*, Little Stint *C. minuta*, Redshank *Tringa totanus* and Greenshank *T. nebularia*. In winter and on passage noteworthy species are Black-necked Grebe *Podiceps nigricollis*, Spoonbill *Platalea leucorodia*, Greater Flamingo *Phoenicopterus ruber*, Slender-billed Gull *Larus genei* and Caspian Tern *Hydroprogne tschegrava*.

**Legal status** Unprotected.

**Tenure** Private ownership of the salt extracting company.

**Management practices** Regulation of water levels for salt extraction.

**Threats** Some shooting.

**Scientific research** Surveys of wintering waterfowl have been carried out since 1967, under I.W.R.B. auspices.

**Principal reference material**

Gaugris, Y. 1968. Nouvelles données sur la sauvagine dans le Sud-Tunisie. *Alauda* 36(4): 287–288.

Johnson, A. R. and Hafner, H. 1972. Dénombrements de sauvagine en automne sur des zones humides de Tunisie et d'Algérie. Mimeo.; summarized in *I.W.R.B. Bulletin* 33: 51–62.

Goldschmidt, B. von and Hafner, H. 1973. Dénombrement de la sauvagine en Tunisie et dans le nord-est de l'Algérie, janvier 1973. Mimeo.; summarized in *I.W.R.B. Bulletin* 35: 38–46.

Smart, M. 1974. Midwinter counts in Tunisia 1973/74. *I.W.R.B. Bulletin* 37: 82–85.

**10. KNEIS ISLANDS and SFAX – GABES COASTLINE**

**Criteria for inclusion** 1b,d,e; 2a,b,c; 3c; 4a,b.

**Geographical location** 33°52'–34°45'N 10°00'–43'E Self-explanatory: the small Kneis islands are 2–3km off the coast about 55 km south-west of Sfax.

**Area** The islands have a land surface of c.700 ha and the lagoons along the coast have an area of between 2,500 and 3,000 ha.

**Altitude** Sea level.

**Water depth** Varies with tides; no estimates of the maximum or minimum are quoted.

**Wetland types** 3, 10, 11.

**Ecology** Forming an ecological entity with the Thyna salt pans (Site No. 9). This region of the Tunisian coast is the only one in the western Mediterranean where there are marked tidal movements. The lagoons with their expanses of mud, exposed at low tide or covered only by shallow water, provide a major wintering area for herons and waders, in particular. The surroundings are covered by a typical halophytic vegetation of glasswort *Salicornia* and sea-lavender *Limnium*. Among the breeding species are Little Egret *Egretta garzetta*, Redshank *Tringa totanus*, Slender-billed Gull *Larus genei*, Common Tern *Sterna hirundo* and Little Tern *S. albifrons*. In winter and on passage notable species are Great White Egret *Egretta alba*, Grey Heron *Ardea cinerea*, Spoonbill *Platalea leucorodia*, Glossy Ibis *Plegadis falcinellus* and Flamingo *Phoenicopterus ruber*, together with thousands of waders, including Grey Plover *Pluvialis squatarola*, Dunlin *Calidris alpina*, Knot *C. canutus* (unusual in this part of the Mediterranean), Curlew *Numenius arquata* and Black-tailed Godwit *Limosa limosa*.

**Legal status** Unprotected.

**Tenure** State ownership.

**Management practices** None.

**Threats** An oil-refinery at Es Skhira, 50 km south-west of the Kneis islands, could be a source of pollution.



## TUNISIA

**Scientific research** Surveys of wintering waterfowl have been carried out regularly since 1967, under I.W.R.B. auspices.

### **Principal reference material**

Castan, R. 1961. Nouvelles recherches sur l'avifaune des îlots de la côte sud-est de Tunisie. *Alauda* 29(1): 31-52.

Johnson, A. and Hafner, H. 1972. Dénombrements de sauvagine en automne 1971 sur des zones humides de Tunisie et d'Algérie. Mimeo.; summarized in *I.W.R.B. Bulletin* 33: 51-62.

Goldschmidt, B. von and Hafner, H. 1973. Dénombrements de la sauvagine en Tunisie et dans le nord-est de l'Algérie, janvier 1973. Mimeo.; summarized in *I.W.R.B. Bulletin* 35: 38-46.

Smart, M. 1974. Midwinter counts in Tunisia 1973/74. *I.W.R.B. Bulletin* 37: 82-85.

## 11. SEBKHET SIDI MANSOUR and EN NOUAL

**Criteria for inclusion** 1a,c; 2a; 4a,b.

**Geographical location** 34°15'-25'N 9°39'-58'E About 30 km inland from the coast and 60 km north-north-west of Gabès.

**Area** The Sebkhet Sidi Mansour section covers a maximum of 3,000 ha, the En Noual 11,000 ha.

**Altitude** Slightly above sea-level.

**Water depth** Shallow; maximum 1.5 m; varying greatly with rainfall and evaporation.

**Wetland type** 17.

**Ecology** Lake in a semi-desert area, more saline at its western, much less so at the eastern end, and occasionally drying out completely. When this occurs, the area to the east is ploughed up and planted with cereals.

The lake is frequented by great numbers of Flamingos *Phoenicopterus ruber* (exceptionally, on 23 November 1971, 75,000). Nesting was attempted in 1963, but the colony was destroyed by egg-collecting. Other species of waterfowl occurring in winter in important numbers include Black-necked Grebe *Podiceps nigricollis*, Avocet *Recurvirostra avosetta*, Little Stint *Calidris minuta*, Crane *Grus grus*, Teal *Anas crecca*, Shoveler *A. clypeata*, Pochard *Aythya ferina* and White-headed Duck *Oxyura leucocephala* (190, November 1971).

**Legal status** Unprotected.

**Tenure** State ownership.

**Management practices** None.

**Threats** Egg-collecting by local villagers.

**Scientific research** Surveys of wintering waterfowl in cooperation with I.W.R.B.

### **Principal reference material**

Johnson, A. R. and Hafner, H. 1972. Dénombrements de sauvagine en automne

sur des zones humides de Tunisie et d'Algérie. Mimeo.; summarized in *I.W.R.B. Bulletin* 33: 51–62.

Hovette, C. and Kowalski, H. 1972. Dénombrements de la sauvagine dans le Maghreb, janvier/fevrier 1972. Mimeo.; summarized in *I.W.R.B. Bulletin* 34: 42–58.

Goldschmidt, B. von and Hafner, H. 1973. Dénombrements de la sauvagine en Tunisie et dans le nord-est de l'Algérie, janvier 1973. Mimeo.; summarized in *I.W.R.B. Bulletin* 35: 38–46.

Smart, M. 1975. Recensements des Oiseaux d'eau en Tunisie, janvier 1975. Mimeo.; I.W.R.B.

## 12. CHOTT EL FEDJADJ and SEBKHET EL HAMMA

**Criteria for inclusion** 1a,c; 2a,b; 4a,b.

**Geographical location** c.33°52'–34°02'N 9°36'–57'E Extending over a wide area from 40 to nearly 120 km due west of Gabès.

**Area** c.50,000 ha.

**Altitude** Near sea level.

**Water depth** Shallow, depending on seasonal rainfall.

**Wetland type** 17.

**Ecology** Brackish to fresh water with more or less halophytic vegetation of sedges *Carex* spp., *Tamarix* etc. Flamingos *Phoenicopterus ruber* nested in 1974 (8,000 pairs) at El Fedjadj. In some winters the number of ducks, particularly Pochard *Aythya ferina* and Shoveler *Anas clypeata*, are quite significant. The hot springs of El Hamma, at the eastern end of the area, are of great scientific interest as the only known habitat of a small blind crustacean *Thermosbaena mirabilis*.

**Legal status** Unprotected.

**Tenure** State ownership.

**Management practices** None.

**Threats** Apparently none.

**Scientific research** Surveys of wintering waterfowl in association with I.W.R.B. and subsequently by I.W.R.B. missions.

### Principal reference material

Delamare-Deboutville, C. 1960. *Biologie des eaux souterraines littorales et continentales*. Paris.

Goldschmidt, B. von and Hafner, H. 1973. Dénombrements de la sauvagine en Tunisie et dans le nord-est de l'Algérie, janvier 1973. Mimeo.; summarized in *I.W.R.B. Bulletin* 35: 38–46.

Smart, M. 1974. Midwinter counts in Tunisia 1973/74. *I.W.R.B. Bulletin* 37: 82–85.

Smart, M. 1975. Recensement des oiseaux d'eau en Tunisie, janvier 1975. Mimeo.; I.W.R.B.

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### 13. CHOTT DJERID

**Criteria for inclusion** 1a,e; 2a; 4a.

**Geographical location** 33°24'–34°01'N 7°48'–9°00'E Extending from the immediate south and east of Tozeur to distances of up to 125 km at the furthest point.

**Area** c.700,000 ha.

**Altitude** Just above sea level.

**Water depth** Shallow, depending on the amount of rainfall.

**Wetland type** 17.

**Ecology** Brackish to salty lake with substrate of clay and gypsum and significant seasonal variations in water level. The Flamingo *Phoenicopterus ruber* nests in some years (3,000 pairs, 1959). The area may well be of importance to waders Limicolae on passage. The Houbara Bustard *Chlamydotis undulata* has been recorded.

**Legal status** Unprotected, although it has been proposed that the northern part of the wetland should be included in a National Park.

**Tenure** State-ownership.

**Management practices** None.

**Threats** None reported.

**Scientific research** None, but a general ecological survey of the area was undertaken under the auspices of the International Biological Programme in support of the proposals for establishing a National Park.

**Principal reference material**

Castan, R. 1960. Le Flamant rose en Tunisie (*Phoenicopterus ruber roseus* Pallas). Nidification dans le Chott Djerid en 1959, et déplacements au cours de l'année. *Alauda* 28(1).

### 14. BAHIRET EL BIBAN

**Criteria for inclusion** 1b,e; 2a; 4a.

**Geographical location** 33°13'–19'N 10°54'–11°24'E On the south-east coast and, at its nearest point, no more than 15 km west of the Libyan border, but extending a further 35 km westwards.

**Area** c.30,000 ha.

**Altitude** Sea level.

**Water depth** Shallow.

**Wetland type** 7.

**Ecology** A shallow lagoon connected to the sea. Important to migrating and wintering waterfowl, particularly waders Limicolae. Nesting of several species of Laridae, including Slender-billed Gull *Larus genei*, Caspian Tern *Hydroprogne tschegrava* and Gull-billed Tern *Gelochelidon nilotica* has been observed in the

past but there has been no information since 1965 as to the importance of the area in this respect.

**Legal status** Unprotected.

**Tenure** State ownership.

**Management practices** None.

**Threats** None reported.

**Scientific research** No information.

**Principal reference material**

None listed.

## 15. DAR FATMA

**Criteria for inclusion** Not assessed.

**Geographical location** 36°48'N 8°45'E Extreme north-western corner of Tunisia in the Monts de la Medjerda or Kroumirie sector of the Atlas mountains, close to the Algerian border and c.25 km south-west of Tabarka.

**Area** c.3 ha.

**Altitude** c.770 m.

**Water depth** No information.

**Wetland types** 7, 8.

**Ecology** The only peat bog in Tunisia, in a shallow basin supplied with water, from neighbouring hills, by a small stream and by subterranean seepage. True bog communities dominated by the moss *Sphagnum subsecundum* occupy a very small area but other species of interest include spike-rush *Eleocharis multicaulis*, blinks *Montia fontana*, a St. John's wort *Hypericum afrus* and a bog pimpernel *Anagallis crassipes*. It is surrounded by soligenous mire communities of green heather *Erica scoparia*, reed *Phragmites communis*, asphodel *Asphodelus microcarpus* (= *aestivus*) and quillwort *Isoetes hystrix*. The surrounding hills have oak woodlands (*Quercus faginea* and *Q. suber*). Between 150–200 plant species have been identified, including mosses and sedges not found elsewhere in Tunisia. Little is known of the fauna but the invertebrates should be of considerable interest.

**Legal status** Unknown; assumed to be unprotected.

**Tenure** No information.

**Management practices** A small area has been fenced.

**Threats** The area of true bog is so small that it could be damaged very easily, e.g. by parties of students.

**Scientific research** Surveys have so far been limited to listing the flora.

**Principal reference material**

Radford, G. L. and Peterken, G. F. 1971. Report on field-trials in Tunisia. In Nicholson, E. M. and Douglas, G. (eds) *IBP/CT Progress Report* Pp. 36–94.

# TURKEY

## SUMMARY OF WETLAND SITUATION

The subcontinent of Asia Minor forms a natural link between the land masses of Eurasia and Africa, through which huge numbers of migratory birds move between breeding grounds in northern latitudes and winter quarters in the Nile Delta and Tropical Africa. Many species of waterfowl in fact find suitable conditions for wintering in the extensive wetlands of Turkey itself. These can be conveniently considered within the six regions of Thrace, the Black Sea coastlands, western Anatolia, the southern coastlands, the Central Plateau and the eastern highlands. Climatological characteristics vary from region to region. The Black Sea and Mediterranean coasts have a fairly mild and wet winter, the central Plateau and east a pronounced continental climate, with hot dry summers and severe cold and snow in winter. Thrace and western Anatolia differ again from the latter in that their winters are rainy with only infrequent cold spells. Almost all the 26 river basins in the country contained substantial wetlands, which in 1967, subject to annual fluctuations according to rainfall, were estimated to have covered about 350,000 ha. But of the 200,000 ha or 57 percent of the total actually surveyed it was found that 150,000 ha had been drained and the rest was scheduled for drainage. To what extent these plans have been subsequently implemented, has not been reported. The existing wetlands of each region and their importance for waterfowl, in particular, are reviewed below.

**Thrace.** The most important wetland is undoubtedly the Meriç/Evros Delta situated on both sides of the border with Greece. Most of the Turkish part of the delta is now under cultivation, chiefly for rice, and as briefly mentioned in the Summary for Greece (p. 143 *antea*) nesting of such colonial species as herons Ardeidae and Glossy Ibis *Plegadis falcinellus*, is largely confined to the Greek sector. However, the great concentrations of duck Anatidae and Coot *Fulica atra* which occur in the delta in winter, tend to feed at night on the fields in the Turkish sector, returning to Greece during the day. Coordinated action by the two countries to maintain what is on the whole still a viable ecosystem and one of the most important in the Mediterranean basin, is therefore eminently desirable. A good start was made in 1970 by an IUCN Working Group, in co-operation with the Greek authorities, to find a balance between economic activities in the delta and conservation requirements, and it is important that this work should be continued and extended to the Turkish zone, where there are two other wetlands of international importance in the region, namely the Saros Körfezi bay (notable for the large numbers of wintering Wigeon *Anas penelope*) and the Büyük Cekmece, with similar concentrations of grebes Podicipitidae and Coots *Fulica atra*.

**Black Sea coastlands.** The Kızılırmak delta, including Balik Gölü and Karabogaz (= Cernek Gölü), and the Yesilirmak delta 60 km to the east, are the most important breeding and wintering sites for waterfowl, with particularly noteworthy concentrations of grebes Podicipitidae off-shore and in the harbour of Samsun situated between the two deltas.

**Western Anatolia.** Manyas or Kuş Gölü, often referred to as Kuşçenneti (= bird

paradise), has become the best known of the lakes, thanks to its protected status and breeding colonies of Dalmatian Pelican *Pelecanus crispus*, herons Ardeidae and Glossy Ibis *Plegadis falcinellus*, while 35 km to the east another freshwater lake, Apolyont Gölü, is also rich in breeding birds and of special importance to Smew *Mergus albellus* in winter. The status of Marmara Gölü is less well known, due to dense vegetation round its shores which makes observation difficult, but the flocks of wintering Teal *Anas crecca* are significant in some years. The Menderes delta, usually flooded in winter, also attracts great numbers of Teal and other waterfowl, especially Wigeon *Anas penelope* (maximum 105,000), Pintail *A. acuta* (up to 60,000), Shoveler *A. clypeata* and Coot *Fulica atra* (up to 50,000). Inland and not far from the source of the Menderes, the shallow Acigöl provides suitable habitat for Flamingo *Phoenicopterus ruber* of which up to 2,000 have been recorded and which may sometimes nest in the area. To the north, on the upper Menderes, Civril or Isikli Gölü has a good concentration in winter of White-fronted Goose *Anser albifrons* (up to 3,000, Jan. 1973), Ruddy Shelduck *Tadorna ferruginea*, Shelduck *T. tadorna*, Mallard *Anas platyrhynchos*, *A. crecca* and *A. acuta*.

**Southern coastlands.** These become very important to wintering waterfowl when the wetlands of the Central Plateau freeze over. The main sites are Burdur Gölü (which has the biggest concentration of wintering White-headed Duck *Oxyura leucocephala* with up to 4,000 regularly counted and a maximum of 8,988 in Jan. 1973), Hoyran and Egridir Gölü, Beyşehir Gölü, Goksu delta, Seyhan delta, including Tuzla Gölü, and the Ceyhan delta, with its lagoons, Akyatan, Akyayan and Yumurtalik. The sandy beaches of the two deltas are the last known breeding sites of marine turtles in the Mediterranean (recent information about their status is lacking). The Beyşehir Gölü, the largest freshwater lake in Turkey, may have a breeding population of *Pelecanus crispus*, as well as Cormorant *Phalacrocorax carbo* and various species of Ardeidae and Anatidae, but its exact status is uncertain.

**Central Plateau.** Several wetlands of outstanding importance to breeding waterfowl are located on the plateau, notably Ereğli, where White Pelican *Pelecanus onocrotalus* bred in 1971 (c.420 pairs) and *P. crispus* in 1970 (c.50 pairs), as well as many other species such as *Phalacrocorax carbo* and various Ardeidae and Anatidae, including Greylag Goose *Anser anser*. The Tuz Gölü, largest saltlake in Turkey, has a colony of *Phoenicopterus ruber* (over 3,500 pairs) and is frequented by Cranes *Grus grus* on passage. Flamingos (up to 10,000) also visit Sife Gölü to the north-east of the Tuz. Kurbaga Gölü (Sultansazlığı) has a freshwater ecosystem with dense vegetation, which provides favourable habitat for large numbers of waterfowl, including *Pelecanus onocrotalus*. Excess water flows into a saltwater wetland further to the north.

**Eastern Turkey.** Lake Van is by far the largest wetland, but due to difficulties of access has not been studied in detail.

## References

A Technical Meeting on Wetland Conservation, organized and co-sponsored by IUCN, ICBP and IWRB, was held from 9 to 16 October 1967 in Ankara, Bursa and Istanbul. Many papers on Turkish wetlands and their conservation were presented and published in 1968 in the Proceedings, IUCN Publications new series No. 12, pp. 1-274.

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Ornithological Society of Turkey (now Ornithological Society of the Middle East) 1972, 1975 and 1978. Bird Reports for 1970 to 1975 (give details of occurrences of all species).

Atkinson-Willes, G. L. 1976. The numerical distribution of ducks, swans and coots as a guide in assessing the importance of wetlands in midwinter. In *Proc. Intern. Conf. on Conserv. of Wetlands and Waterfowl*, Heiligenhafen, Fed. Rep. of Germany, December 1974. I.W.R.B., Slimbridge.

**WETLANDS OF INTERNATIONAL IMPORTANCE**

	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
<b>Thrace</b>					
1.	Meriç/Evros delta	40°44'–54'N	26°00'–15'E	c.5,000 ha	1a,b,c,d,e; 2a,b; 3a,b,c; 4a,c Unprotected
1.1	Gala Gölü	40°46'–51'N	26°10'–15'E	3,200 ha	1a,b,c,d,e; 2a; 3a,c Unprotected
2.	Saros Körfezi bay	40°33'–41'N	26°32'–53'E	c.20,000 ha	1a Unprotected
3.	Büyükçekmece	41°02'–05'N	28°33'–34'E	c.1,200 ha	1a Unprotected
<b>Black sea coastlands</b>					
4.	Kızılırmak wetland complex	41°13'–44'N	35°43'–37°00'E	c.66,000 ha	1a,b,c,d,e; 2a; 3b,c Unprotected
4.1	Kızılırmak delta	41°34'–41'N	35°36'–36°08'E	c.28,100 ha	
4.2	Balık Gölü	41°34'–41'N	36°04'–08'E	3,900 ha	
4.3	Karabogaz Gölü (= Cernek Gölü)	41°40'N	35°44'–48'E	c.400 ha	
4.4	Yesilirmak delta	41°13'–23'N	36°31'–37°00'E	c.33,600 ha	
5.	Samsun Harbour	41°17'N	36°22'E	No Information	1a Unprotected
<b>Western Anatolia</b>					
6.	Kuş or Manyas Gölü	40°07'–14'N	27°53'–28°04'E	16,200 ha	1a,c,d,e; 2a; 3a,b,c; 4a Partly protected (Kuşçenneti National Park)
7.	Apolyont or Ulubat Gölü	40°08'–14'N	28°25'–35'E	13,500 ha	1a,c,d,e; 2a; 3c Unprotected
8.	Marmara Gölü	38°35'–37'N	27°56'–28°05'E	c.2,000 ha	1a,b; 2a Unprotected
9.	Menderes delta (incl. Bafa Gölü)	37°27'–33'N	27°12'–35'E	c.10,000 ha	1a,b,c,d,e; 2a Unprotected
10.	Acigöl	37°48'–53'N	29°42'–59'E	c.10,800 ha	1a; 2a,b? Unprotected
11.	Civril or Işıklı Gölü	38°15'N	29°50'–55'E	c.4,000 ha	1a,c,d; 2a Unprotected
<b>Southern coastlands</b>					
12.	Burdur wetland complex	37°34'–45'N	29°44'–30°22'E	c.12,250 ha	See individual sectors

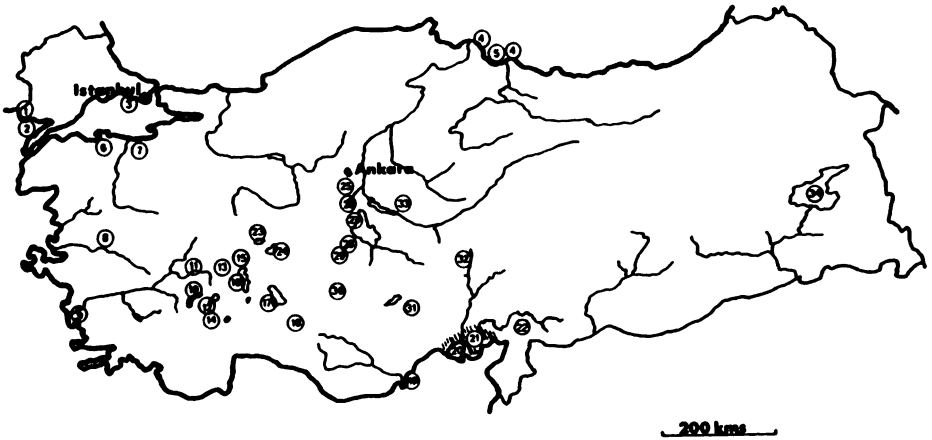
	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criterial Conservation status</i>
12.1	Burdur Gölü	37°40'–52'N	30°02'–22'E	c.10,500 ha	1a,b,c,d,e; 2a; 3a Unprotected
12.2	Corak (or Bayındır) Gölü	37°41'N	29°49'E	c.700 ha	1a,c,d; 2a Unprotected
12.3	Yaraşlı Gölü	37°34'–35'N	29°58'E	c.650 ha	1a,c,d; 2a Unprotected
12.4	Calti Gölü	37°45'N	29°44'E	c.400 ha	1a Unprotected
13.	Alpaslan Gölü	38°15'N	30°27'E	No information	1a Unprotected
14.	Karataş Gölü	37°23'N	29°58'E	c.800 ha	1a Unprotected
15.	Karamık Gölü	38°25'–29'N	30°45'–54'E	c.4,100 ha	1a,b; 2a Unprotected
16.	Hoyran/Eğridir complex	37°38'– 38°16'N	30°43'–58'E	c.50,800 ha	See individual sectors
16.1	Hoyran Gölü	38°06'–16'N	30°43'–54'E	c.18,600 ha	1a,b,d,e; 2a Unprotected
16.2	Eğridir Gölü	37°51'– 38°06'N	30°45'–58'E	c.30,000 ha	1a,b,d,e; 2a Unprotected
16.3	Kovada Gölü	37°38'–44'N	30°51'–52'E	c.2,200 ha	Not assessed Partly protected (Nat. Park 900 ha)
17.	Beyşehir Gölü	37°35'–57'N	31°17'–43'E	c.72,000 ha	Not assessed No information
18.	Suğla Gölü	37°13'–25'N	31°56'– 32°05'E	c.12,400 ha	1a; 2a Unprotected
19.	Göksu delta (incl. Paradeniz Gölü) near Silifke	36°12'–22'N	33°52'– 34°05'E	11,200 ha	1a,b,c,d,e; 2a; 3c Unprotected
20.	Seyhan delta	36°40'– 37°13'N	34°52'– 35°19'E	c.95,000 ha	1a,b,c,d,e; 2a; 3c Unprotected
20.1	Aynaş Gölü	36°48'N	34°52'E	No information	As above
20.2	Tuzla Gölü	36°42'N	35°03'E	c.720 ha	1a,b,c,d,e; 2a; 3c Unprotected
20.3	Seyhan Baraji (Seyhan Gölü)	37°02'–13'N	35°06'–19'E	c.11,500 ha	No information
21.	Ceyhan delta	36°31'–58'N	35°10'–45'E	c.170,000 ha	Not assessed for the delta as a whole
21.1	Akyatan Gölü	36°32'–38'N	35°10'–18'E	4,900 ha	1a,b,c,d,e; 2a; 3c Unprotected
21.2	Akyayan Gölü	36°33'N	35°27'–31'E	c.1,000 ha	As above
21.3	Iskele or Yumurtalık lagoons	36°42'–46'N	35°34'–40'E	c.4,000 ha	No information
22.	Emen/Gavur complex				
22.1	Emen Gölü	36°50'N	36°30'E	No information	1a Unprotected
22.2	Gavur Gölü	37°10'N	36°45'E	No information	1a Unprotected



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	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
<b>Central plateau</b>					
23.	Eber/Akşehir complex				
23.1	Eber Gölü	38°36'–42'N	31°03'–16'E	12,500 ha	1a,b; 3c Unprotected
23.2	Akşehir Gölü	38°29'–36'N	31°17'–31'E	33,500 ha	1a,b,d; 2a Unprotected
24.	Çavuşçu Gölü	38°21'–29'N	31°51'–55'E	c.4,800 ha	1a,b,c; 2a; 3a Unprotected
25.	Mogan Gölü	39°45'N	32°48'E	c.600 ha	1a Unprotected
26.	Gölbek Gölü (or Kurak Gölü)	39°23'N	32°55'E	No information	1a,d?,e?; 2a Unprotected
27.	Tuz gölü	38°29'– 39°10'N	33°02'–46'E	164,200 ha	1a,b,d,e; 2a Unprotected
27.1	Kulu or Küçük Gölü	39°07'N	33°09'E	c.700 ha	1a,c; 2a Unprotected
28.	Gez or Tersizhan Gölü	38°30'–35'N	33°01'–06'E	c.6,400 ha	1a; 2a? Unprotected
29.	Bugur, Acituz or Bulok Gölü and marshes	38°33'N	32°58'E	c.1,200 ha	1a,e; 2a Unprotected
30.	Sakyatan marshes (Konya)	37°44'–55'N	32°45'–50'E	c.1,000 ha	Not assessed Unprotected
31.1	Hotamış or Bataklık Gölü	37°31'–39'N	33°01'–06'E	c.9,500 ha	1a,b,c,d,e; 2a; 3a?,c Unprotected
31.2	Ereğli Gölü	37°28'–40'N	33°41'–58'E	Small lakes spread over c.50,000 ha	1a,b,c,d,e; 2a Unprotected
32.	Kurbaga Gölü and Sultansazlığı marshes	38°16'–22'N	35°10'–21'E	c.14,000 ha	1a,b,c; 2a Unprotected except for bird nesting colonies
33.	Sife or Seyfe Gölü	39°16'–18'N	34°24'–26'E	c.3,200 ha	1a,b,c,d; 2a Unprotected
<b>Eastern Turkey</b>					
34.	Van Gölü	38°16'–58'N	42°16'– 43°34'E	360,000 ha	1a,b,c,d,e; 2a Unprotected

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## DETAILS OF LISTED AREAS

### 1. MERİÇ/EVROS DELTA

#### 1.1 Gala Gölü

**Criteria for inclusion** 1a,b,c,d,e; 2a; 3a,c.

**Geographical location** 40°46'–51°N 26°10'–15'E At its nearest point 2.5 km east of the eastern or left bank of the Meriç river (Greek border) and nearly 7 km north-east of Enez (near the rivermouth), in the Edirne sub-province.

**Area** 3,200 ha.

**Altitude** About 2 m above sea level.

**Water depth** Maximum about 5 m; average 2 m.

**Wetland types** 7, 9, 12, 18, 22, 23, 24.

**Ecology** Gala Gölü, a large freshwater lake, is the main feature of the Turkish sector of the delta, but there are also a number of lagoons and ponds, as well as grasslands inundated in winter when the river floods. Excessive flooding is, however, prevented by a long dike on the Turkish side of the river (the centre of the river is the international border). The dike also facilitates irrigation of the rice-fields bordering the river, although since it was constructed the productivity of the fishery, which used to be high, has noticeably declined.

Although, for the above-mentioned reasons, the Greek sector offers more natural and better nesting habitats in which waterfowl can breed, the Turkish sector plays a valuable role as a feeding ground. In winter the number of waterfowl can exceed 80,000 birds; the Coot *Fulica atra* is one of the most numerous (averaging 7,000 with a maximum of 21,400 recorded in November, 1970), but there are also huge flocks of Mallard *Anas platyrhynchos* (maximum 11,870, Jan. 1971) and Teal *A. crecca* (max. 10,580, Jan. 1971) and more moderate numbers of Gadwall *A. strepera*, Wigeon *A. penelope*, Pintail *A. acuta*, Shoveler *A. clypeata*, Tufted Duck *Aythya fuligula* and Pochard *A. ferina*. A noteworthy species of the area is the White-tailed Eagle *Haliaeetus albicilla*, of which a pair or two may still breed, as

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compared with the 50 to 70 of a few years ago, and of which quite a number winter.

**Legal status** Unprotected. Some areas along the river are within military zones and therefore inaccessible and relatively undisturbed.

**Tenure** State ownership.

**Management practices** The flood control (dike) project already mentioned dates from the late 1960s and has resulted in about 80 percent of the delta losing its natural character.

**Threats** Changes in the water regime due to extension of irrigated areas; increasing the proportion of the land surface drained and put under cultivation and adopting more intensive agricultural practices, including the pasturing of a greater density of livestock and pig-breeding; and continuing clearance of tree cover, thus for example denying the eagles their nesting sites.

**Scientific research** Biological studies have been carried out by the Zoological Institutes of the Universities of Istanbul and Ege, as well as by zoologists from several foreign institutions.

### Principal reference material

Ornithological Society of Turkey, 1975. Bird Report 1970–1973.

Ornithological Society of Turkey, 1978. Bird Report 1974–1975.

Müller, G. 1978. A Management plan for the Meriç Delta. In *Proceedings of a Technical Meeting on Wetland Conservation*. IUCN Publications new series No. 12, pp. 242–248.

## 4. KIZILIRMAK wetland complex

### 4.2 Balik Gölü

**Criteria for inclusion** 1a,b,c,d,e; 2a; 3b,c.

**Geographical location** 41°34'–41°N 36°04'–08'E On the eastern side of the Kızılırmak delta, 12 km east of Bafra and 40 km north-west of Samsun, a little over half way along the Black Sea coast from the Bosphorus to the USSR border.

**Area** 3,900 ha.

**Altitude** Slightly above sea level.

**Water depth** Maximum 4 m; average 0.6 m.

**Wetland types** 7, 9, 10, 11, 18, 23.

**Ecology** Balik Gölü is a natural lagoon in the Kızılırmak river delta, its salinity very low although some salt-tolerant plants border it, including sea rush *Juncus maritimus* and glasswort *Salicornia* sp. Freshwater species tend to occur on the western and southern shores, mainly reeds and bulrushes *Typha*, *Phragmites* and *Scirpus*. Various species of grasses and herbaceous plants form the ground cover in wet areas. Deciduous woodland is found along the north-eastern side of the lagoon, elms *Ulmus*, ash *Fraxinus*, oak *Quercus* and poplar *Populus* spp. being the dominant species. Several decades ago such woodlands covered a large portion of the delta and the Ring-necked Pheasant *Phasianus colchicus* is reputed to have been a common breeding bird, being here within its original range (the name

'Phasianus' is the classical Latin name of the Kızılırmak river and 'colchicus' is derived from the Latin name for this part of the Black Sea coastlands).

The lagoon is highly eutrophic and contains many species of fish (Balik Gölü means 'fish lake' in Turkish) including the sturgeons *Huso huso* and *Acipenser* sp., Black Sea Herring *Caspialosa* sp., Pike *Esox lucius*, Carp *Cyprinus carpio*, Wels *Silurus glanis*, eels *Anguilla* sp., Zährte *Vimba vimba*, a bream *Abramis* sp. and Asp *Aspius aspius*. Breeding birds include Dalmatian Pelicans *Pelecanus crispus* (60–70 pairs in the period 1970 to 1973); Bittern *Botaurus stellaris*, Squacco Heron *Ardeola ralloides* and Great White Egret *Egretta alba* possibly breed, Grey Heron *Ardea cinerea* certainly (colony of 48 occupied nests at Yurukler Koy, July 1971), and presumably the Purple Heron *A. purpurea*, which is present in moderate numbers in the summer. The White Stork *Ciconia ciconia* and Black Stork *C. nigra* both nest in the delta, as does the Crane *Grus grus* (15 pairs, 1970–1973).

In winter waterfowl abound on Balik Gölü, recorded numbers ranging from 15,000 in Jan. 1971 to 56,000 in Jan. 1973. The lake is certainly the most important concentration area for Greylag Goose *Anser anser* in Turkey (maximum 5,462, Jan. 71). Mallard *Anas platyrhynchos* numbers sometimes exceed 10,000 (maximum 31,690, Jan. 1971), Teal *A. crecca* are normally around 5,600 (but a maximum of 16,750 was noted in Jan. 1973), Pintail *A. acuta* similarly range from several hundred to a maximum of 4,360 (Jan. 1973) and Shoveler *A. clypeata* up to 1000 (Jan. 1973). The top Coot *Fulica atra* count gave a figure of 15,295 (also in Jan. 1973), although the regular wintering population tends to be about 10,000.

**Legal status** Unprotected.

**Tenure** State ownership.

**Management practices** None. Intensive cultivation in the surrounding fields, grazing and commercial fishing in the wetland itself are the typical land use features.

**Threats** Chiefly drainage and in-filling, but the hunting pressure was also severe at the time of the 1973 survey.

**Scientific research** Some hydrobiological studies have been undertaken by the Zoological Institutes of the Universities of Istanbul and Ege.

**Principal reference material**

Ornithological Society of Turkey, 1975. Bird Report 1970–1973.

## 6. KUŞ or MANYAS GÖLÜ

**Criteria for inclusion** 1a,c,d,e; 2a; 3a,b,c; 4a.

**Geographical location** 40°07'–14°N 27°53'–28°04'E Marmara region, 16 km south of Bandırma, in Balıkesir sub-province.

**Area** 16,200 ha.

**Altitude** About 15 m above sea level.

**Water depth** Maximum 6 m; average about 3 m.

**Wetland types** 18, 23.

**Ecology** Kus gölü, which means 'bird lake', is now used rather than the old name of Manyas, to indicate the wealth of the lake's bird life. It is a highly eutrophic water body, the westernmost of four large lakes in the hinterland of the Sea of

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Marmara's south-eastern shore. Its 21 fish species include Pike *Esox lucius*, Carp *Cyprinus carpio*, Shad *Caspialosa moeotica*, Catfish or Wels *Silurus glanis*, Rudd *Scardinius erythrophthalmus* and Roach *Rutilus rutilus*. The crayfish *Astacus leptodactylus* is also quite common. Reptiles and amphibians abound.

Where rivers and streams enter the lake, dense stands of *Typha*, *Phragmites*, *Carex*, *Tamarix*, *Cyperus* and *Scirpus* species occur and the finger-grass *Digitaria paspaloides*, accidentally introduced from North America with rice seeds about fifteen years ago, has taken over large areas of wet soil. Patches of willow *Salix* and other groundwater forest provide the main nesting-place for large colonies of herons, spoonbills, cormorants and pelicans. Several hundred pairs (450–500, June 1970) of Spoonbill *Platalea leucorodia* breed, small numbers staying to winter, and about the same number of Glossy Ibis *Plegadis falcinellus*. At least seven species of Ardeidae nest in the area, namely the Bittern *Botaurus stellaris*, Little Bittern *Ixobrychus minutus*, Night Heron *Nycticorax nycticorax* (c.500 pairs), Squacco Heron *Ardeola ralloides* (175 pairs), Little Egret *Egretta garzetta* (up to 220 pairs) – June 1970 counts –, Grey Heron *Ardea cinerea* (400 pairs, March 1972) and Purple Heron *A. purpurea* (about 30 pairs). The most spectacular of the breeding colonies is that of the Dalmatian Pelican *Pelecanus crispus*, the nests being built on man-made platforms in the trees and gradually increasing in number as more platforms are added (there were at least 30 in April 1970). Other nesting waterfowl include Cormorant *Phalacrocorax carbo* (maximum yet recorded was 500 pairs in March 1972), Pygmy Cormorant *P. pygmaeus* (maximum 70, June 1973), Greylag Goose *Anser anser* and Mallard *Anas platyrhynchos*.

Success of the breeding colonies depends entirely on the water level of the lake in early spring. Normally, at this time of year, the willows stand in water about a metre deep, which gives security to the nesting birds. At other times of year, on both migrations, the lake is also visited by White Pelican *Pelecanus onocrotalus* (the exceptionally high number of 10,000 was recorded on 27 Sept. 1972) and, in mid-winter, waterfowl censuses each year from 1970 to 1973, produced a highest figure of 6,900, which included 1,740 White-fronted Geese *Anser albifrons* and 86 Greylags *A. anser*. The most suitable feeding grounds for geese are at the western end of the lake but the neighbouring Apolyont Gölü, well to the east, is also an important feeding area, especially for Kuş Gölü breeding species.

**Legal status** The Kuşçenneti ('bird paradise') National Park is located in the north-east corner of the Kuş Gölü, covering an area of 52 ha only but surrounded by a further 200 ha buffer-zone.

**Tenure** State ownership.

**Management practices** As previously mentioned platforms are constructed in suitable trees to attract more pelicans and there is also an observation tower from which the public can watch the nesting birds. The lake sustains a commercial fishery and rice, cotton and grain are cultivated in the surrounding fields. Grazing by livestock has been found to be essential to the maintenance of suitable feeding grounds for Spoonbills and Ibises.

**Threats** Overfishing of species of fish in greatest demand is adversely affecting the lake ecosystem. Other activities which may have serious repercussions include interference with the ecology of the lake, e.g. alterations to the water level, location of industrial enterprises in the vicinity and uncontrolled development of tourism.

**Scientific research** Hydrobiological studies were carried out by the University of

Istanbul during the period 1945–1959. As might be expected the avifauna has attracted the attention of students from both Turkey and abroad.

### Principal reference material

Kosswig, C. 1956. Das Vogelparadies am Manyas See in West Anatolien. *Kosmos* 52.

Oktaç, M. 1966. Über Pelikanbruten am Manyas See (Türkei). *J. Orn.* 108.

Géroutet, P. 1977. Coup d'oeil au 'Paradis des Oiseaux' et au Lac Manyas, en Turquie. *Nos Oiseaux* 34(1): 23–30.

Ornithological Society of Turkey 1973, 1975, 1978. Bird Reports for period 1970–1975.

## 9. MENDERES DELTA including BAFA GÖLÜ

**Criteria for inclusion** 1a,b,c,d,e; 2a; 3c.

**Geographical location** 37°27'–33'N 27°12'–35'E About 68 km south-west of Aydın, in the vicinity of the site of ancient Miletus.

**Area** c.10,000 ha.

**Altitude** Slightly above sea level.

**Water depth** Maximum 3 m; average 1 m.

**Wetland types** 7, 9, 12, 23.

**Ecology** An alluvial plain on the Aegean with a large lake, Bafa Gölü, 8 km inland from the rivermouth. The shore zone is a mixture of brackish lagoons, surrounded by stretches of glasswort *Salicornia*, and of bare soil and sand. The freshwater vegetation along the river itself, is mainly composed of *Typha*, *Phragmites*, *Juncus* and *Tamarix* species and is also found bordering small ponds or on wetter soils. The salinity of the soil decreases rapidly away from the sea and most of the hinterland is under cultivation.

In winter the aspect of the delta changes dramatically. Extensive floods are caused if the rain is heavy and most of the area is covered by 0.5 m of water. During this period, which usually lasts up to two months, huge concentrations of waterfowl take advantage of the situation, especially as the weather tends to be mild and frosts rare, to forage among the remains of the crops or feed in the lagoons, which abound in fish and other aquatic life. The Bafa Gölü and larger lagoons also provide good roosting areas and their margins excellent habitat for waders Limicolae.

The total number of waterfowl during the winter rains is of the order of 40,000 to over 80,000 and numbers counted in January of the years indicated include Great Crested Grebe *Podiceps cristatus* (max. 2,848, 1973), Dalmatian Pelican *Pelecanus crispus* (regularly up to 333, max. c.1,000, 1972), Cormorant *Phalacrocorax carbo* (max. 355, 1972), Pygmy Cormorant *P. pygmaeus* (max. c.450, 1970), Little Egret *Egretta garzetta* (max. 90, 1970), Great White Egret *Egretta alba* (max. over 700, 1972), Grey Heron *Ardea cinerea* (max. c.360, 1972), Little Egret *Egretta garzetta* (max. 90, 1970), Great White Egret *Egretta alba* (max. over 700, 1972), Grey Heron *Ardea cinerea* (max. c.360, 1072), Greater Flamingo *Phoenicopterus ruber* (regularly up to 3,929, max. 6000, 1970), Mute Swan *Cygnus olor* (max. 85, 1970), White-fronted Goose *Anser albifrons* (max. 1,500, 1970), Sheld-

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uck *Tadorna tadorna* (max. 628, 1971), Mallard *Anas platyrhynchos* (regularly up to 10,000, max. 15,000, 1970), Gadwall *A. strepera* (exceptionally 1,000, 1973), Teal *A. crecca* ((regularly up to 6,650, max. 38,116, 1971), Wigeon *A. penelope* (max. 15,000, 1970), Pintail *A. acuta* (max. 8,152, 1971), Shoveler *A. clypeata* (regularly up to c.1,500, max. 2,604, 1072) and Coot *Fulica atra* (regularly up to 12,500, occasionally over 18,000). The White-tailed Eagle *Haliaeetus albicilla*, rated as a 'vulnerable' species in the 1979 edition of the Red Data Book, can still be found in the delta at all times of year.

**Legal status** Unprotected.

**Tenure** State ownership.

**Management practices** None. Commercial fishing is the main human activity, especially on Lake Bafa.

**Threats** Continuation of drainage operations; severe hunting pressure; disturbance of nesting birds by villagers and grazing cattle.

**Scientific research** Some limnological and hydrobiological studies have been made by the Zoological and Botanical Institutes of the Universities of Istanbul and Ege.

### Principal reference material

Porter, R. 1968. Notes on some Western Anatolian Wetlands in Spring and Summer. In *Proc. Techn. Meeting on Wetland Conservation*, Ankara-Bursa-Istanbul, October 1967. Morges, IUCN Publications new series No. 12: 69–74.

Ornithological Society of Turkey, 1973, 1975, 1978. Bird Reports 1970–1975.

## 12. BURDUR WETLAND COMPLEX

### 12.1 Burdur Gölü

**Criteria for inclusion** 1a,b,c,d,e; 2a; 3a.

**Geographical location** 37°40'–52°N 30°02'–22°E On a south-west to north-east axis, about 32 km long, and 4 km to the west of Burdur.

**Area** 10,500 ha.

**Altitude** 845 m.

**Water depth** Maximum 75 m; average 6 m.

**Wetland type** 17.

**Ecology** Generally speaking the ecology of Burdur remains little known, although its interest has, for example, been demonstrated by the discovery of an endemic species in the plankton fauna *Arctodiaptomus burduricus*. However the value of the lake, as indicated by its waterfowl population, has now been investigated in some detail. It is of special importance as a wintering area for the rare and declining White-headed Duck *Oxyura leucocephala*, which usually arrives in mid-August and stays until early April (numbers normally ranging up to 4,113, but a maximum of 8,988 recorded in January 1973). Exceptionally high numbers of Black-necked Grebe *Podiceps nigricollis* were observed in Jan. 1971 (18,000). Species of duck recorded in substantial numbers during January censuses are Red-crested Pochard *Netta rufina* (2,604, 1973), Tufted Duck *Aythya fuligula* 11,210, 1973), Mallard *Anas platyrhynchos* (1,203, 1973), Teal *A. crecca* (530, 1973),

Wigeon *A. penelope* (875, 1973), and Pintail *A. acuta* (276, 1973). Very high numbers of Coot *Fulica atra* (120,690, 1973) are also noteworthy. It is clear that January 1973 was exceptionally favourable for waterfowl in this area, with numbers totalling over 200,000, the reason apparently being that particularly severe weather was experienced that year on the Central Plateau.

**Legal status** Unprotected.

**Tenure** State ownership.

**Management practices** None reported.

**Scientific research** Some limnological studies have been made of this saline lake.

#### **Principal reference material**

Nümann, W. 1961. Die anatolischen Seen und ihre fischereiliche Bewirtschaftung. *Zeits. für fisherei und deren Hilfswissenschaften*, Band 10(8–10): 773–799.

Koning, F. J. and Dijksen, L. J. 1971. Report on I.W.R.B. Mission to Turkey, winter 1970–1971. *I.W.R.B. Bulletin* 32: 51–67.

The Ornithological Society of Turkey, 1973–1978. Bird Reports 1970–1975.

Koning, F. J. and Dijksen, L. J. 1974. Report on I.W.R.B. Mission to Turkey, January 1973. *I.W.R.B. Bulletin* 37: 69–70.

## **16. HOYRAN/EĞRIDIR COMPLEX**

### **16.3 Kovada (or Kovara) Gölü**

**Criteria for inclusion** Not assessed.

**Geographical location** 37°38'–44'N 30°51'–52'E About 16 km south of Eğridir and connected with the lake of that name.

**Area** 2,200 ha (National Park 900 ha).

**Altitude** 900 m.

**Water depth** Maximum 6.7 m.

**Wetland types** 19, 20.

**Ecology** Formed by a combination of folding and karstic action. Kovada was formerly joined to Eğridir Gölü, from which it was separated by an alluvial in-fill, through which a canal has now been excavated to restore the link. Unlike most of the lakes of the Anatolian plateau, this particular complex is reputed to drain into the Mediterranean. The waters are noted for their greenish colour, due to fine sediments in suspension, which reduce visibility to 1.5 m.

Mean temperatures in the area range from 25°C in summer to 0°C in winter with 613 mm annual rainfall. The lake is surrounded by mountains rising to peaks of 2,635 and 2,950 m and noted for their forests of unusual species of pine (*Pinus brutia*), fir (*Abies cilicica*) and oak (*Quercus volcanica*). Birds recorded on or round the mountain lake include Greylag Goose *Anser anser*, Ruddy Shelduck *Tadorna ferruginea*, Pheasant *Phasianus colchicus* and Rock Partridge *Alectoris graeca*.

**Legal status** A National Park 'Kovada Gölü Milli Parki' first proposed in 1970, is described and illustrated in the 1973 guidebook to Turkish National Parks, and covers about 40 percent of the lake area.



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**Tenure** State ownership, but a village and two small settlements have the right to graze and cultivate parts of the area.

**Management practices** The lake is leased for carp fishing, 30–40 tons being exported annually. It is also part of the Kovada power generating system. The lake surroundings were at one time used for military training, but are now being developed for tourists.

**Threats** Possible disturbance from the hydroelectric development, troop training and growth of camping and other tourist facilities.

**Scientific research** No information.

### Principal reference material

Master Plan for Protection and Use: Kovada Lake National Park. USAID/T March 1970 – 1276 – 300.

Orman Bakanlığı, 1973. Türkiye Millî Parkları. Page 12.

## 21. CEYHAN DELTA

### 21.1 Akyatan Gölü

**Criteria for inclusion** 1a,b,c,d,e; 2a; 3c.

**Geographical location** 36°33'–38'N 35°10'–18'E About 44 km south of Adana and immediately to the west of Karataş Burun (headland).

**Area** About 4,900 ha.

**Altitude** About 4 m above sea level.

**Water depth** Maximum 3 m; average about 1 m.

**Wetland type** 9.

**Ecology** Akyatan is a large shallow lake about 3 km wide and 12 km long lying between the Seyhan and Ceyhan rivermouths. It is connected to the sea through a natural channel and is rich in fish, mainly marine species, which are of great importance to a local commercial fishery. The lagoon is also of vital importance to wintering waterfowl, as is the nearby but smaller Akyayan lagoon, which complements Akyatan, waterfowl moving freely between them.

To the north there is intensive cultivation, separated from the lagoon by a narrow strip of grassland. The shoreline is bordered by a dune zone about a kilometre wide, which extends north-westwards for about 50 km, except where it is crossed by the Seyhan and Tarsus rivers. The dunes are still mobile and eucalyptus trees have been planted around the mouth of the Tarsus river to stabilize them. There were plans in 1973 to extend these plantings to the southern end of the dunes. Shoreline vegetation includes sedges *Carex*, *Iris* and *Narcissus* spp. Dune vegetation is patchy, mainly confined to the low-lying dune slacks. The richest vegetation is at the north-western end of the lagoon and in general the wet grasslands of this flat and low-lying area are much frequented by migratory waterfowl in winter.

Numbers of waterfowl present vary from year to year according to weather conditions on the Central Plateau. Recent counts of wintering ducks, geese and coots give figures of 123,000 (1970), 183,300 (1971) 312,000 (1972) and 35,000 (1973), with numbers of Coot *Fulica atra* regularly reaching 25,000, and occasionally as high as 80,000 (Jan. 1970) or 112,000 (Jan. 1971). Duck species include

Wigeon *Anas penelope* (average 20,496, max. 39,125, 1971), Teal *A. crecca* (average 78,900, max. 252,500 in Jan. 1972), Pintail *A. acuta* (average 3,000, max. 19,692, 1971). Flamingos *Phoenicopterus ruber* winter here in numbers up to 19,000 (Jan. 1972). Large numbers of waders and gulls also frequent the delta lagoons.

This is another area in which marine turtles, presumably the Green Turtle *Chelonia mydas*, are reported as nesting.

**Legal status** Unprotected.

**Tenure** State ownership.

**Management practices** The surrounding agricultural land is used for cotton production. Commercial fishing in the lagoon is of importance.

**Threats** Pollution from the heavy use of pesticides in surrounding fields. Southerly winds carry sand into the lagoon and eucalyptus trees are being planted to stop this but could have undesirable effects.

**Scientific research** Little has been published so far on the status of breeding birds of the area. Limnological studies have been carried out by the Hydrobiological Station, Istanbul.

#### Principal reference material

The Ornithological Society of Turkey 1973–1978. Bird Reports.

Atkinson Willes, G. L. 1976. The numerical distribution of ducks, swans and coots as a guide in assessing the importance of wetlands in mid-winter. *Proc. of the Int. Conf. on Cons. of Wetl. and Waterf.*, Heiligenhafen, Dec. 1974. I.W.R.B. publication, pp. 199–254.

## 21. CEYHAN DELTA (continued)

### 21.3 Iskele (or Yumurtalik) Lagoons

**Criteria for inclusion** 1a,b,c,d,e; 2a; 3c.

**Geographical location** 46°42'–46°N 35°34'–40'E South-east sector of the Ceyhan delta, about 40 km south-east of Adana and 18 km east of Karatas.

**Area** Probably c.4,000 ha out of the 170,000 ha of the total delta area.

**Altitude** Almost sea level.

**Water depth** Maximum 2 m; average 0.7 m.

**Wetland types** 7, 9.

**Ecology** The lagoons form part of the complex of water bodies in the delta, most of them being saline but a few in the vicinity of the river having fresh water.

Salinity diminishes in winter, with the onset of rainfall and flooding, and the lagoons then become increasingly suitable for waterfowl. Vegetation varies widely according to distance from the sea; on the inland side there are scattered clumps of *Pinus brutia* surrounded by *maquis*-type ground cover. Nearer the lagoons, marshland vegetation takes over, with a narrow fringe of sedges and reeds *Juncus*, *Carex*, *Typha* and *Phragmites* around the waters. Finally, on the edge of the sea, the appearance of *Salicornia* marks the increase in salinity and bare sandy beaches extend for several kilometres, where sea-turtles (said to be mainly *Chelonia mydas*)

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used to nest and may still do so, though recent evidence is lacking. In the area as a whole commercial fishing is the main economic activity.

The delta has been inadequately studied during the breeding season, but its importance for wintering waterfowl and Flamingos *Phoenicopterus ruber* is well known. Numbers vary greatly from year to year, depending on weather conditions on the Central Plateau, but ducks and coots can be as many as 80,000, and anything from 5,000 to 15,000 flamingos (probably from central Anatolia) may visit the area between December and March.

**Legal status** Unprotected.

**Tenure** State ownership.

**Management practices** None. Commercial exploitation of marine products, said to include turtles, still continues.

**Threats** No information since 1973, when no serious threats were reported.

**Scientific research** Some limnological and hydrobiological studies have been carried out by the Hydrobiology Institute of the University of Istanbul.

### Principal reference material

Information received from Dr. Tansu Gürpınar, Ankara (1973).

The Ornithological Society of Turkey (1975). Bird Report 1970–1973.

## 23. EBER/AKŞEHİR COMPLEX

### 23.1 Eber Gölü

**Criteria for inclusion** 1a,b; 2a; 3c.

**Geographical location** 38°36'–42'N 31°03'–16'E About 48 km east-south-east of Afyon, at the northern foot of the Sultan range of the western Taurus mountains.

**Area** 12,500 ha.

**Altitude** 995 m.

**Water depth** Maximum 6 m; average 2 m.

**Wetland type** 18.

**Ecology** Eber Gölü is a natural freshwater lake, almost entirely overgrown with reeds *Phragmites* and *Typha* spp. but with a few hundred hectares of open water in the middle and numerous channels through the dense vegetation kept open by fishermen. The lake is highly eutrophic and has a rich aquatic fauna and flora. Fish are abundant, three species, Pike *Esox lucius*, Carp *Cyprinus carpio* and Wels *Silurus glanis*, being of commercial value. Species of waterfowl known to nest here include Greylag Goose *Anser anser*, Mallard *Anas platyrhynchos*, Garganey *A. querquedula*, Marbled Teal *A. angustirostris*, Red-crested Pochard *Netta rufina*, Coot *Fulica atra* and Moorhen *Gallinula chloropus*. Another possible breeding species is the Ferruginous Duck *Aythya nyroca* and also recorded in the breeding season are Pygmy Cormorant *Phalacrocorax pygmaeus*, Squacco Heron *Ardeola ralloides*, Little Egret *Egretta garzetta*, Purple Heron *Ardea purpurea* and Glossy Ibis *Plegadis falcinellus*. The rare White-headed Duck *Oxyura leucocephala* was seen here in August 1971. In winter up to 3,500 White-fronted Geese *Anser albifrons* have been observed (Jan. 1970).

**Legal status** Unprotected but shooting is at least partially banned in the breeding season (March – August).

**Tenure** State ownership.

**Management practices** Egg collecting and illegal hunting are controlled by official wardens. Reed cutting is allowed.

**Threats** Untimely reed cutting may cause disturbance.

**Scientific research** Some biological and limnological studies have been carried out by the Zoological Institutes of the Universities of Istanbul and Ege.

**Principal reference material**

Ornithological Society of Turkey, 1973–1978. Bird Reports for the period 1970–1975.

### 23. EBER/AKŞEHİR COMPLEX (continued)

#### 23.2 Akşehir Gölü

**Criteria for inclusion** 1a,b,d; 2a.

**Geographical location** 38°29'–36'N 31°17'–21'E About 10 km to the south-east of Eber Gölü (site No. 23.1) and the same distance north of the town which gives it its name.

**Area** 33,500 ha.

**Altitude** 990 m.

**Water depth** Maximum 5.5 m; average 2 m.

**Wetland type** 18.

**Ecology** Very similar to its twin, Eber Gölü: a natural freshwater lake with reedbeds of *Typha* and *Phragmites* spp. covering 80% of its surface. The two lakes are in fact connected by a small stream. But while Eber Gölü is noted for its breeding waterfowl, Akşehir provides favourable feeding conditions in winter, the wheatfields along its northern border normally remaining free of snow. White-fronted Geese *Anser albifrons* are particularly numerous, up to 15,000 being regularly recorded with a maximum of 29,575 in January 1973. The Greylag Goose *Anser anser* is present in winter in small numbers (maximum 186, Dec. 1970). The Pygmy Cormorant *Phalacrocorax pygmaeus* is present throughout the year, in numbers up to 177 individuals (Jan. 1971), suitable breeding habitat and a plentiful supply of fish (particularly carp) ensuring that, as on Eber Gölü, quite a number stay to nest.

**Legal status** Unprotected.

**Tenure** State ownership.

**Management practices** Cattle-grazing, fishing and reed cutting.

**Threats** No serious threats yet reported.

**Scientific research** Hydrobiological and limnological studies have been carried out by the Zoological Institutes of Istanbul and the University of Ege.

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**Principal reference material**

Nümann, W. 1961. Die anatolischen Seen und ihre fischereiliche Bewirtschaftung. *Zeits. für Fischerei und deren Hilfswissenschaften*, Band 10 (8–10); 773–799.

Ornithological Society of Turkey, 1973–1978. Bird Reports for period 1970–1975.

Koning, F. J. and Dijkzen, L. J. 1974. I.W.R.B. Mission to Turkey, January 1973. *I.W.R.B. Bulletin* 37: 69–70.

**27. TUZ GÖLÜ**

**Criteria for inclusion** 1a,b,d,e; 2a.

**Geographical location** 38°29'–39°10'N 33°02'–46'E Northern limit of the salt-lake is about 90 km south of Ankara, from where it extends a further 80 km southwards.

**Area** 164,200 ha.

**Altitude** 899 m.

**Water depth** Shallow; maximum 0.5 m; average 0.2 m.

**Wetland type** 17.

**Ecology** The Tuz Gölü is the second largest lake in Turkey, shallow and of high salinity, in summer drying out almost completely and leaving a salt crust several centimetres thick. A few small freshwater streams enter the lake but the water level depends on annual rainfall. It is surrounded by a vast steppe landscape, very thinly populated and much of it inaccessible, agricultural activities apart from grazing are limited to only a few sites, and the vegetation is typically halophytic, dominated by wormwood *Artemisia fragrans* with an admixture of meadow-grass *Poa bulbosa*, barley *Hordeum* sp., *Alyssum campestre*, medick *Medicago turbinata*, *Delphinium orientalis*, chamomile *Anthemis* sp. and garlic *Allium* sp. The extent of *Artemisia fragrans* is a good indication of salinity.

The species of birds breeding in the Tuz are relatively few but include Shelduck *Tadorna tadorna*, Ruddy Shelduck *T. ferruginea*, Avocet *Recurvirostra avosetta*, Great Sand Plover *Charadrius leschenaultii*, Stone Curlew *Burhinus oedicephalus*, Slender-billed Gull *Larus genei* and Herring Gull *L. argentatus*. A breeding colony of Flamingo *Phoenicopterus ruber* of approximately 3,500 pairs with their young was observed in June 1972 and 1973. During the autumn migration and in winter the lake and steppe attract great numbers of birds, including *Phoenicopterus ruber* again, Cranes *Grus grus* (maximum 4,186 in the Tuz and associated lakes, Nov. 1970), White-fronted Goose *Anser albifrons* (regularly up to 17,000, maximum 36,108, Nov. 1970), the Shelducks *Tadorna tadorna* (max. 815, Jan. 1970) and *T. ferruginea* (max. 2,164, Nov. 1970) and, in smaller numbers, Mallard *Anas platyrhynchos*, Teal *A. crecca*, Shoveler *A. clypeata*, *Recurvirostra avosetta* (over 1,100, March 1970), Ruff *Philomachus pugnax* and other waders. Severe weather conditions on the Central Plateau usually, however, forces the majority of birds to move to coastal wetlands for at least part of most winters.

**Legal status** Unprotected.

**Tenure** State ownership.

**Management practices** Salt exploitation takes place in the northern part of the

lake. Stock-grazing and some wheat growing are typical of the land use in areas bordering the lake.

**Threats** No apparent threats in the immediate future.

**Scientific research** Ecological and biological studies have been carried out by the botanical and zoological institutes of the Universities of Istanbul, Ankara and Ege.

**Principal reference material**

Ornithological Society of Turkey 1973–1978. Bird Reports for period 1970–1975.

### 32. KURBAGA GÖLÜ and SULTANSAZLIĞI MARSHES

**Criteria for inclusion** 1a,b,c; 2a; 3c.

**Geographical location** 38°16'–22'N 35°10'–21'E About 45 km south-south-west of Kayseri and east of the road and railway from Kayseri to Adana.

**Area** About 14,000 ha.

**Altitude** 1,074 m.

**Water depth** Maximum 3 m; average 0.7 m.

**Wetland types** 17, 18, 23, 24.

**Ecology** The Kurbaga Gölü/Sultansazlığı wetland is located in a wide, enclosed basin in Central Anatolia. It is surrounded by high mountains and water flows into the basin from the west, north and south-east, although most of the flow from west and north is tapped for irrigation. Hence, it is the largest river, the Yahali, flowing in from the south-east, on which the wetland largely depends. The result is that there are two distinct ecosystems. freshwater and saltwater, the former in the south of the area, the latter at a slightly lower level in the north of the area. Both are surrounded by grasslands and more occasionally by bare soil.

The freshwater area includes a large lake of about 4,000 ha, which is covered by extensive reedbeds, but with some open water and a number of small islands. The lake level fluctuates seasonally, offering a variety of habitats and attracting numerous kinds of birds. Its productivity is high, especially in respect of plankton, and there is a rich cover of reeds and rushes *Typha*, *Scirpus* and *Carex* spp. Small fish, including toothcarp *Alphanius* sp., are common and provide much of the food of such species as herons and terns. Amphibians and reptiles are also abundant. The excess water from the freshwater system runs into the saline water system to the north, transporting a certain amount of trophic material with it, and the intermediate zone is a particularly important feeding area for birds. The saline area is called 'Yay gölü' and consists of a single, wide, pan-type lake. It is surrounded by vegetation, in which glasswort *Salicornia* sp., sea-lavender *Limonium* sp. and rushes *Juncus* sp. are dominants. Heavy grazing has, however, led to deterioration of the sward and is responsible for the destruction of many ground nests and the wind-erosion of overgrazed areas.

The wetland is nevertheless, still of extraordinary importance for waterfowl. Species known or thought to nest include White Pelican *Pelecanus onocrotalus* (22 present, May 1970), Squacco Heron *Ardeola ralloides* (50 pairs, May 1970), Little Egret *Egretta garzetta* (200 pairs, May 1970), Purple Heron *Ardea purpurea*, Grey Heron *A. cinerea*, Spoonbill *Platalea leucorodia* (30 pairs, May 1970), Glossy Ibis *Plegadis falcinellus* (100 pairs, May 1970), White Stork *Ciconia ciconia* (40 pairs, May 1970), Flamingo *Phoenicopterus ruber* (1,500 pairs, May 1970) and Crane

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*Grus grus* (50 pairs, May 1970). A few Anatidae, notably the Marbled Teal *Anas angustirostris* (in small numbers) and the Greylag Goose *Anser anser* (up to 50 pairs) are reported as nesting, but the principal importance of the wetland for ducks is as a stopping place on migration and occasionally as a wintering-ground if the lake is not frozen over. Thus, exceptionally high numbers (c.200,000) of Teal *Anas crecca* were recorded in Jan. 1970 and November 1971, and other counts were of Mallard *Anas platyrhynchos* (2,500, Nov. 1971), Wigeon *A. penelope* (500, Nov. 1970), Pintail *A. acuta* (12,000, Nov. 1971) and Shoveler *A. clypeata* (500, Nov. 1971).

**Legal status** The breeding colonies are officially protected.

**Tenure** State-ownership.

**Management practices** Stock-grazing and reed-cutting are the main kinds of land use.

**Threats** A Government proposal to drain the entire area was dropped after national and international intervention. Overgrazing and consequent wind-erosion are now the most serious threat.

**Scientific research** Hydrological studies have been carried out by the Government.

### Principal reference material

Ornithological Society of Turkey, 1973–1978. Bird Reports for period 1970–1975.

## 34. VAN GÖLÜ

**Criteria for inclusion** 1a,b,c,d,e; 2a.

**Geographical location** 38°16'–58°N 42°16'–43°34'E At its nearest point only 50 km from the Iranian border, about 300 km west of Tabriz. The nearest town is Bitlis 20 km from the south-west corner of the lake.

**Area** 360,000 ha.

**Altitude** 1,720 m.

**Water depth** The maximum is over 300 m.

**Wetland type** 17.

**Ecology** Lake Van was formed by volcanic damming of a tectonic basin. Its waters are of a soda type, with a pH of 9.6. The littoral and benthic species are poor and few in number but some endemic algae and rotifers have been found. Although little evidence has yet been obtained of any dense concentrations of waterfowl, in an area whose size and inaccessibility hamper observations, considerable numbers of grebes Podicipitidae have been recorded, of all five Western Palearctic species, both pelicans occur (up to 600 White Pelican *Pelecanus onocrotalus* in June), several heron Ardeidae species, especially the Little Egret *Egretta garzetta*, fair numbers of waders Limicolae on migration, especially in autumn, and several species of gulls and terns, of which some like the Gull-billed Tern *Gelochelidon nilotica* probably nest.

**Legal status** Unprotected.

**Tenure** No information.

**Management practices** Some fisheries are operated.

**Threats** None reported.

**Scientific research** No information.

**Principal reference material**  
None listed.



# UNION OF SOVIET SOCIALIST REPUBLICS

## SUMMARY OF WETLAND SITUATION

The wetlands of the European part of the USSR and indeed most of those in the vast Asian sector, particularly to the west of the Mid-Siberian Plateau, provide the main breeding grounds for the majority of migrant waterfowl wintering in south-western Europe and the Mediterranean basin, south-west Asia and much of Africa. The eastern Siberian wetlands are similarly the principal source of the migrants which winter in the rest of southern Asia and, in the case of the Limicolae, in Australasia also. For a comprehensive review of these sites, the number of which runs into thousands at least another two volumes the size of this Director would be required. In these circumstances, the advice of the Wetland Section of the Central Laboratory for Nature Conservation, which is responsible to the USSR Ministry of Agriculture, has been followed and only the 12 Wetlands, designated as of international importance for the purposes of the Ramsar (Wetlands) Convention to which the Soviet Union became a party on 11 October 1976, have been listed, marked on the map and, in most cases, briefly described. For completeness the only one of these in the far east, Lake Khanka near Vladivostok, has not been omitted, though well beyond the bounds of the Western Palearctic.

The Ramsar sites were selected as particularly characteristic of a vegetational/climatic zone or region: for example the Gulf of Kandalaksha of the taiga; Matsalu Bay of the mixed forest country; the Black Sea bays and Sivash Bay, Sea of Azov, of the steppes; the Volga delta and eastern Caspian bays of desert country; and the Kirov bays, south-west Caspian coast, of the Caucasian region. They tend to be either broad expanses of shallow water such as the various sea bays or integrated wetland systems, such as those of the Volga delta or north of the Danube rivermouth (No. 8 on the List), with a mixture of salt and fresh water and varying degrees of mineralization. Their international importance depends on richness and diversity of flora and fauna, especially of waterfowl, high biological productivity (they often constitute reserves or gene pools of rare, endangered, endemic or relict species of plants and animals) and a protected status which enables them to sustain populations of waterfowl at different stages in their annual life cycle. Thus the most northerly site, Kandalaksha, serves mainly as a breeding-ground, Matsalu bay on the Baltic both for breeding and as a stopping-place on migration, the Black Sea sites and Volga delta for nesting, moulting, as migratory staging-posts and to a limited extent for wintering, and the southernmost sites of the eastern and south-western Caspian mainly as wintering grounds, notably of two species included in the USSR Red Data Book, the Greater Flamingo *Phoenicopterus ruber* and the Red-breasted Goose *Branta ruficollis*.

The listed wetlands are variously located but for the most part either in areas liable to more extreme climatic conditions, such as desert and dry steppes, or in areas of intensive development and dense human populations, which may greatly enhance their value. Their protected status therefore varies widely according to the degree to which they are subject to the impact of human activities.

## References

There are two principal sources of published information:

(a) Proceedings of the International Regional Meeting on Conservation of Wildfowl Resources, Leningrad, 25–30 September 1968. Papers include:  
Ardamatskaya, T. Wildfowl of the Ukrainian Black Sea coastal region.

Gavrin, V. Numbers of waterfowl in Kazakhstan.

Isakov, Y. A. Status and distribution of Waterfowl Resources in the western part of the USSR.

Karpovitch, V. and Kester, B. Resources of Eider on the Murman and White Seas.

Krivososov, G. The Volga Delta as a Wildfowl Haunt.

Kumari, E., Mihelsons, H. A. and Ivanauskas, T. L. Wildfowl in the Soviet Baltic Region.

Priklonsky, S., Pavlov, M. and Panchenko, V. Wildfowl in the Central Provinces of the European part of the USSR.

Shevareva, T. Geographical distribution of the main dabbling duck populations in the USSR and the main directions of their migrations.

Tasliev, A., Eminov, A. and Sukhinen, A. Wildfowl wintering in the Kara-Kum Canal Basin in South Turkmenia.

Uspensky, S. Wildfowl in the Arctic and sub-Arctic zones of the USSR.

Yrlov, K. Status of the stock of wildfowl in the Lake-Forest Steppe of Western Siberia.

(b) Papers presented at the 22nd Annual Board Meeting of the I.W.R.B. held at Alushta, Crimea, 16–21 November 1976, by

Azarov, V. I., Vengerov, M. P., Ivanov, G. K., Koshelev, A. I., Kuzyakin, V. A. and Mikhanteyev, A. I. Waterfowl populations in the Forest-Steppe zone of Western Siberia.

Bianki, V. V. Swans and Geese in the Murmansk Region and northern Karelia.

Krivenko, V. G. Status of the waterbodies and waterfowl population in the Pre-Caucasus.

Krivososov, G. A. Wetlands and Waterfowl in the Caspian Sea area.

Kumari, E. State of wetlands and numbers of waterfowl in the north-west USSR.

Kydyraliyev, A. K. Wetlands and Waterfowl populations in Kirghizia.

Mineev, Y. N. Waterfowl population distribution in the Bolshezemelskaya tundra.

Priklonsky, S. G. Status of the wetlands and waterfowl populations in the Central Regions of the R.S.F.S.R.

(c) Luther, H. and Rzóška, J. 1971. *Project Aqua*, a source book of inland waters proposed for conservation. IBP Handbook No. 21. Published for the International Biological Programme by Blackwell Scientific Publications, Oxford and Edinburgh.

Lists 43 natural lakes and 20 man-made lakes, of which all but 12 are west of the

Mid-Siberian Plateau. It has not yet been possible to assess which of them have an internationally important limnological interest. But there is no doubt that many are in that category and three of them, the Volga Delta, Issyk-Kul lake and Lake Khanka, are included on avifaunal grounds in the List which follows of the twelve Wetlands of International Importance designated for purposes of the Ramsar (Wetlands) Convention.

## WETLANDS OF INTERNATIONAL IMPORTANCE

### \*Nominated for inclusion in the Ramsar Convention list

	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
*1.	Kandalaksha Bay, White Sea (Murmansk distr., R.S.F.S.R.)	66°45'– 67°08'N	32°31'– 34°05'E	208,000 ha	1a,b,e; 2a; 3a,b; 4a,b Partly protected
*2.	Matsalu Bay (Estonian S.S.R.)	58°40'–54'N	23°20'– 24°00'E	59,000 ha	1a,b,e; 2a; 3a,b,c; 4a,b Partly protected
*3.	Volga Delta (Astrakhan, R.S.F.S.R.)	45°24'– 46°24'N	47°46'– 49°20'E	650,000 ha	1a,b,c,d,e; 2a,c; 3a,b,c; 4a Partly protected
*4.	Kirov Bays (Lenkoran, Masally and Neftechala distr., Azerbaijan S.S.R.)	38°53'– 39°18'N	48°40'– 49°15'E	98,400 ha	1a,b,c,e; 2a,b; 3b; 4a Protected
*5.	Krasnovodsk and North-Cheleken Bays (Krasnovodsk distr., Turkmenkaya S.S.R.)	39°34'– 40°01'N	53°00'–40'E	188,700 ha	1a,b,c,d,e; 2a; 3b; 4a,b Protected
*6.	Sivash Bay, Azov Sea (Kherson distr., Ukrainskaya S.S.R.)	46°05'–12'N	34°21'–50'E	22,400 ha	1a,b,c,e; 2a; 4a Protected
*7.	Karkinitzki Bay (Crimea distr., Ukrainskaya S.S.R.)	45°50'– 46°00'N	33°22'–47'E	37,400 ha	1a,b,c; 2a; 3a,b,c; 4a,b Ramsar Convention site restricted to 7,200 ha
*8.	Dunai (Danube) intertidal flats; with Yagorlytski and Tendrovski Bays (Odessa, Nikolayev and Kherson distr., Ukrainskaya S.S.R.)	45°25'–30'N 46°07'–30'N	29°32'–40'E 31°40'– 32°22'E	7,800 ha 84,700 ha	1a,b,c,d,e; 2a; 3a,b,c; 4a,b Partly protected

	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
•9.	Kurgal'dzhin and Tengiz lakes (Tselinograd distr., Kazakh S.S.R.)	50°11'–44'N	68°37'–69°43'E	193,000 ha	Not assessed Partly protected (185,200 ha Hunting Reserve)
•10.	Lakes below confluence of Irgiz and Turgay rivers (Ghalkarteniz saltlakes, Aktyubinsk distr., Kazakh S.S.R.)	48°14'–49°11'N	61°53'–62°30'E	348,000 ha	Not assessed No information
•11.	Issyk-Kul lake (Issyk-Kul distr., Kirghiz S.S.R.)	42°09'–45'N	76°09'–78°23'E	629,800 ha	Not assessed Unprotected in 1971; present status uncertain
•12.	Khanka lake (Primorski distr., R.S.F.S.R.)	44°32'–45°14'N	132°00'–52'E	310,000 ha (USSR sector)	Not assessed Unprotected in 1971; present status uncertain

## USSR



### DETAILS OF LISTED AREAS

#### 1. KANDALAKSHA BAY

**Criteria for inclusion** 1a,b,e; 2a; 3a,b; 4a,b.

**Geographical location** 66°45'–67°08'N 32°31'–34°05'E Head of the Kandalakshskaya Guba (Gulf), a few kilometres south of Kandalaksha city, Murmansk oblast, Russian S.F.S.R.

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**Area** 208,000 ha.

**Altitude** Sea level, shores rising to 100 m.

**Water depth** Generally shallow but with a big tidal variation.

**Wetland types** 3, 5, 10, 11, 19, 21, 22.

**Ecology** Characteristic of the White Sea and taiga zone. The head or inner end of a 180 km long 60 km wide sea gulf, in which there are 860 skerries or rocky islands, some covered with coniferous forest, others with no tree cover. Temperatures are below freezing on about 180 days a year.

The wetland is of great importance as a major nesting ground of Eider *Somateria mollissima* (about 8,000 pairs) and there are probably between 2,000 and 4,000 pairs of Red-breasted Merganser *Mergus serrator*, Oystercatcher *Haematopus ostralegus*, Common Gull *Larus canus*, Herring Gull *L. argentatus* and Arctic Tern *Sterna paradisaea*. Other breeding birds include Arctic Skua *Stercorarius parasiticus*, Razorbill *Alca torda*, the guillemots *Uria aalge* and *U. lomvia* and Puffin *Fratercula arctica*.

**Legal status** The wetland includes Kandalaksha state nature reserve (30,900 ha), completely protected with recreational and other kinds of human activity prohibited, and Keretskiy state refuge (19,400 ha), in which hunting is prohibited and natural resources exploitation controlled. The remaining 157,700 hectares of the Bay area are under general protection.

**Tenure** State ownership.

**Management practices** A shipping channel is maintained and the commercial fishery is subject to controls.

**Threats** Sport fishing and other water sports outside the reserves are on a very small scale and do not present any threat.

**Scientific research** Studies have been undertaken by research staff of Kandalaksha state nature reserve and Belomorskaya biological station of Moscow State University since the 1950s.

#### **Principal reference material**

Proceedings of the Kandalaksha state nature reserve. Issue 1, 1958; issue 2, 1960; issue 3, 1960; issue 4, 1963.

Bianki, V. V. 1967. Waders, Gulls and Guillemots of the Gulf of Kandalaksha. Proceedings of the Kandalaksha state nature reserve, issue 4.

Karpovitch, V. and Kester, B. 1970. Resources of Eider on the Murman and the White Sea. In *Proc. Internat. Regional Meeting Conserv. Wildfowl Resources*, Leningrad, USSR, 25-30 Sept., 1968, Moscow.

## **2. MATSALU BAY**

**Criteria for inclusion** 1a,b,e; 2a; 3a,b,c; 4a,b.

**Geographical location** 58°40'–54'N 23°20'–24°00'E About 90 km south-west of Tallinn, Estonian S.S.R.

**Area** 59,000 ha.

**Altitude** Near sea level.

**Water depth** Maximum 8 m.

**Wetland types** 3, 5, 6, 8, 10, 12.

**Ecology** Bordering the mixed forest zone and with a temperate climate, the bay at its western mouth has salt water, rocky shores and treeless marine islands, in contrast with its inner eastern end where the water is much fresher, the shores have a dense belt of reeds *Phragmites* and submerged vegetation backed by water meadows.

The wetland is a very important staging post on the migrations of Anseriformes and Charadriiformes (up to 950,000): noteworthy species are Whooper Swan *Cygnus cygnus*, Bewick's Swan *C. columbianus bewickii*, Barnacle Goose *Branta leucopsis*, Brent Goose *Branta bernicla*, dabbling and diving ducks Anatini and Nyrocinini (about 350,000 of them) and Ruff *Philomachus pugnax* (up to 100,000), especially in spring. It is estimated that at times there are a million non-breeding sea-ducks off-shore, including the scoters *Melanitta fusca* and *nigra*, Long-tailed Duck *Clangula hyemalis*, Goldeneye *Bucephala clangula* and Scaup *Aythya marila*. Species which nest on the shores of the Bay include Mute Swan *Cygnus olor*, Greylag Goose *Anser anser*, Eider *Somateria mollissima*, Tufted Duck *Aythya fuligula*, Goosander *Mergus merganser*, Velvet Scoter *Melanitta fusca*, Coot *Fulica atra* and Caspian Tern *Hydroprogne tschegrava*. Mallard *Anas platyrhynchos* and Pochard *Aythya ferina* come to the Bay to moult.

**Legal status** Part of the Bay constitutes the 4,000 ha Matsalu state nature reserve which gives total protection to a section of the natural wetland complex. The remaining 55,000 ha form a buffer zone in which hunting is prohibited and a general measure of protection is given.

**Tenure** State ownership.

**Management practices** Haymaking on areas outside the reserve.

**Threats** None reported.

**Scientific research** Started a century ago and carried out on a regular basis since 1945 by research staff of the Matsalu state nature reserve and by scientists of the Institute of botany and zoology of the Estonian Academy of Sciences. It has included hydrobiological research of considerable interest to Project AQUA of the Conservation of Terrestrial Communities (CT) Section of the International Biological Programme.

#### **Principal reference material**

- Kumari, E. V. 1970. Changes in the bird fauna of Matsalu Bay during the last 100 years. *Ornis Fennica* (47(2); 45–51.
- Kumari, E. V., Mihelsons, H. A. and Ivanauskas, T. L. 1970. Wildfowl in the Soviet Baltic Region. In *Proc. Internat. Regional Meeting Conserv. Wildfowl Resources*, Leningrad, USSR, 25–30 Sept., 1968, Moscow.
- Anon. 1973. *Matsalue maastik ja linnud* (Landscape and Birds of Matsalu). Valgus, Tallinn.

### **3. VOLGA DELTA**

**Criteria for inclusion** 1a,b,c,d,e; 2a,c; 3a,b,c; 4a.

**Geographical location** 45°24'–46°24'N 47°46'–49°20'E To the immediate east

and south of Astrakhan, on the border of the R.S.F.S.R. and Kazakh S.S.R. and the north-west shore of the Caspian Sea.

**Area** 650,000 ha.

**Altitude** 28.5 m below sea level.

**Water depth** Up to 2 m in the outer delta, up to 12 m in the channels.

**Wetland types** 2, 9, 24, 25.

**Ecology** Typical delta wetland with its transition from fresh to moderately saline water of the surrounding Caspian Sea. The dense vegetation bordering the channels is mainly willow *Salix* and reeds *Phragmites*, *Typha* and *Sparganium*, together with various submerged and floating species. Among the rarer of these are the endemic lotus *Nelumbo caspium*, water chestnut *Trapa natans*, *Marsilea quadrifolia* and water lettuce *Salvinia natans*.

A most important migrating, nesting, moulting and migration stopping place for waterfowl, frequented in spring and autumn by an estimated 5 to 7 million migrants. Prominent among these are Anatidae, including Whooper Swan *Cygnus cygnus*, Greylag Goose *Anser anser*, Mallard *Anas platyrhynchos*, Gadwall *A. strepera*, Teal *A. crecca*, Pintail *A. acuta*, Tufted Duck *Aythya fuligula* and Ferruginous Duck *A. nyroca*. *Anas acuta*, *A. crecca* and also Garganey *A. querquedula* (about 300,000) dominate the moulting grounds. The delta is equally important as a breeding ground for colonies of protected colonial nesting species such as Cormorant *Phalacrocorax carbo*, Dalmatian Pelican *Pelecanus crispus*, Night Heron *Nycticorax nycticorax*, Squacco Heron *Ardeola ralloides*, Little Egret *Egretta garzetta*, Great White Egret *Egretta alba*, Purple Heron *Ardea purpurea*, Grey Heron *A. cinerea*, Spoonbill *Platalea leucorodia* and Glossy Ibis *Plegadis falcinellus*. It is estimated that these total some 230,000 pairs. Other nesting waterfowl are the Mute Swan *Cygnus olor*, *Anser anser*, *Anas platyrhynchos* and Coot *Fulica atra*.

**Legal status** The delta includes the 62,400 ha Astrakhan state nature reserve in which protection is total, together with a 21,000 ha buffer zone in which hunting is prohibited at all seasons, fishing is controlled, movement by boat or vehicle restricted and transportation under ranger supervision. Much of the remaining half-million hectares is within state refuges (about 120,000 ha) or no-fishing zones, and some general protection is given elsewhere.

**Tenure** State ownership.

**Management practices** Navigation is restricted to the sea-channel in the western part of the delta and fishing to certain defined channels. Other activities in areas outside the reserve include fish-breeding, rice-cultivation, haymaking, melon-cultivation and cutting and storing of reeds.

**Threats** Spring firing of vegetation (mainly of reeds); uncontrolled hunting (poaching) and hydroelectric installations and construction work.

**Scientific research** Regular studies have been carried out by the research staff of the Astrakhan state nature reserve since 1930, also by research staff of the Caspian ornithological station since 1960. Research for fisheries purposes and into the zoology of the area (much work has been done on the birds) was noted as of special interest by the IBP Project AQUA.

**Principal reference material**

- Isakov, Yu. A. and Krivonosov, G. A. 1969. Migration and moulting of waterfowl in the Volga delta. Proceedings of the Astrakhan state nature reserve, issue 12, Astrakhan (summary in English).
- Krivonosov, G. 1970. The Volga Delta as a Wildfowl Hunt. In *Proc. Internat. Regional Meeting Conserv. Wildfowl Resources*, Leningrad, 25–30 Sept. 1968. Moscow.
- Anon. 1977. *Waterfowl resources of the Caspian Sea coast and adjacent areas* (protection, use and study), Astrakhan.

**4. KIROV BAYS**

**Criteria for inclusion** 1a,b,c,e; 2a,b; 3b; 4a.

**Geographical location** 38°53'–39°18'N 48°40'–49°15'E On the south-west Caspian coast about 130 km south-south-west of Baku, in the districts (from south to north) of Lenkoran, Masally and Neftechala, Azerbaijan S.S.R.

**Area** 98,400 ha.

**Altitude** 28.5 below sea level.

**Water depth** Average between 1 and 2.5 m.

**Wetland type** 5, 6, 7, 25.

**Ecology** Salinity is very variable and also seasonal. The water is eutrophic, with a rich emergent vegetation dominated by reeds *Phragmites* and submerged vegetation dominated by eel-grass *Zostera*. The bays which extend south-westwards for some 70 km from the mouth of the Kura River provide wintering grounds for some 300,000 to 450,000 swans, geese and ducks, as well as other waterfowl, including two species listed in the USSR Red Data Book – Flamingo *Phoenicopterus ruber* and Red-breasted Goose *Branta ruficollis*, also storks and ibises *Ciconiiformes* and Coot *Fulica atra*.

The following nesting species are to be found on the shores of the bays in numbers estimated at between 20,000 and 24,000 pairs: Pygmy Cormorant *Phalacrocorax pygmaeus*, Night Heron *Nycticorax nycticorax*, Squacco Heron *Ardeola ralloides*, Cattle Egret *Bubulcus ibis*, Little Egret *Egretta garzetta* and Glossy Ibis *Plegadis falcinellus*.

**Legal status** The Kizyl-Agach state nature reserve is within the limits of the wetland and gives total protection to some 88,400 ha. The remaining 10,000 hectares are under general protection.

**Tenure** State ownership.

**Management practices** Commercial fishing in the Lesser Bay (controlled); fish-breeding and spawning installations.

**Threats** General fall in the level of the Caspian Sea; decrease, due to the use of water for irrigation, in the flow of the Kura and other rivers into the Bays; irregular discharge or withdrawal of water by the fish-breeding enterprises; and some poaching.

**Scientific research** Carried out on a regular basis by the research staff of the Kizyl-Agach state nature reserve since the 1950s. Work on the hydrobiology of



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the area was noted by Project AQUA as being of special interest.

**Principal reference material**

Anon. 1968 and 1972. *Waterfowl resources of the USSR, their reproduction and use*. Moscow.

Anon. 1977. *Wildfowl resources of the Caspian Sea coast and adjacent areas*, Astrakhan.

**5. KRASNOVODSK and NORTH CHELEKEN BAYS**

**Criteria for inclusion** 1a,b,c,d,e; 2a; 3b; 4a,b.

**Geographical location** 39°34'–40°01' N 53°00'–40'E To the immediate south and east of Krasnovodsk, the main port at the southern end of the east coast of the Caspian Sea in the S.S.R. of Turkmeniya.

**Area** 188,700 ha.

**Altitude** 28.5 m below sea level.

**Water depth** Averaging about 2–3 m.

**Wetland type** 5, 6, 7, 11.

**Ecology** Saline with high biological productivity (phyto- and zoo- plankton, zoo-benthos, submerged vegetation). Being on the border of a vast desert zone, these wetlands are of great importance as a resting-place for migratory waterfowl and also as a wintering ground in the USSR. Up to a million duck Anatidae pass through in spring and autumn. The wetland is the principal winter quarters of up to 15,000 Flamingos *Phoenicopterus ruber*, a generally scarce species in the USSR, and of other waterfowl in numbers varying between a half and two million, the dominant species being wild swans *Cygnus* spp., Mallard *Anas platyrhynchos*, Red-crested Pochard *Netta rufina*, Tufted Duck *Aythya fuligula*, Pochard *A. ferina* and Coot *Fulica atra*.

**Legal status** The 262,000 ha Krasnovodskiy state nature reserve, in which there is total protection, surrounds the bays, in which hunting and recreational activities are specifically prohibited.

**Tenure** State ownership.

**Management practices** Navigation through the bays is restricted to shipping channels; there is a limited commercial fishery.

**Threats** Expansion of recreational activities, on the part of the 1000 or so inhabitants of local communities, at present largely confined to the shore. The winters can at times be extremely severe, hence the big fluctuations in the numbers of wintering waterfowl.

**Scientific research** Carried out by the research staff of the Krasnovodskiy state nature reserve on a regular basis. Annual counts of waterfowl on wintering grounds are carried out in cooperation with the Caspian ornithological station.

**Principal reference material**

Anon. 1977. *Wildfowl resources of the Caspian Sea coast and adjacent areas* (protection, use and study). Astrakhan.

## 6. SIVASH BAY, Sea of Azov

**Criteria for inclusion** 1a,b,c,e; 2a; 4a.

**Geographical location** 46°05'–12'N 34°21'–50'E Between Genichesk and the north-east coast of the Crimea, Ukrainian S.S.R., and largely isolated from the rest of the Sea of Azov by the Arabatskaya Strelka.

**Area** 22,240 ha.

**Altitude** Practically sea level.

**Water depth** Up to 1 m, altering according to whether winds are off-shore or on-shore.

**Wetland types** 5, 6, 10, 11, 17, 18, 25.

**Ecology** The ecosystem consists of eutrophic shallow salt-water bays with numerous spits and islands which tend to become parched in times of drought and are very exposed when the wind is blowing off-shore. The generally flat and treeless coast is covered with a halophytic sward. The high degree of biological productivity helps to sustain numerous nesting, moulting and migrating waterfowl according to season. Duck Anatidae and waders Limicolae predominate among the migrants and are numbered in the hundreds of thousands. The breeding population is of the order of 10,000 pairs, composed mainly of Shelduck *Tadorna tadorna*, Great Black-headed Gull *Larus ichthyaetus*, Sandwich Tern *Sterna sandvicensis* and Little Tern *Sterna albifrons*. The bay provides one of the most important moulting places of Mute Swan *Cygnus olor* (3,000–4,000) and Shelduck *Tadorna tadorna* (2,000–3,000) in the USSR.

**Legal status** The boundaries of the wetland and of the Azavo-Sivashskiy state hunting reserve coincide, so that hunting is controlled and the whole area enjoys reasonable protection.

**Tenure** State ownership.

**Management practices** Strictly controlled hunting.

**Threats** None reported.

**Scientific research** Mid-winter counts of waterfowl have been carried out periodically since the 1960s but there has been no systematic programme of studies although both the biological and limnological aspects are of interest.

### Principal reference material

Sabinevskiy, B. V. and Sevastjanov, V. I. 1975. Distribution of waterfowl in the north-western coast of the Sea of Azov, in Sivash, and in Karkinitzkiy and Dzarilgachskiy Bays of the Black Sea in January 1975. In *Transactions of the All-Union Conference on bird migration*, part I, Moscow.

## 7. KARKINITSKI BAY

**Criteria for inclusion** 1a,b,c; 2a; 3a,b,c; 4a,b.

**Geographical location** 45°50'–46°00'N 33°22'–47'E On the opposite side, or west, of the Crimean isthmus to Sivash Bay (Listed Area No. 6). The greater part comes under the jurisdiction of the Crimean province of the Ukrainian S.S.R.

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**Area** 37,400 ha.

**Altitude** Sea level.

**Water depth** Average about 8 m, decreasing to 1 m or less in inshore waters.

**Wetland types** 5, 6, 7, 10.

**Ecology** Typically of the steppe-zone bordering the Black Sea on the north, the flat coast is broken up into numerous spits and islands, its dominant vegetation thick reedbeds of *Phragmites communis*. The salt water has a rich benthos, as indicated by extensive submerged stands of eel-grass *Zostera* and stoneworts *Chara*.

The bay is important for waterfowl at all seasons. Up to 100,000 Anatidae and Limicolae pass through in spring and especially in autumn, the Whooper Swan and Mute Swan *Cygnus cygnus* and *olor*, and the Greylag Goose *Anser anser* and White-fronted Goose *A. albifrons* being the most numerous of the former and Ruff *Philomachus pugnax* and various sandpipers *Calidris* spp. the most numerous of the latter. About 12,000 pairs of waterfowl nest, notably Shelduck *Tadorna tadorna*, Red-breasted Merganser *Mergus serrator*, Herring Gull *Larus argentatus*, Mediterranean Gull *L. melanocephalus*, Gull-billed Tern *Gelochelidon nilotica*, Caspian Tern *Hydroprogne tschegrava* and Common Tern *Sterna hirundo*. Specially protected colonies, totalling about 1,000 pairs, are composed mainly of Little Egret *Egretta garzetta*, Great White Egret *E. alba*, Grey Heron *Ardea cinerea* and Glossy Ibis *Plegadis falcinellus*. Some 200 Mute Swans *Cygnus olor* spend the summer in the bay, without nesting, and they and others collect here in what is one of the most important moulting grounds of the species, in numbers of up to 4,000 or 5,000. Finally, the wintering population of well over 50,000 waterfowl, includes swans, sea-ducks and freshwater ducks, Coots *Fulica atra* and gulls.

**Legal status** A protected section of the Krimskoye hunting reserve (the Lebjazji islands, 100 ha), where no human exploitation or recreational activities are allowed, is located within the borders of the wetland; otherwise the water area is under general protection.

**Tenure** State ownership.

**Management practices** Controlled commercial fishing; recreational activities restricted to the sea-shore.

**Threats** None reported.

**Scientific research** Systematic studies are carried out by the research staff of the Krimskoye state hunting reserve. Annual counts of moulting *Cygnus olor* and *Tadorna tadorna*; participation in the international programme for colour-marking certain species of wild swan; and some hydrobiological investigations.

#### **Principal reference material**

Ardamatskaya, T. B. 1970. Wildfowl of the Ukrainian Black Sea Coastal Region. In *Proc. Internat. Regional Meeting Conserv. Wildfowl Resources*, Leningrad, USSR, 26-30 Sept., 1968. Moscow.

#### **8. DUNAI (Danube) tidal flats (Dunajskiye plavni) with YAGORLYTSKI and TENDROVSKI BAYS**

**Criteria for inclusion** 1a,b,c,d,e; 2a; 3a,b,c; 4a,b.

**Geographical location** Dunajskiye plavni: 45°25'–30'N 29°32'–40'E Along the coast near the main Danube rivermouth and Romanian border about 150 km south-west of Odessa. The Yagorlytski Liman and Tendrovskiy Zaliv: 46°07'–30'N 31°35'–32°10'E About 50–60 km south-west of Kherson and the same distance due east of Odessa, in the Nikolayev and Kherson districts of the Ukrainian S.S.R.

**Area** Dunajskiye plavni – 7,800 ha; Yagorlytski and Tendrovski Bays – 84,700 ha.

**Altitude** Sea level rising to several metres above sea-level on the coastal fringe.

**Water depth** Maximum up to 6 m.

**Wetland types** Dunajskiye plavni - 6, 9, 11, 18; Yagorlytski and Tendrovski Bays – 5, 6, 7, 10, 11, 17.

**Ecology** The Dunajskiye plavni consists of channels, islands, sandy spits and fresh-water lakes, with the typical vegetation of such areas – composed largely of dense reedbeds of *Phragmites communis*, *Typha* and *Carex* and extensive submerged stands of *Vallisneria spiralis*, *Trapa natans*, *Salvinia natans* and similar species.

The Yagorlytski and Tendrovski Bays are salt-water lagoons, separated from the Black Sea by low, narrow sandy spits. Ground vegetation is represented by pseudo-steppe forms, while the shallow waters support a rich aquatic vegetation mainly of such species as eel-grass *Zostera*, tassel pondweed *Ruppia* and stoneworts Characeae.

Several thousand pairs of waterfowl, including some rare protected species, nest in the Dunajskiye plavni wetlands, among them the Dalmatian Pelican *Pelecanus crispus*, White Pelican *Pelecanus onocrotalus*, Spoonbill *Platalea leucorodia*, Glossy Ibis *Plegadis falcinellus*, Mute Swan *Cygnus olor*, Greylag Goose *Anser anser*, Ferruginous Duck *Aythya nyroca* and Coot *Fulica atra*. An estimated 50,000 birds, including ducks, gulls, coots and about 2,500 swans, overwinter on the flats.

Tendrovski and Yagorlytski Bays, on the other side of Odessa, provide nesting grounds for much greater numbers of waterfowl, an estimated 200,000 to 230,000 pairs, notably Shelduck *Tadorna tadorna*, Gadwall *Anas strepera*, Red-breasted Merganser *Mergus serrator*, Redshank *Tringa totanus*, Mediterranean Gull *Larus melanocephalus*, Slender-billed Gull *L. genei* and Sandwich Tern *Sterna sandvicensis*. Yagorlytski is another most important summer moulting ground for *Cygnus olor* (800–1,000). The total wintering population of the two bays is of the order of 100,000, chiefly made up of the swans *Cygnus cygnus* and some 12,000 *C. olor*, surface-feeding ducks – Mallard *Anas platyrhynchos*, Wigeon *A. penelope* and Teal *A. crecca*, diving ducks – Pochard *Aythya ferina* and Ferruginous Duck *A. nyroca*, and Coot *Fulica atra*. The Red-breasted Goose *Branta ruficollis* is a not uncommon wintering species. In spring and again in autumn the two bays are in the path of great movements of waterfowl, sometimes totalling several hundreds of thousands of birds. The most numerous are divers *Gavia* spp., grebes *Podiceps* spp., *Cygnus cygnus*, *C. olor*, Greylag Goose *Anser anser*, White-fronted Goose *A. albifrons*, sandpipers *Calidris* spp. and Ruff *Philomachus pugnax*. Other quite abundant Limicoline species are Common Snipe *Gallinago gallinago* and Woodcock *Scolopax rusticola*.

**Legal status** The 50,000 ha Chernomorski state nature reserve occupies some of the area of the two bays and gives total protection, with no human exploitation or recreational activities permitted; also the no-shooting area of the Yagorlytski

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ornithological refuge (30,300 ha), so that in effect only the remaining 4,400 ha have to rely on general protection.

**Tenure** State ownership.

**Management practices** Limited and controlled fishing. No other information.

**Threats** None reported.

**Scientific research** Systematically undertaken by the research staff of Chernomorski state nature reserve and Odesskiy State University. Regular counts of wintering and nesting birds are made and scientists participated in the international programme for colour-marking of swans in order to elucidate their distribution and movements.

**Principal reference material**

Ardamatskaya, T. B. 1970. Wildfowl of the Ukrainian Black Sea Coastal Region. In *Proc. Internat. Regional Meeting Conserv. Wildfowl Resources*, Leningrad, 25–30 Sept., 1968. Moscow.

**11. ISSYK-KUL Lake**

**Criteria for inclusion** Not assessed.

**Geographical location** 42°09'–45'N 76°09'–78°23'E About 100 km due south of Alma Ata, Kirghiz S.S.R.

**Area** 629,800 ha.

**Altitude** 1,609 m.

**Water depth** Maximum 702 m; mean 279 m.

**Wetland type** 19.

**Ecology** A large deep lake lying in a tectonic basin between the ranges of the Kungei Alatau to the north and the Terskei Alatau to the south. It has no outflow and the water is brackish and oligotrophic, with a transparency of 20.4 m. The lake water does not freeze over during the winter, the water temperature never falling below 2.75°C.

**Legal status** The Issyk-Kulsky State Reserve, listed in the World Directory of National Parks and other Protected Areas, but not described, is quoted as covering 809,000 hectares so must include a considerable belt of country round the shores of the lake.

**Tenure** State ownership.

**Management practices** Fishery for the Zander or pike-perch *Stizostedion lucioperca* and also for introduced Carp *Cyprinus carpio*. There is a health resort with hot-springs at Aksu on the lake shore.

**Threats** Possible changes in run-off and inflow into the lake due to afforestation of mountain slopes surrounding the lake.

**Scientific research** The lake is important for limnological research. A number of studies have been undertaken and papers published, eight of which are listed in the Project AQUA volume (Luther and Rzóska, 1971), in which this site is included.

**Principal reference material**

- Two of the more general publications are –  
 Sherbakov, D. I. 1952. On the shores of Issyk-Kul. *Nauka i Zhizn* 1.  
 Baranov, I. V. 1961. Limnological types of lakes of the USSR. *Hydroteioizdat*. Leningrad.

**12. KHANKA Lake**

**Criteria for inclusion** Not assessed.

**Geographical location** 44°32'–45°14'N 132°00'–52'E About 160 km north of Vladivostock, in the Primorski district of the R.S.F.S.R., the border with China (Manchuria) crossing the lake at its northern end about 20 km from the northern shore.

**Area** 310,000 ha (USSR sector; total including the Chinese sector about 400,000 ha).

**Altitude** 69 m.

**Water depth** Maximum 10 m.

**Wetland type** 18.

**Ecology** An extensive lake lying in a basin of one of the headwaters of the Ussuri River, with an outflow via this tributary (the Sungucha) into the main Ussuri. Plants which are relicts of the Tertiary are to be found in and around the lake. Much of this surrounding area has, however, now been put under rice cultivation. The lake and its inflowing and outflowing rivers were noted for the presence of two endangered species of Ciconiiformes, the Oriental White Stork *Ciconia boyciana* and the Japanese Crested Ibis *Nipponia nippon*, but there are no recent reports of the occurrence of the two species in the immediate vicinity.

**Legal status** No information, but reported to make no provision for the protection of the lake area.

**Tenure** State ownership.

**Management practices** Rice-growing and fishery; there is a good deal of boat traffic on the lake.

**Threats** The fisheries and lake navigation, in particular, may disturb relict species of considerable limnological interest.

**Scientific research** No information.

**Principal reference material**

None quoted.

# UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND

## SUMMARY OF WETLAND SITUATION

With a coastline exceeding 7,000 km, numerous offshore islands, a wide variety of freshwater habitats and a temperate climate, the British Isles provide refuge for many species of waterfowl particularly on passage and in winter. The richest areas are found in and bordering the intertidal zone. The extensive tidal flats on the northern Irish Sea coasts, from the Solway to north Wales, and the coasts of the North Sea and Channel are particularly important. The shallower coastal waters of northern Scotland and offshore islands are significant for the numbers of wintering sea-ducks. Farmland and the coastal grazing marshes of east and southern Scotland, as well as certain localities in England (Ribble, Wash, Severn), support the majority of the world population of several species of geese Anserinae. These geese also depend on estuaries and inland wetlands for roosting.

The larger inland waters, which are ice-free in all but the most exceptional winters, complement the coastal sites. They include natural lakes such as Lough Neagh in Northern Ireland and Loch Leven in south-east Scotland, as well as freshwater marshes, man-made reservoirs and gravel pits.

Most of the areas of greatest importance for breeding waterfowl are in northern Scotland where human population pressures are less acute. Here sea lochs, highland lakes and extensive tracts of peatland provide relatively undisturbed sites for both ducks Anatidae and wading birds of the Order Charadriiformes.

Nearly 100 wetlands of international importance have been identified in Great Britain and many are notified as Sites of Special Scientific Interest (SSSI). This ensures that the Government's statutory adviser on nature conservation, the Nature Conservancy Council (NCC), is included in the planning consultation process and can draw attention to the likely ill effects of any proposed developments. Some key sites are owned by the NCC or Voluntary bodies such as the Royal Society for the Protection of Birds. Other sites are safeguarded by management agreements. Thirteen sites have so far been designated under the Ramsar Convention on Wetlands of international importance, which the United Kingdom ratified on 5 January 1976, and these are indicated under 'conservation status' in the check-list which follows.

Waterfowl research is undertaken by voluntary organizations such as the RSPB, Wildfowl Trust, British Trust for Ornithology (BTO) and many university departments as well as the Institute of Terrestrial Ecology. The NCC supports much of this work and carries out survey work of its own. A book, 'The estuary birds of Britain and Ireland' is currently being written based on data gathered by the NCC-funded Birds of Estuaries Enquiry.

It should be noted that in the check-list below, initials are used under the 'conservation status' heading for the various types of protected area or organizations concerned with protection, as follows:

AONB Area of Outstanding Natural Beauty  
ASI Area of Scientific Interest

LNR	Local Nature Reserve
NNR	National Nature Reserve
NWR	National Wildfowl Refuge
RSPB	Royal Society for the Protection of Birds
SBS	Statutory Bird Sanctuary
SSSI	Site of Special Scientific Interest
SWT	Scottish Wildfowl Trust
WT	Wildfowl Trust

## WETLANDS OF INTERNATIONAL IMPORTANCE

### \*Nominated for inclusion in the Ramsar Convention list

	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
<b>England</b>					
1.	Abberton Reservoir (Essex)	51°49'N	0°52'E	1,228 ha	1a,b; 3a,b NWR, SBS, SSSI
2.	Blackwater Flats and Marshes (Essex)	51°44'N	0°40'–53'E	1,276 ha	1a,b,c,e SSSI
*3.	Bridgwater Bay (Somerset)	51°13'N	3°04'W	4,266 ha	1a,e; 2a; 3c NNR, NWR, Ramsar Convention listed site
*4.	Bure Marshes (Norfolk)	52°40'–42'N	1°24'–29'E	412 ha	1d,e; 2a; 3b,c NNR (part owned by Norfolk Naturalists' Trust).
5.	Chesil Bank and Fleet (Dorset)	50°37'N	2°28'–36'W	792 ha	1a,c,d; 2c; 3b SBS, SSSI, AONB
6.	Chichester and Langstone Harbours (Sussex, Hampshire)	50°48'–49'N	0°01'–55'W	5,528 ha	1a,b,e; 3b SSI, RSPB reserve (Gayton sands)
7.	Cranes Moor (Hampshire)	50°50'N	1°43'W	435 ha	2a SSSI
8.	Dee Estuary (Cheshire and Clwyd)	53°12'–23'N	3°02'–19'W	12,611 ha	1a,b; 3a,b SBS, SSSI. Partly RSPB reserve.
9.	Duddon Estuary (Cumbria)	54°13'N	3°14'W	3,817 ha	1a,b SSSI
10.	Esthwaite Water (Cumbria)	54°22'N	2°59'W	170 ha	1e; 3b NNR, SSSI
11.	Exe Estuary (Devon)	50°37'N	3°25'W	2,314 ha	1a,b,c; 3b SSSI
12.	Foulness and Maplin Sands (Essex)	51°40'N	0°52'E	13,600 ha	1a,b,c; 3b SSSI
13.	Hamford Water (Essex)	51°53'N	1°13'E	2,396 ha	1c,e; 2a SSSI
*14.	Hickling Broad and Horsey Mere (Norfolk)	52°43'–46'N	1°34'–39'E	829 ha	1c; 3c NNR, SSSI, partly Norfolk Naturalists' Trust property, Ramsar Convention listed site.



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	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
15.	Humber (Humberside)	53°40'N	0°44'W	12,600 ha	1a,b SSSI
16.	Irthinghead Mires (Cumbria, Northumberland)	55°05'N	2°31'W	603 ha	1e; 2b; 3a SSSI
*17.	Lindisfarne (Northumberland)	55°36'–41'N	1°50'W	3,123 ha	1a,b,c; 3b NNR, AONB, Ramsar Convention listed site
18.	Malham Tarn and vicinity (North Yorkshire)	54°06'N	2°10'W	335 ha	1c; 3b SSSI
19.	Medway Estuary (Kent)	51°24'N	0°41'E	7,942 ha	1a,b SSSI
*20.	Minsmere Level – Walberswick (Suffolk)	52°14'N	1°36'W	1,902 ha	1c; 2a; 3a,b,c SSSI, RSPB non statutory Nature Reserve (611 ha), Ramsar Convention listed site.
21.	Moor House (Cumbria)	54°41'N	2°25'W	3,894 ha	1c; 2a; 3b NNR, Designated a Biosphere Reserve.
22.	Morecambe Bay (Lancashire, Cumbria)	53°56'– 54°14'N	2°46'–3°11'W	39,100 ha	1a,b; 3b SSSI
23.	Mersey Estuary (Merseyside)	53°19'N	2°50'W	6,346 ha	1a,b SSSI
*24.	North Norfolk coast (Norfolk) incl. Scott Head, Holkham, Blakeney Point and Cley- Salthouse marshes	52°55'–57'N	0°41'–1°05'E	5,559 ha	1c,e; 2a; 3a,b,c NNR, SSSI, Ramsar Convention listed site
*25.	Ouse Washes (Cambridgeshire, Norfolk)	52°21'–36'N	0°01'–22'E	3,003 ha	1a,b,c; 2b; 3a,b,c NWR, SSSI, Ramsar Convention listed site (2,598 ha)
26.	Redgrave – South Lopham Fen (Norfolk, Suffolk)	52°21'N	1°00'–02'E	130 ha	1c; 2a SSSI
27.	Ribble Estuary (Lancashire, Merseyside)	53°39'–46'N	2°42'–3°01'W	11,740 ha	1a,b NNR, SBS, SSSI
28.	Rostherne Mere (Cheshire)	53°21'N	2°23'W	151 ha	1a; 3b NNR
29.	Roydon Common (Norfolk)	52°46'N	0°30'E	181 ha	2a,b SSSI
30.	Scarning Fen (Norfolk)	52°40'N	0°53'E	4 ha	1d,e SSSI

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	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
31.	Severn Estuary from New Grounds, Slimbridge, to Cardiff (Avon, Gwent, Glamorgan)	51°30'–43'N	2°29'–3°13'W	35,200 ha	1a,b; 3b SSSI, WT management of 1,857 ha.
32.	Stour Estuary (Suffolk, Essex)	51°57'–58'N	1°04'–17'E	2,166 ha	1a,b; 2a SSSI
33.	Surlingham Broad and Marshes and Rockland Broads (Norfolk)	52°35'–37'N	1°24'–27'E	309 ha	1c,d; 3b SSSI
34.	The Swale and South Sheppey (Kent)	51°21'–25'N	0°44'–58'E	9,102 ha	1a,b,c,e; 2a LNR, SSSI
35.	Upper Solway incl. Rockcliffe and Burgh Marshes (Cumbria), Caerlaverock and Blackshaw Bank (Dumfries) and the Nith Merses (Galloway)	54°50'– 55°00'N	3°03'–39'W	29,300 ha	1a,b; 3b Includes Caerlaverock NNR (5,406 ha)
36.	Taw/Torridge Estuary (Devon)	51°00'–07'N	4°04'–13'E	4,046 ha	1a,b SSSI, includes Braunton Burrows NNR (605 ha)
37.	Teesmouth (Cleveland)	54°36'–39'N	1°07'–11'E	496 ha	1a,b; 3b SSSI
38.	The Wash (Norfolk, Lincolnshire)	52°48'– 53°08'N	0°01'–34'E	68,500 ha	1a,b SSSI, LNR (Gibraltar Point, 400 ha)
39.	Derwent Ings between Wheldrake and Wressell (North Yorkshire, Humberside)	53°47'–53'N	0°55'W	300 ha	1a; 2a SSSI
<b>Scotland</b>					
	Upper Solway Flats and Marshes	See No. 35 above			
40.	Blar nam Faoileag (Highland)	58°23'N	3°28'N	4,600 ha	2a SSSI
41.	Cairngorm Lochs (Crampian)	58°04'N	3°47'W	179 ha	2a,b NNR
42.	Carsebreck Lochs (Tayside)	56°16'N	3°50'W	344 ha	1a SSSI
43.	Claish Moss (Strathclyde)	56°45'N	5°44'W	526 ha	1c; 2a NNR
44.	Cromarty Firth (part) (Highland)	57°40'N	4°15'W	12,533 ha (provisional)	1a,b SSSI

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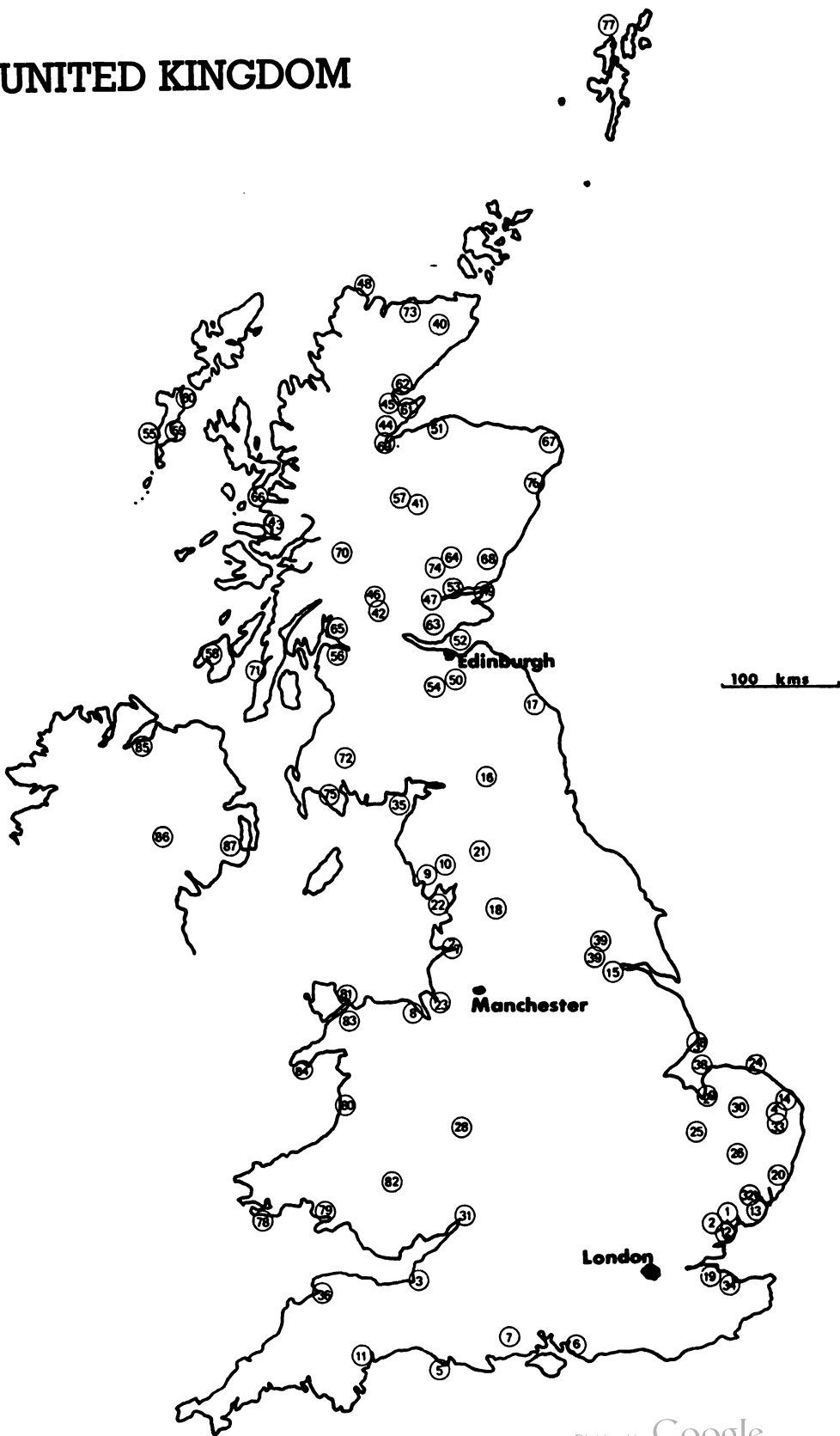
	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
45.	Lower Dornoch Firth (Highland)	57°51'N	4°06'W	3,436 ha (provisional)	1a SSSI
46.	Drummond Point (Tayside)	56°20'N	3°51'W	134 ha	1a SSSI
47.	Dupplin Lochs (Tayside)	56°22'N	3°34'W	265 ha	1a,b SSSI
48.	Lochs Croispol, Ian Innis and Borralaidh, Durness (Highland)	58°33'N	4°46'W	495 ha	2a Major part SSSI
49.	Eden Estuary and Tentsmuir Point (Fife)	56°22'–26'N	2°48'–51'W	1,205 ha	1a,b NNR, LNR, SSSI
50.	Fala Flow (Lothian)	55°49'N	2°55'W	529 ha	1a SSSI
51.	Findhorn Bay (Crampian)	57°38'N	3°41'W	5,050 ha	1c; 2a SSSI
52.	Firth of Forth (Fife, Lothian)	56°06'N	2°58'W	2,750 ha	1a,b SSSI, LNR
53.	Firth of Tay (Tayside, Fife)	56°23'N	3°10'W	2,200 ha	1a SSSI
54.	Gladhouse Reservoir (Lothian)	55°46'N	3°07'W	302 ha	1a,b SSSI, LNR
55.	Howmore Estuary, Loch Roag and Loch Fada (Western Isles)	57°18'N	7°23'W	328 ha	2a SSSI
56.	Inner Clyde (Strathclyde)	55°56'N	4°34'W	1,419 ha	1a,b SSSI
57.	Insh Marshes (Highland)	57°06'N	3°52'W	1,000 ha	1c; 2e; 3b RSPB reserve, SSSI
58.	Gruinart and Indaal lochs, Islay (Strathclyde)	55°45'–55'N	6°15'–23'W	c.3,700 ha	1a,b; 2a SSSI
*59.	Druidibeg, a'Machair and Stilligary Lochs (Western Isles: South Uist)	57°19'–21'N	7°21'–24'W	1,677 ha	1a; 3b NNR (1,658 ha), SSSI, Ramsar Convention listed site
60.	Loch an Duin (Western Isles: North Uist)	57°39'N	7°11'W	49 ha	2a SSSI
61.	Loch Eye (Highland)	57°48'N	3°58'W	360 ha	1d,e SSSI
62.	Loch Fleet (Highland)	57°56'N	4°02'W	1,283 ha	2a SSSI
*63.	Loch Leven (Tayside)	56°12'N	3°23'W	1,597 ha	1a,b; 3a,b NNR, Ramsar Convention listed site

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	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
64.	Loch Lintrathen (Tayside)	56°41'N	3°10'W	218 ha	1a SWT Reserve, SSSI
*65.	Loch Lomond (Strathclyde)	56°04'N	4°35'W	7,100 ha	1d; 3b NNR. Ramsar Convention listed site (253 ha)
66.	Loch Morar (Highland)	56°57'N	5°40'W	2,630 ha	2b SSSI
67.	Loch of Strathbeg (Grampian)	57°37'N	1°52'W	365 ha	1a,b SSSI
68.	Loch of Rescobie and Balgavies (Tayside)	56°39'N	2°47'W	212 ha	1a SSSI
69.	Munlochy Bay (Highland)	57°33'N	4°13'W	348 ha	1a,b SSSI
*70.	Rannoch Moor (Highland, Strathclyde, Tayside)	56°33'–42'N	4°28'–47'W	10,300 ha	1c,e; 2a NNR (1,482 ha), Ramsar Convention listed site (1,499 ha)
71.	Rhunahaorine (Strathclyde)	56°40'N	5°40'W	327 ha	1a SWT reserve, SSSI
72.	Silver Flowe (Dumfries and Galloway)	55°07'N	4°23'W	608 ha	2a,b 188 ha included in an NNR/SSSI. The total area, 3,105 ha incl the Galloway Forest Park, is designated as a Biosphere Reserve.
73.	Strathy River Bogs (Highland)	58°27'N	4°03'W	894 ha	2a NNR, SSSI
74.	Tay-Isla Valley (Tayside)	56°34'–35'N	3°19'–26'W	1,118 ha	1a,b SSSI
75.	White Loch (Dumfries, Galloway)	54°46'N	4°33'W	60 ha	1a SSSI
76.	Ythan Estuary (Grampian)	57°20'N	1°58'W	980 ha	1a,b NNR (part)
77.	North Roe (Shetland Islands)	60°34'N	1°25'W	3,061 ha	2a SSSI
<b>Wales</b>					
78.	Bosherston Lake (Dyfed)	51°36'N	4°55'W	80 ha	2b SSSI
79.	Burry Inlet (Dyfed, West Glamorgan)	52°48'N	4°15'W	4,942 ha	1a,b,c,e; 2a Part included in an NNR/SSSI
*80.	Cors Fochno and Dyfi (Dyfed, Gwynedd, Powys)	52°29'–34'N	3°41'–4°03'W	2,497 ha	1c,e; 2a,b; 3b NNR/SSSI (1,607 ha) Ramsar Convention listed site

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	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
81.	Conwy Bay (Gwynedd)	53°14'–19'N	3°50'W	2,610 ha	1a,b SSSI
82.	Llangorse Lake (Powys)	51°56'N	3°16'W	220 ha	1e; 2a National Park (Brecon Beacons), SSSI
83.	Llyn Idwal (Gwynedd)	53°07'N	4°02'W	12 ha	2a,c Included in Cwm Idwal NNR (398 ha)
84.	Llyn Tegid (Gwynedd)	52°53'N	4°37'W	435 ha	2a; 3b In National Park (Snowdonia), SSSI
<b>Northern Ireland</b>					
85.	Lough Foyle parts of (a) east and (b) south-west coasts (Londonderry)	(a)55°02'– 11'N (b)55°04'– 07'N	6°58'–7°06'W  7°12'–16'W	3,000 ha	1a,b; 2a ASI, includes an NNR in the Roe estuary
*86.	Loughs Neagh and Beg (Antrim, Londonderry, Tyrone, Armagh, Down)	54°30'–50'N	6°13'–37'W	51,800 ha	1a,b,e; 3a Ramsar Convention listed site, ASI.
87.	Strangford Lough (Down)	54°20'–36'N	5°32'–45'W	13,700 ha	1a,b,c,e ASI, NNR (Granagh Bay, Quoile Pondage Basin), SBS (Grey Abbey Is.)

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**DETAILS OF LISTED AREAS**

**1. ABBERTON RESERVOIR**

**Criteria for inclusion** 1a,b; 3a,b.

**Geographical location** 51°49'N 0°52'E At its nearest point 4.5 km south of the centre of Colchester, Essex, and thence extending south-westwards a distance of c.7 km.

**Area** 1,228 ha.

**Altitude** c.20 m.

**Water depth** Maximum c.16 m; mean 4.7 m.

**Wetland type** 15.

**Ecology** A permanent lowland reservoir, with rich aquatic and marsh flora, about 6 km to the north of the Blackwater estuary (Site No. 2). The lake is divided by causeways into three basins; the largest (c.400 ha) has concrete banks, the other two are fringed by a belt of great reedmace *Typha latifolia*, reed canary-grass *Phalaris arundinacea* and rushes *Juncus* spp. Summer draw-down exposes extensive mudflats in all three basins. The reservoir is bordered by farmland, which provides a useful buffer against disturbance.

The reservoir is outstandingly important as an autumn arrival point and wintering locality for migrant Anatidae (average autumn peak 1966–72, 7,500; max. 10,000), and as a moulting centre for c.2,600 Pochard *Aythya ferina* (max. 5,000) and 2,500 Tufted Duck *Aythya fuligula*. Mallard *Anas platyrhynchos* reach an average autumn/winter peak of 4,200 (max. 7,400); Teal *A. crecca* 1,650 (max. 2,700); Wigeon *A. penelope* 2,000 (max. 2,750); Shoveler *A. clypeata* 400 (max. 650); *Aythya ferina* 1,000 (max. 1,600); *A. fuligula* 900 (max. 2,650); and Goldeneye *Bucephala clangula* 400 (max. 730).

**Legal status** A Statutory Bird Sanctuary, covering 1,188 ha of reservoir and surrounds, was declared in 1967. The reservoir is also notified as a Site of Special Scientific Interest.

**Tenure** Owned by Essex Water Company.

**Management practices** Permit holders only are allowed within the perimeter fence, which in most places runs 100 m from the shore. Fishing is allowed at four points. A public picnic site is provided and there is also a substantial observation hide from which visitors can view the waterfowl. The Company's regulations are enforced by its employees.

**Threats** No water sports are allowed at present, but there is an increasing demand for recreational facilities, especially sailing, throughout south-east England.

**Scientific research** An intensive bird-ringing programme has been in operation since 1949. By 1973 a total of 50,000 Anatidae had been banded, including c.30,000 *A. crecca* and 10,000 *A. platyrhynchos*. The decoy is manned throughout the year.

**Principal reference material**

Wainwright, C. B. 1967. Results of wildfowl ringing at Abberton Reservoir, Essex, 1949–1966. *Wildfowl Trust 18th Ann. Rep.*, pp. 28–35.

IUCN, 1975. *World Directory of National Parks and other Protected Areas*: ref. UNI(2).5.20. Morges.

### 3. BRIDGWATER BAY

**Criteria for inclusion** 1a,e; 2a; 3c.

**Geographical location** 51°13'N 3°04'W Adjoining the estuary of the River Parrett and about 9.5 km north of Bridgwater, Somerset. The bay at its nearest point is 29 km south-west of Bristol, Avon.

**Area** 4,266 ha.

**Altitude** Almost all at sea level.

**Water depth** In this largely intertidal area the mean rise and fall of the tide varies from 1.9 to 4.6 m.

**Wetland type** 3, 8.

**Ecology** The site includes the extensive intertidal mudflats to the west of the River Parrett, 41 ha of saltmarsh pasture, a 4.8 km strip of the river bank south from the mouth, and 9 km of the Huntspill River, an artificial waterway built to help drain the Somerset levels in the hinterland. The main habitats are mudflats, saltmarsh, shingle beach, dune grassland and sea wall. The principal botanical feature is the extensive sward of rice grass *Spartina townsendii*. Over 100 species of flowering plants have been recorded, including the very local Ray's knotgrass *Polygonum raii* and sea purslane *Halimione portulacoides*.

More than 200 species of birds have been recorded in the area, mainly Anatidae and waders. Up to 3,000 Shelduck *Tadorna tadorna* use the Bay as a moulting ground, the only known site in Britain. The Wigeon *Anas penelope* reaches an average winter peak of 4,800 (max. 10,000), Mallard *A. platyrhynchos* 2,400 (max. 4,000), Teal *A. crecca* 900 (max. 2,150) and Black-tailed Godwit *Limosa limosa* 1,500 (max. 5,000). A flock of 50–100 White-fronted Geese *Anser albifrons* (max. 360) roosts on Fenning Island, 1 km offshore, which is also used as a nesting site by c.2,000 pairs of gulls, mainly Herring Gull *Larus argentatus* and Lesser Black-back *L. fuscus*.

**Legal status** An area now calculated to be 2,459 ha has been a National Nature Reserve since 1954. The total bay area has been designated for the Ramsar (Wetlands) Convention list. The Nature Conservancy Council manages the NNR section under a Nature Reserve Agreement with the Somerset River Authority.

**Tenure** The Nature Conservancy Council (of the National Environment Research Council) owns 51 ha, the rest is publicly owned.

**Management practices** One full-time warden is employed to manage the reserve and assist in research. Shooting by permit is allowed in parts of the reserve. An observation hide overlooks the area most used by waterfowl.

**Threats** None reported.

**Scientific research** Regular counts of wildfowl and waders; studies of the feeding preferences of *A. penelope*, to provide information necessary for the management of the saltmarsh; extensive studies of *Spartina* by the Nature Conservancy; and studies by university workers on the coastal formation processes of erosion and accretion.

#### Principal reference material

There are many scientific publications dealing with the research carried out on the Reserve in the fields of ornithology, botany and physiology. A bibliography



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has been prepared by the Nature Conservancy Council, which has also published a Guide for visiting naturalists. The area is listed and described in the World Directory of National Parks and other Protected Areas (IUCN, 1975): ref. UNI(2).5.9. Morges.

### 4. BURE MARSHES

**Criteria for inclusion** 1d,e; 2a; 3b,c.

**Geographical location** 52°41'N 1°29'E Floodplain of River Bure between Wroxham and Ranworth, about 10 km north-east of Norwich, Norfolk.

**Area** 412 ha.

**Altitude** Sea level to 5 m.

**Water depth** c.1 m.

**Wetland type** 18 (50 ha), 21 (362 ha).

**Ecology** Most of the unreclaimed fenland in the flood plain of the River Bure between Wroxham and Ranworth; subject to a small tidal fluctuation. It contains three lakes, which originated as mediaeval peat diggings, and most of the remaining area was later managed as shallow turf ponds, mowing marshes or sedge beds. These activities have declined greatly since the early 1900s and natural succession has since resulted in the invasion of turf ponds by fen vegetation and the transition of fen to fen woodland. The former system of man-made canals has also silted up and become overgrown.

The reserve contains a wide variety of fenland communities, ranging from aquatic and open fen habitats to mature alder *Alnus* woodland. The vegetation is influenced by the alkaline nutrient-rich condition of the water. The dominant species of open fen are reed *Phragmites communis* and fen sedge *Cladium mariscus*, often associated with marsh hog's fennel *Peucedanum palustre*, bog myrtle *Myrica gale* and berry-bearing alder *Frangula alnus*. Other widespread species include royal fern *Osmunda regalis*, marsh fern *Thelypteris palustris*, lesser tussock sedge *Carex mepropinquata*, and cowbane *Cicuta virosa*.

The diverse habitats support a wide variety of breeding birds, including Great Crested Grebe *Podiceps cristatus*, Gadwall *Anas strepera*, Teal *A. crecca*, Shoveler *A. clypeata* and Kingfisher *Alcedo atthis*. There are also large colonies of Grey Heron *Ardea cinerea* and Common Tern *Sterna hirundo*. The winter population of Anatidae totals 1–2,000. The Otter *Lutra lutra* is resident in the reserve.

There is a moderately strong population of the Swallowtail butterfly *Papilio machaon britannica*, a subspecies now confined to this district.

**Legal status** National Nature Reserve since 1958. Designated for the Ramsar (Wetlands) Convention list.

**Tenure** Managed by the Nature Conservancy Council under Nature Reserve Agreements with three separate private owners.

**Management practices** The aim is to maintain substantial areas of open fen and to clear and maintain the dike system. Access to the reserve is restricted to a trail from which visitors can, during the summer months, see one of the lakes and most of the various habitats; it is used by nearly 10,000 people each year. A warden and estate worker are employed throughout the year, and the trail is managed by a seasonal warden.

**Threats** The River Bure, adjoining the Reserve, carries an exceptionally heavy traffic of pleasure craft, and pollution by oil and eutrophication by sewage are possible threats. Unauthorised entry into the Reserve is not a problem, thanks to the difficult terrain.

**Scientific research** Much of the work on the origin of the Norfolk Broads and on the sequence of natural succession and alluvial stratigraphy of the Broadland fens, was done in the Reserve. It is currently being used for research into the ecology of dikes, the Water Vole *Arvicola amphibius* and Coypu *Myocaster coypus*.

**Principal reference material**

Lambert, J. M. 1951. Alluvial stratigraphy and vegetational succession in the region of the Bure valley broads. *J. Ecol.* 39.

Lambert, J. M. *et al.* 1960. The making of the broads. *R. Geogr. Soc. Research Series* 3.

Ellis, E. A. 1965. *The Broads*. Collins, London.

Nature Conservancy, 1965. *Report on Broadland*. London.

IUCN, 1977. *World Directory of National Parks and other Protected Areas*; ref. UNI2).7.6. Morges.

## 5. CHESIL BANK and FLEET

**Criteria for inclusion** 1a,c,d; 2c.

**Geographical location** 50°37'N 2°28'–36'W 5 km west of Weymouth, Dorset.

**Area** 792 ha.

**Altitude** Sea level.

**Water depth** Less than 1 m over most of the Fleet at minimum tide level; 2.5 m deep in the 'Narrows' channel.

**Wetland type** 7.

**Ecology** The Fleet is a natural lagoon, separated from the sea by the 150 m wide shingle ridge of the Chesil Bank. It is 13 km long, varies in width from 200 m to 850 m, and connects with the sea through a small gap at the eastern end. The Fleet is tidal and sea water can also percolate through the bank; at times the water level in the Fleet may be as much as 2.5m above that of the sea since it does not drain entirely at low tide. Consequently only small areas of bottom are exposed at low water, mainly in the eastern sector.

The dominant plant is eel-grass *Zostera* spp., occurring in extensive beds at the western end. The drift line is dominated in parts with shrubby sea-blite *Suaeda fruticosa*. The only other woody plants are blackthorn *Prunus spinosa*, fen sallow *Salix cinerea* and *Tamarix anglica*. Sea campion *Silene maritima* and sea pea *Lathyrus japonicus* are abundant higher up on the Bank. In all, 167 flowering plants have been recorded on the shingle ridge, the margins of the Fleet, and the Bank on the landward side. The invertebrate fauna is varied and interesting, and has been the subject of detailed studies.

The Fleet is an important nursery ground for the Bass *Dicentrarchus labrax* and a wintering area for c.7,000 Anatidae and 2,500 waders. The Wigeon *Anas penelope* reaches an annual peak of 5,000 or more and, at Abbotsbury at the western

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end, there is a semi-domesticated population of c.675 Mute Swan *Cygnus olor* (max. 850), of which 30–50 pairs breed colonially. There is also a large breeding colony of Common Tern *Sterna hirundo* and a colony of c.200 pairs of Little Tern *Sterna albifrons*.

**Legal status** The Fleet and Chesil Bank were notified as a Site of Special Scientific Interest in 1952 and also designated as an Area of Outstanding Natural Beauty. The Swannery at Abbotsbury has been designated a Statutory Bird Sanctuary.

**Tenure** Private; the bed of the Fleet, two thirds of the Chesil Bank and much of the coastline at the western end belongs to one owner, the eastern coastland to numerous owners and the eastern end of the Bank to the Crown Estate Commissioners.

**Management practices** The landowners keep strict control at the western end and hold the shooting rights, but wildfowling under their control is restricted to a limited number of members of the local Wildfowlers' Association. Tourists are catered for at the Swannery, which is controlled by a resident warden; there are boats for hire at the eastern end.

**Threats** Pollution by sewage, over-fishing, and illegal shooting on a small scale. Increased recreational use may become a threat in the future.

**Scientific research** The area has been, and continues to be, the subject of detailed physiographic and biological studies.

### Principal reference material

Spencer, B. E. 1965. Survey of the Fleet, near Weymouth, Dorset (Dec. 1964). Mimeo., Min. Ag. Fish & Food, Conway.

Bird, E. C. F. 1970. The physiography of the Fleet. *Proc. Dorset Nat. Histo. Arch. Soc.*

Carr, A. P. 1971. Experiments on longshore transport and sorting of pebbles: Chesil Beach, England. *Jour. Sedimentary Petrology* 41: 1084–1104.

Whittaker, J. E. 1972. Recent brackish and marine Ostracoda from the Fleet and Weymouth Bay, Dorset: a study in ecology. Ph.D. thesis, Univ. of Aberystwyth.

## 8. DEE ESTUARY

**Criteria for inclusion** 1a,b; 3a,b.

**Geographical location** 52°12'–23'N 3°02'–19'W Sixteen km south-west of Liverpool (Merseyside, Cheshire and Clwyd).

**Area** 12,611 ha.

**Altitude** Sea level.

**Water depth** Tidal; mean of spring tides 4 m.

**Water depth** 3, 5, 8.

**Ecology** The Dee estuary lies in a glacial valley, the origins of which are physiographically interesting. It is c.20 km long and 6 km wide, and in the upper 15 km has almost continuous expanses of intertidal sand and silt. The process of siltation is still continuing, and the conformation of the central creeks and banks is constantly changing. Along the shores, and more especially at the head of the estuary

there are extensive areas of saltmarsh, with a wide range of plant communities at different levels and in different conditions of salinity. Both northern and southern species are represented, some close to their limit of distribution, but in general the vegetation is typical of saltmarshes elsewhere in Britain. In places there has been extensive spread of rice grass *Spartina anglica* (=townsendii), following its introduction in the 1920s.

The invertebrate fauna is abundant and diverse. The channels and pools are rich in crustacea, mollusca and nematode and annelid worms, and the open flats carry notable populations of the shore crab *Carcinus maenas* and the spire-shell snail *Hydrobia ulvae*. In places up to 12,500 *Hydrobia* per square metre are recorded. The saltmarshes are also rich in invertebrates, especially arthropods.

The estuary is internationally important as a wintering-place for c.5,000 Anatidae and 120,000 waders. The Pintail *Anas acuta* reaches an average peak of 1,400 (max. 2,500) and Shelduck *T. tadorna* 2,500 (max. 4,500). The wader population includes concentrations of Oystercatcher *Haematopus ostralegus*, Ringed Plover *Charadrius hiaticula*, Knot *Calidris canutus*, Sanderling *C. alba*, Redshank *Tringa totanus*, Curlew *Numenius arquatus* and Bar-tailed Godwit *Limosa lapponica*. The estuary also attracts many thousands of wintering passerines, notably Skylark *Alauda arvensis* and Rock Pipit *Anthus spinoletta*.

Inshore marine fishes are plentiful, and the estuary is traversed by migratory freshwater species, including Salmon *Salmo salmo*. The Grey Seal *Halichoerus grypus* occurs in some numbers on the sandbanks near the mouth.

**Legal status** A Statutory Bird Sanctuary is established on c.2,400 ha of the lower estuary near West Kirby and Caldy; it includes the Hilbre Islands which provide the main wader roost at high water. The whole estuary is notified as a Site of Special Scientific Interest.

**Tenure** The Deeside Naturalists' Club leases a bird-ringing site from British Steel at Connah's Quay near the head of the estuary; the Mosey Naturalists' Association has a reserve at Shotton; RSPB owns a Reserve at Gayton Sands; the Dee Wildfowling Club has shooting rights. Otherwise most of the shoreline is presumably privately owned.

**Management practices** None, except as indicated in the previous section.

**Threats** The eventual construction of a proposed bunded reservoir storage scheme would cause major changes. Their extent will depend on the location and shape of the reservoirs and the uses to which the reclaimed land is put. Meanwhile the *Spartina anglica* invasion threatens to destroy the normal saltmarsh succession and hasten the accretion of silt. Another threat is continued industrialization, e.g. a new 250-acre industrial estate planned for Shotton.

**Scientific research** Staff and students from the University of Liverpool have made detailed studies of the progress of saltmarsh formation and of the invasion of *Spartina anglica*, over the past 20 years. Research into the birds and invertebrates of the Dee Estuary is being undertaken by Salford University. A Bird Observatory is established near Hilbre Island, and undertakes large-scale ringing of waders. Liverpool Polytechnic has initiated a study of *Calidris alpina*.

#### **Principal reference material**

Liverpool Bay Study Group papers and Dee Ins. Cons. Group list.

**14. HICKLING BROAD and HORSEY MERE****Criteria for inclusion** 1c; 3c.**Geographical location** 52°43'–46'N 1°34'–39'E Hickling is about 20 km north-east of Norwich, Norfolk, Horsey about 3.5 km further east and 2.5 km from the sea.**Area** 829 ha.**Altitude** Sea level to 5 m.**Water depth** Maximum 1.5 m; mean 1 m.**Wetland types** 18, 21.

**Ecology** Two shallow lakes, Hickling Broad itself and Heigham Sound, together with much of the marginal reedswamp and fen vegetation both inside and outside the retaining flood-bank, are included in an NNR. The Broad is believed to have been formed by extensive peat and clay digging at a time when the level of the sea was relatively low. The topography has since been extensively modified by drainage of the surrounding marshland, and by embankment of the Broad and associated waterways. The Broad is in direct connection with the River Thurne and its waters are eutrophic and slightly brackish due to percolation of salt from the sea near the source of the Thurne.

The range of habitats includes reedswamp, dominated by *Phragmites communis* or *Typha angustifolia*; sedgebeds, dominated by *Cladium mariscus*; mixed fen communities of *Schoenus nigricans*, *Carex elata*, hog's fennel *Peucedanum palustre*, *Valeriana officinalis* and yellow looestribe *Lysimachia vulgaris*; acidophilous communities of the fern *Dryopteris cristata*, cinquefoil *Potentilla palustris*, the rush *Juncus acutiflorus*, bogbean *Menyanthes trifoliata*, pale sedge *Carex curta*, the mosses *Sphagnum palustre* and *Sphagnum fimbriatum*, and fen carr (alder, birch and willow *Alnus glutinosa*, *Betula pubescens* and *Salix cinerea*); mowing or grazing marshes; and neglected grazing marshes in various stages of reversion to mixed fen. The aquatic communities are also of interest and contain greater naiad *Najas marina*, *Nitellopsis obtusa*, stonewort *Chara* spp. and the seaweed *Cladophora sauteri*.

The Hickling reserve and also Horsey Mere are noted breeding places for many species of birds, including Bittern *Botaurus stellaris*, Gadwall *Anas strepera*, Garganey *A. querquedula*, Little Tern *Sterna albifrons*, Kingfisher *Alcedo atthis* and Bearded Tit *Panurus biarmicus*. The Marsh Harrier *Circus aeruginosus*, Water Rail *Rallus aquaticus*, Dusky Redshank *Tringa erythropus*, Ruff *Philomachus pugnax* and Black-tailed Godwit *L. limosa* occur regularly, the waders often in some numbers. In winter the reserve attracts 3–4,000 Anatidae, notably Mallard *Anas platyrhynchos* (1,250), Teal *A. crecca* (1,250) and Shoveler *A. clypeata* (max. 700).

The reserve is also noted as one of the principal strongholds for the Swallowtail butterfly *Papilio machaon britannica*, a subspecies restricted to this district.

**Legal status** The National Nature Reserve (488 ha) was established in 1958. Scheduled as an Area of Outstanding Natural Beauty. Designated for the Ramsar (Wetlands) Convention list.

**Tenure** The reserve is owned by the Norfolk Naturalists' Trust and a private landowner. The Trust manages the privately owned land by agreement with the owner, and the whole is subject to a Nature Reserve Agreement with the Nature

Conservancy Council. Other areas are in private ownership.

**Management practices** The water levels in the marshland are controlled to provide optimum conditions for birds throughout the year. Boating on the Broad is unrestricted, but a permit is required to visit the surrounding marshland. Several observation hides are provided, and visitors can make escorted tours of the reserve either by boat or on foot. The reserve is maintained by a warden and two marshmen, the cost being to some extent offset by the sale of reed and sedge.

**Threats** Deterioration of water quality following improvements to drainage in the agricultural catchment area. The aquatic flora and fauna have already been adversely affected. A constant effort has to be made to control the introduced coypu *Myocaster coypus*, which has done much damage to the ecosystem.

**Scientific research** Some of the research of Lambert *et al.* on the origin of the Broads was carried out at Hickling and the site is also being used for research on the ecology of the Swallowtail butterfly.

#### Principal reference material

Lambert, J. W. *et al.* 1960. The making of the Broads. *R. Geogr. Soc. Research Series 3.*

Ellis, E. A. 1965. *The Broads.* Collins, London.

Nature Conservancy, 1965. *Report on Broadland.* London.

## 17. LINDISFARNE

**Criteria for inclusion** 1a,b,c; 3b.

**Geographical location** 55°36'–41'N 1°46'–52'W Northumberland coast, 15 km south-east of Berwick-upon-Tweed.

**Area** 3,643 ha.

**Altitude** Less than 10 m.

**Water depth** Tidal: mean rise from datum at Springs 4.7 m; at Neaps 3.8 m.

**Ecology** A National Nature Reserve includes most of the area and comprises areas of saltmarsh, and a moderately lime-rich dune system with well developed base-rich slacks. Low sandstone cliffs and wave-cut platforms with rock pools provide further diversity. The tidal flats support large populations of *Enteromorpha* seaweed and eel-grass *Zostera*, but the saltmarsh has been heavily invaded by rice-grass *Spartina anglica*. The dune system carries a particularly varied flora, combining northern and southern elements, with notable orchid and bryophyte populations in the slacks.

The primary interest is the winter population of c.25,000 Anatidae and 30,000 waders. Wigeon *Anas penelope* increased from a maximum of c.10,000 in winters 1966–68 to c.22,000 in 1970–72; Whooper Swans *C. cygnus* reach an annual peak of 3–400 and Brent Geese *Branta bernicla hrota* between 350 and 1,700 (max. recorded in 1973–74). The wader population includes 15,000 Dunlin *Calidris alpina*, 11,000 Knot *C. canutus* and 4,000 Bar-tailed Godwit *Limosa lapponica*.

**Legal status** National Nature Reserve, established 1964 and extended 1966 and 1969 to a total of 3,279 ha. Scheduled as an Area of Outstanding Natural Beauty. Designated for the Ramsar (Wetlands) Convention list.

**Tenure** Leased by the Nature Conservancy Council from private owners.

**Management practices** Bye-laws prohibit the taking of specimens, the introduction of plants or animals, the use of vehicles, except on roads, and camping, and are enforced by the Nature Conservancy Council which undertakes the management of the reserve. Access on foot is unrestricted, and there is considerable tourist pressure in summer. Up to 750 permit holders are allowed to shoot over parts of the reserve; the rest is maintained as a sanctuary. Two wardens are employed. Management projects include dune-stabilization and control of *Spartina*.

**Threats** Natural accretion, hastened by the encroachment of *Spartina*. Considerable pressure from summer visitors.

**Scientific research** Recent projects have included studies of the feeding ecology of Ringed Plover *Charadrius hiaticula*, Grey Plover *Pluvialis squatarola*, Bar-tailed Godwit *Limosa lapponica* and Curlew *Numenius arquata* (University of Durham); routine counts of waterfowl and waders, and assessment of the effects of hunting on the local concentrations of birds, are undertaken.

**Principal reference material**

Perry, R. A. 1946. *Naturalist on Lindisfarne*. Lindsay Drummond.

Galliers, J. A. 1970. *Geomorphology of Holy Island, Northumberland*. Dept. of Geog. University of Newcastle upon Tyne Research Series 6.

Smith, P. C. and Evans, P. R. 1973. Studies of Shorebirds at Lindisfarne, Northumberland. 1. Feeding Ecology and behaviour of the Bar-tailed Godwit. *Wildfowl* 24: 135-139.

## 19. MEDWAY ESTUARY

**Criteria for inclusion** 1a,b.

**Geographical location** 51°24'N 0°41'E South-east sector of the estuary, downstream along the right bank from Chatham and Rochester and thence c.12 km to the rivermouth at Sheerness, north Kent.

**Area** 7,942 ha.

**Altitude** Sea level to 5 m.

**Water depth** Tidal (mean Spring tides 5.7 m); ditches and fleets in fresh marshes up to 1 m.

**Wetland types** 8, 25.

**Ecology** Mudflats and saltmarsh islands with the fresh grazing marshes on the adjoining Chetney peninsula. The mudflats carry rich growths of blanketweed *Enteromorpha*, and in places eel-grass *Zostera* is becoming re-established. The saltmarshes are generally dominated by either sea purslane *Halimione portulacoides* or invasive rice-grass *Spartina anglica*, with typical associated species. The ditches and fleets in the Chetney grazing marshes contain brackish to freshwater communities; the emergent vegetation includes clubrushes *Scirpus maritimus* and *S. tabernaemontani*, spike rush *Eleocharis palustris*, reedbeds of *Phragmites* and the rare goose-foot *Chenopodium botryodes*; the commonest aquatic plants are fennel-like pondweed *Potamogeton pectinatus*, hornwort *Ceratophyllum submer-*

sum, spiked water milfoil *Myriophyllum spicatum* and water crowfoot *Ranunculus* sp.

The estuary supports a winter peak of 15–20,000 Anatidae and c.10,000 waders, notably the Curlew *Numenius arquata* (max. 2,000). The numbers of nearly all species increased substantially between 1966 and 1973 and average annual peaks and maxima have been noted as follows: Brent Goose *Branta bernicla* 370 (565), Shelduck *T. tadorna* 2,500 (3,000), Wigeon *Anas penelope* 7,000 (8,800), Teal *A. crecca* 3,000 (4,800) and Pintail *A. acuta* 600 (1,250). The Chetney marshes provide an important feeding ground, notably for *A. crecca*; nine species of Anatidae breed regularly, and more than 150 nests have been recorded in one season.

**Legal status** 1,255 ha of the mudflats, saltmarsh and freshmarsh have been notified as a Site of Special Scientific Interest.

**Tenure** The estuary is controlled and most of the foreshore owned by the Medway Ports Authority; small areas of foreshore are owned by the Crown Commissioners; the Chetney marshes are privately owned.

**Management practices** The Wildfowlers' Association of Great Britain and Ireland (WAGBI) has established a reserve of 810 ha on Chetney, in collaboration with the owner; a flock of Greylag Goose *A. anser* has been introduced, and efforts are being made to induce *A. crecca* to nest.

**Threats** The Medway Estuary has been proposed as a Maritime Industrial Development Area. The western sector is already industrialized, and development on the scale suggested would undoubtedly destroy the remaining wetland habitat. Pollution from the oil refinery near the mouth has caused much temporary damage. Disturbance from pleasure boats is increasing.

**Scientific research** WAGBI has undertaken studies of wildfowl food preferences, based on viscera analysis, and also a survey of duck productivity, in which sex and age ratio figures are obtained from the wings of shot birds.

#### Principal reference material

Gillham, E. H. and Holmes, R. C. 1950. *The birds of the North Kent Marshes*. London.

Harrison, J. G. 1970. *The Breeding Birds of Chetney*. Kent Orn. Soc. Spec. supp.

Harrison, J. G. 1971. The Duck Production Survey 1970–1. *WAGBI Ann. Rep.*

Nature Conservancy, 1971. *Wildlife Conservation in the North Kent Marshes*. Report of a working party.

Harrison, J. G. 1972. *Wildfowl of the North Kent Marshes* WAGBI Conservation Publication.

Harrison, J. G., Humphreys, J. N. and Graves, G. 1973. *Breeding Birds of the Medway Estuary*. Joint KOS – WAGBI Conservation Publication.

## 20. MINSMERE LEVEL and WALBERSWICK

**Criteria for inclusion** 1c; 2a; 3a,b,c.

**Geographical location** 52°14'N 1°36'E (midpoint). A stretch of varying width (max. c. 2.5 km) of the Suffolk coast from Walberswick through Dunwich to the level of Saxmundham about 7 km north of Aldeburgh.



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**Area** 1,907 ha.

**Altitude** Sea level to 26 m.

**Water depth** Up to 1 m.

**Wetland type** 21.

**Ecology** The Minsmere Nature Reserve in the centre of the area comprises c.200 ha of marshland and 400 ha of rising ground to the north and west. On the east the marshes are separated from the North Sea by a shingle beach and embankment, the latter having been built in the 19th century to reclaim land for pasture. In 1940 and again in 1953 the marshes were reflooded by the sea, and have since developed into a complex of reedbeds and freshwater meres. On the seaward side some 16 ha have been artificially converted into an area of brackish lagoons and shingle banks to encourage nesting terns and waders.

The fresh marsh flora is poorly developed, because of its recent origin, and is dominated by the reed *Phragmites communis*; there is however a notable and expanding colony of fen sowthistle *Sonchus palustris*. The higher ground is heathland, mostly *Callunetum*, and scattered woodlands.

The reserve is of prime ornithological importance, over 210 species of birds being recorded annually of which c.100 breed. The marshes are particularly noted as the only habitual British breeding site for Marsh Harrier *Circus aeruginosus*, and for growing colonies of Avocet *Recurvirostra avosetta* and the terns *Sterna hirundo*, *S. sandvicensis* and *S. albifrons*. There are also large breeding populations of Bearded Tit *Panurus biarmicus* and *Acrocephalus* warblers and significant numbers of Bittern *Botaurus stellaris*, Gadwall *Anas strepera* (45 pairs), Teal *A. crecca* (30 pairs) and Shoveler *A. clypeata* (35 pairs).

Because of its easterly situation the reserve provides an important arrival and staging point for migrant waterfowl and waders. In winter it holds a peak of 1–2,000 Anatidae, mainly *Anas* spp. Bewick's Swan *Cygnus columbianus bewickii* occurs regularly (max. 80). The Otter *Lutra lutra* is among the mammals present.

**Legal status** Site of Special Scientific Interest. Non-statutory Nature Reserve (611 ha). Designated for the Ramsar (Wetlands) Convention list.

**Tenure** The reserve is leased from the private landowner by the Royal Society for the Protection of Birds (RSPB).

**Management practices** Projects undertaken by the RSPB include control of water levels, the development of an area of brackish water and shingle islands to attract breeding terns and waders, and the control of *Phragmites communis* by various methods, including systemic herbicides. This control has no adverse side-effects, and helps to diversify the flora and dependent fauna. Access to the reserve is by permit only, and is limited to four days per week between April and mid-September.

**Threats** None foreseeable.

**Scientific research** Current studies relate to methods of habitat improvement, methods of gull control, the interaction of gulls and terns breeding together, and the ecology of *Recurvirostra avosetta*.

**Principal reference material**

Regular reports in the RSPB journal *Birds* and occasional papers in *British Birds*. Conder, P. 1964. Notes on the management of freshwater reed marsh of Minsmere

and saltwater lagoons of Havergate Island, Suffolk, England. In *Project MAR*, Proceedings of the Conference on conservation and management of temperate marshes, bogs and other wetlands, held at Les Saintes-Maries-de-la-Mer, November 1962. IUCN Publ. new series 3, pp. 302–317. Morges.

## 21. MOOR HOUSE

**Criteria for inclusion** 1c; 2a; 3b.

**Geographical location** 54°41N 2°25'W Centred on the area almost due south of Alston, Cumbria, between Cross Fell and Knock Fell and a short distance west of the northern end of Cow Green Reservoir, at source of the river Tees.

**Area** 3,894 ha.

**Altitude** 305–760 m. The highest point in the NNR of which the wetland forms part is 850 m.

**Water depth** Not applicable.

**Wetland type** 22.

**Ecology** The National Nature Reserve (4,040 ha) in which the peatland area is situated includes moorland and fells rising to an altitude of about 850 m. An almost complete section of the northern Pennine Carboniferous strata is exposed within the Reserve and the Ordovician, on which the Carboniferous series is overlaid, outcrops at the foot of the western escarpment. The dominant soil is peat, commonly 2 m deep but over 8 m thick in depressions. It usually overlies an impervious layer of drift, and covers most of the Reserve up to an altitude of 760 m on the eastern side of the summit ridge.

60% of the Reserve is covered by blanket bog, a quarter of which is either eroding or in the process of recolonization. The dominant species of the bog are ling *Calluna vulgaris*, hare's tail grass *Eriophorum vaginatum* and moss *Sphagnum* spp. On the western escarpment heavy sheep grazing has removed the *Calluna* and there is less *Sphagnum*. Species diversity is poor on the bog, as it is on the widespread acidic and ill-drained grasslands developed on peaty gleys and podzolic soils, where heath rush *Juncus squarrosus* and mat grass *Nardus stricta* are frequently dominant. The higher altitude flushes, especially those enriched by calcium, are species-rich notably in bryophytes, whilst limestone outcrops with a range of soil coverage, provide habitats of considerable interest and species rarity. Sub-alpine fescue *Festuca* grasslands cover the summits.

The most prominent mammal is the Swaledale Sheep. Small wild mammals are common but few in species. The number of birds breeding on the Reserve is also small and very few are resident. Of these the Red Grouse *Lagopus lagopus scoticus* is the most common. Predators include the fox *Vulpes vulpes*, stoat *Mustela erminea*, weasel *Mustela nivalis* and raptors such as the Kestrel *Falco tinnunculus*. Trout *Salmo trutta* are common in most streams. The Reserve is best known, however, for its invertebrate fauna much of which shows affinity with that of northern Scandinavia.

**Legal status** National Nature Reserve and declared as first Biosphere Reserve under UNESCO's Man and the Biosphere Programme.

**Tenure** Nature Conservancy Council ownership. There are also three Commons.

**Management practices** The Reserve is in the 'Managed Natural Area' category.

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Grazing by sheep over the past 1,000 years has severely modified the vegetation except on inaccessible rock ledges, so that very few trees survive. The influence of lead mining, mainly in the 19th century, is clearly visible in the form of frequent prospecting open-cuts, mine tips and old surface drains.

**Threats** Walkers using the Pennine Way, which passes through the area, may occasionally be a cause of hazards (such as fires) or other disturbance.

**Scientific research** The Reserve was acquired as an experimental area. Research has been carried out by permanent staff, by scientists from Merlewood Research Station (now belonging to the Institute of Terrestrial Ecology), and by University Departments and other research organizations. The investigations include experiments on conservation and land-use problems and research on particular plant and animal species. The Reserve was the main United Kingdom moorland site for productivity studies in the International Biological Programme (1967–1972).

Good laboratory facilities are available at Moor House Field Station, which is sited on the Reserve, and where there is hostel accommodation for 12 scientists. Climatological records have been taken since 1952 and together with other data are available at the Field Station.

### Principal reference material

A large volume of biological and physical information exists. Over 250 scientific publications have been produced and a list can be obtained from the Officer-in-Charge, Moor House Field Station, Nature Conservancy Council, Garrihill, Cumbria.

Welch, D. and Rawes, M. 1969. The vegetation of the Moor House National Nature Reserve in the Northern Pennines, England. *Vegetation* 16: 239–284.

## 25. OUSE WASHES

**Criteria for inclusion** 1a,b,c; 2b; 3a,b,c.

**Geographical location** 52°21'–36'N 0°01'–22'E The starting point of the washes is 17 km almost due north of Cambridge, the half-way point 7 km north-west of Ely. About two-thirds of the length is in Cambridgeshire, the rest in Norfolk.

**Area** 2,266 ha.

**Altitude** Sea level to 5 m.

**Water depth** Periodic floods up to 3 m in depth.

**Wetland types** 12, 23.

**Ecology** The Ouse Washes comprise a stretch of grassland, c.30 km long and 800 m wide, lying between two canalized watercourses. These canals receive the run-off from a large area of south-east England, and carry it across the intensively cultivated East Anglian fenland, which in places is below sea level. They are embanked on the outer side only, and the grassland between them is used as a flood-relief reservoir. The depth and duration of the flooding varies with rainfall and season, and this is reflected in the vegetation.

The wetter areas are dominated by reed- and floating sweet grass *Glyceria maxima* and *fluitans*, and the drier parts by reed canary grass *Phalaris arundinacea* and bent *Agrostis*. Spike rushes and sedges *Eleocharis* and *Carex* spp. are abundant and provide important food for waterfowl. The genera *Juncus*, *Oenanthe* (water

dropwort) and *Polygonum* (including some rare species) are well represented. The ditches carry a great variety of aquatic plants such as fringed water-lily *Nymphoides peltata*, water parsnip *Sium latifolium*, frogbit *Hydrocharis morsus-ranae* and the four species of duckweed *Lemna*. Although c.32 km from the sea, relicts of former marine flooding still occur, e.g. sea aster *Aster tripolium*, wild celery *Apium graveolens* and sea club-rush *Scirpus maritimus*.

During the winters of 1976–1973, the Washes regularly held peaks of more than 40,000 ducks Anatidae (max. 43,500). Wigeon *Anas penelope* reached an average level of 33,000 (max. 36,000), Teal *A. crecca* 3,500 (max. 5,300), Pintail *A. acuta* 1,075 (max. 36,000), Teal *A. crecca* 3,500 (max. 5,300), Pintail *A. acuta* 1,075 (max. 1,500) and Bewick's Swan *Cygnus columbianus bewickii* 1,000 (max. 1,275). The maximum numbers of other species recorded in the same period were Mallard *Anas platyrhynchos* 6,450, Shoveler *A. clypeata* 1,000, Pochard *Aythya ferina* 5480 and Mute Swan *Cygnus olor* 400. A further 14 waterfowl species were recorded in small numbers.

In summer the meadows attract many breeding birds, particularly Lapwing *V. vanellus*, Redshank *Tringa totanus* and Common Snipe *G. gallinago*. The area also supports one of the few breeding colonies of Black-tailed Godwit *L. limosa*, and is the only known breeding station of Ruff *Philomachus pugnax*, in Britain.

**Legal status** The whole area has been notified as a Site of Special Scientific Interest, and 2,106 ha classified as a National Wildfowl Refuge. An area of 2,598 ha has been designated for the Ramsar (Wetlands) Convention list.

**Tenure** A total of 896 ha is owned or leased – 459 ha by the Royal Society for the Protection of Birds, 292 ha by the Wildfowl Trust and 146 ha by the Cambridgeshire and Isle of Ely Naturalists' Trust – and maintained as a non-statutory reserve. The remaining 1,210 ha is divided between a large number of private owners. An additional 160 ha are reported to have been recently leased or acquired and another 332 ha included for the purposes of the Ramsar Convention.

**Management practices** The reserves are managed to provide optimum conditions for breeding and wintering birds; methods include controlled grazing, hay-cutting and, so far as possible, control of water levels. Observation hides and artificial ponds have been constructed in places to enable visitors to view the birds at close range. Additional food is provided for wintering waterfowl, especially *C. c. bewickii*. Limited shooting is allowed in places which are important primarily as breeding sites. The shooting rights over the 1,210 ha outside the refuges belong to the individual owners.

**Threats** Water abstraction upstream may reduce the extent and duration of winter flooding.

**Scientific research** The RSPB and Wildfowl Trust have studied aspects such as the breeding requirements of waterfowl and waders, with special reference to nesting location, distance from water, topography, drainage, etc.; the nesting diversity of *L. limosa*; the type and quantity of seed foods taken by waterfowl on the Washes; and the best land management practices compatible with flooding and wildlife interests.

#### **Principal reference material**

A descriptive leaflet has been published jointly by the three conservation bodies.

**27. RIBBLE ESTUARY****Criteria for inclusion** 1a,b.**Geographical location** 53°39'–46°N 2°42'–3°01'W From where the river narrows, about 5 km below Preston, c. 16 km downstream to the mouth of the estuary between Lytham St. Anne's on the north bank and Southport on the south bank (Lancashire and Merseyside).**Area** 11,740 ha.**Altitude** Sea level.**Water depth** Tidal: mean at Springs 5.4 m above datum, Neaps 3.5 m.**Wetland type** 8.**Ecology** Extensive tidal mudflats and sandy flats at the seaward end and bordered further upstream by large areas of saltmarsh, notably along the southern shore from Crossens to Longton. Small areas of embanked land are also included within the site and at its south-west corner is the Southport Sanctuary. Over 150,000 waders occur regularly and the peak count is 219,400. The most important species and their maximum numbers are Grey Plover *Pluvialis squatarola* (1,950), Dunlin *Calidris alpina* (98,400), Knot *C. canuta* (102,200), Sanderling *C. alba* (9,450), Redshank *Tringa totanus* (6,500), Black-tailed Godwit *Limosa limosa* (1,400) and Bar-tailed Godwit *L. lapponica* (11,600). Of the Anatidae, winter flocks of which have recently been increasing, the major species are Bewick's Swan *Cygnus columbianus bewickii* (200), Pink-footed Goose *Anser brachyrhynchus* (26,000), Shelduck *Tadorna tadorna* (2,900), Wigeon *Anas penelope* (6,000) and Pintail *A. acuta* (4,700). Breeding species include *Tadorna tadorna*, *Tringa totanus* (about 400 pairs), Black-headed Gull *Larus ridibundus* (about 9,000 pairs) and Common Tern *Sterna hirundo* (about 1,000 pairs), together with small numbers of Mallard *Anas platyrhynchos*, Oystercatcher *Haematopus ostralegus* and Lapwing *Vanellus vanellus*.**Legal status** Site of Special Scientific Interest. The 5,868 ha statutory Southport Sanctuary was established by the Wild Birds (Southport Sanctuary) Order 1965. An area of 2,220 ha has recently been declared a National Nature Reserve.**Tenure** The Nature Conservancy Council has a freehold interest over the NNR; rights are also held by three local authorities and several private persons.**Management practices** At least two Wildfowling associations shoot on the marshes and a substantial number of cattle and sheep are grazed on the saltmarsh.**Threats** Development proposals have included further embankment construction for agricultural and possibly industrial purposes and also one for a major barrage across the mouth of the estuary for the purpose of establishing a marina and facilities for other recreational or commercial activities.**Scientific research** Several projects are being undertaken, mainly under the auspices of the Liverpool Polytechnic, in the estuary and adjacent marshes, including studies of the *Tringa totanus* breeding population and of wintering populations of *Calidris alba* and other waders.**Principal reference material**Greenhalgh, M. E. 1974. Population Growth and Breeding Success in a Marsh Common Tern Colony. *Naturalist* 931: 121–127.

- Greenhalgh, M. E. 1975. *Wildfowl of the Ribble Estuary*. WAGBI Chester.
- Greenhalgh, M. E. 1975. The breeding birds of the Ribble Estuary Saltmarshes. *Nature in Lancashire* 5: 11–19.
- Smith, P. H. and Greenhalgh, M. E. 1977. A four year census of Wading Birds on the Ribble Estuary, Lancashire/Merseyside. *Bird Study* 24: 243–258.
- Forshaw, D. 1979. Pinkfoot numbers in Lancashire. *WAGBI Journal*, autumn issue: 16–19.

## 28. ROSTHERNE MERE

**Criteria for inclusion** 1a; 3b.

**Geographical location** 52°21'N 2°23'W 16 km south-west of the centre of Manchester, in Cheshire.

**Area** Mere 48 ha; total reserve 151 ha.

**Altitude** 21 m.

**Water depth** Maximum 30.4m; mean 13 m.

**Wetland type** 18.

**Ecology** The lake is situated in unspoilt farmland, despite the proximity of the Manchester conurbation. It lies in a hollow, surrounded by glacial drift and, except near the outlet, the land drops steeply to the water's edge (about one-fifth of the catchment is within the Reserve). The shores are sandy and shelve rapidly; about half the lake is over 15 m deep. Reedbeds *Phragmites communis* encircle 50 percent and beyond them mixed woodland of willow *Salix* more than 60 percent of the perimeter.

The Mere is highly calcareous and rich in minerals, supporting an extremely high concentration of phytoplankton (though the variety of species is relatively small). The breeding birds include Great Crested Grebe *Podiceps cristatus*, Common Sandpiper *Tringa hypoleucos*, Woodcock *Scolopax rusticola* and Willow Tit *Parus montanus*. In winter the Mere is used as a daytime refuge by Anatidae, since due to the depth of water and shooting and scaring on surrounding farmland, conditions are unsuitable for feeding. Counts in the period 1968–73 showed Mallard *Anas platyrhynchos* to be the most numerous species, with numbers up to more than 3,500 and total numbers, with Wigeon *A. penelope*, Teal *A. crecca*, Pochard *Aythya ferina* and Coot *Fulica atra*, reaching a peak of between 3,000 and 5,000 in January/February. Very large numbers of gulls of the 5 common species (maximum over 21,000) also use the Mere for roosting. The Reserve is also of some entomological interest and has the distinction of providing the only British record of the Smelt *Osmerus eperlanus* in a freshwater locality.

**Legal status** National Nature Reserve, established 1961.

**Tenure** 77 ha, including the Mere, are owned by the Nature Conservancy Council; 71 ha of adjoining farmland are secured under a Nature Reserve Agreement with the private owner and tenants.

**Management practices** The Reserve has been established in order to maintain the Mere as a strict wildlife refuge and to provide facilities for research into ornithology and freshwater biology. A limited number of permits are issued to

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scientists with suitable projects, and the Conservancy provides some laboratory facilities and a specially designed boat. The woodlands are being managed to improve their general ecological interest. One full-time warden is employed. An observation hide overlooks the mere.

**Threats** None reported.

**Scientific research** The freshwater and ornithological aspects have been studied, also sediments; detailed bird records have been kept for at least sixty years.

**Principal reference material**

Tattersall, W. M. and Coward, T. A. 1914. Faunal Survey of Rostherne Mere I. Introduction and Methods. *Mem. & Proc. Manchester Lit. & Phil. Soc.* (58(8)).

Coward, T. A. 1914. Faunal Survey of Rostherne Mere II. Vertebrata. *Loc. cit.* 58(9).

Boyd, A. W. 1914. Faunal Survey of Rostherne III. Preliminary list of lepidoptera found round the mere. *Loc. cit.* 58(13).

Pearsall, W. H. 1923. The Phytoplankton of Rostherne Mere. *Loc. cit.* 67(3): 45–55.

Boyd, A. W. 1954. Faunal Survey of Rostherne Mere. A revised account of the birds. *Loc. cit.* 96(9): 17 pp.

Michaelis, M. N. 1965. The Lepidoptera of Rostherne Mere NNR. *Manchester Ento. Soc.*

Banks, J. W. 1970. Observations on the fish population of Rostherne Mere. *Cheshire Field Studies* 3(2): 357–379.

**31. SEVERN ESTUARY from NEW GROUNDS, SLIMBRIDGE to CARDIFF**

**Criteria for inclusion** 1a,b; 3b.

**Geographical location** 51°30'–43'N 2°29'–3°13'W Severn estuary from the Newnham bend, 3 km upstream of the New Grounds and 5 km west-north-west of Stroud to the limit of major low tide mudflats and sandbanks between Cardiff and Clevedon.

**Area** 35,200 ha.

**Altitude** Sea level to 12 m.

**Water depth** Tidal: range at estuary mouth between 9 and 12 m.

**Wetland types** 8, 24.

**Ecology** Details are restricted to the situation in the Slimbridge National Wildfowl Refuge, which includes over 1,000 ha of the estuary, 70 ha of saltmarsh pasture, 400 ha of wet grassland, and the 30 ha of pools and enclosures in which the Wildfowl Trust maintains a comprehensive captive collection of the world's waterfowl. The estuary has extensive intertidal sand and mudflats, and provides a major winter roost for migratory waterfowl. The heavily grazed salting pasture is composed of a limited range of species, predominantly rye grass *Lolium perenne* and creeping bent *Agrostis stolonifera* but with an admixture of saltmarsh grass *Puccinellia maritima*, red fescue *Festuca rubra*, meadow barley *Hordeum secalinum* and bulbous foxtail *Alopecurus bulbosus*. The wet grasslands are managed agri-

culturally, and consist mainly of permanent *Lolium* and *Agrostis* pasture. The pools in the enclosures are heavily supplied with food for the captive birds and attract large numbers of migratory ducks, especially in hard weather.

The area is particularly important as a winter resort for White-fronted Goose *Anser a. albifrons* (average peak 5,800, max. 7,600) and Bewick's Swan *Cygnus columbianus bewickii* (average peak 325, max. 400). The geese feed exclusively on the 470 ha of salt and fresh marsh pasture. In addition there are regular concentrations of 2,000 Mallard *Anas platyrhynchos*, 250 Gadwall *A. strepera*, 800 Teal *A. crecca*, 2,500 Wigeon *A. penelope*, 500 Pintail *A. acuta* and 400 Shoveler *A. clypeata*. In all, 3 species of swans, 9 species of geese and 20 species of ducks have been recorded and the total number of Anatidae regularly reaches 10,000.

**Legal status** Site of Special Scientific Interest. National Wildfowl Refuge (1,857 ha) under Wildfowl Trust management.

**Tenure** Private ownership.

**Management practices** The 1,857 of the Wildfowl Refuge is managed by the Wildfowl Trust under long-term agreement with the Berkeley Estates, the owners of the land. The emphasis is primarily on education. Some 200,000 visitors a year visit the waterfowl collection and in winter can also view the migratory flocks of geese and swans at close range from observation hides. Schools make extensive use of the facilities and a comprehensive educational programme has been devised for their use. The reserve is wardened and there is no public access to the fields, saltmarsh or estuary. The landowner reserves the right to shoot over these areas on six occasions each winter.

**Threats** None reported at present.

**Scientific research** The behaviour and ecology of the migratory waterfowl have been and are being studied in detail; the results are applied to the management of the reserve.

#### **Principal reference material**

Regular reports on research projects are contained in Wildfowl Trust Annual Reports, in the Trust's journal *Wildfowl* (No. 30 was published in 1979) and the magazine *Wildfowl News*.

### **59. DRUIDIBEG, a'MAACHAIR and STILLIGARRY LOCHS**

**Criteria for inclusion** 1a; 3b.

**Geographical location** 57°19'N 7°21'W North-western part of South Uist, Western Isles, close to Howmore and bisected by the main north-south road.

**Area** 1,677 ha.

**Altitude** Sea level to 30 m.

**Water depth** Described as shallow; no figures quoted.

**Wetland types** 18, 19, 21, 22.

**Ecology** The whole reserve area is underlain by Lewisian gneiss. The eastern section is a flat, peaty moorland basin, containing the shallow Lock Druidibeg with its numerous islands. The western (seaward) section is *machair*, the bedrock being covered with a mantle of shell sand of marine origin and the several lochs



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providing eutrophic conditions, in contrast with the oligotrophic conditions of the eastern section.

In the latter typical moorland vegetation is dominant, whereas in the western section dune vegetation along the seashore gives way to mires and permanent pasture inland supporting many basophilous species, but often modified by cultivation and development of permanent pastures. There are scarcely any trees but some scrub occurs on the islands in Loch Druidibeg and a small experimental plantation of the once native hardwoods of the Outer Islands has been established by the Nature Conservancy Council. The intertidal zone is mostly bare sand, though some short-stemmed furoid seaweeds and wracks have colonized the larger stones.

The National Nature Reserve was originally established as a sanctuary for the largest existing breeding population of the indigenous strain of Greylag Goose *Anser anser*. Typical moorland birds including the Golden Eagle *Aquila chrysaetos* occur in the eastern section, while on the western machair lochs and marshy ground, ducks and several species of wader nest or spend the winter. The Rabbit *Oryctolagus cuniculus* is numerous in the dunes and on the machair and the Otter *Lutra lutra* still haunts Loch Druidibeg. Other mammals present are the Brown Rat *Rattus norvegicus*, Wood Mouse *Apodemus* (= *Sylvaemus*) *sylvaticus* and Short-tailed Vole *Microtus agrestis*; the Grey Seal *Halichoerus grypus* occurs offshore. The lochs and running waters contain Atlantic Salmon *Salmo salar* and both Brown(non-migratory) and Sea(migratory) Trout *Salmo trutta*. The Common Eel *A. anguilla* occurs and there are two species of Sticklebacks, Three-spined and Nine-spined *Gasterosteus aculeatus* and *P. pungitius*. Over 900 species of invertebrates have been identified. Some of the freshwater aquatic species are uncommon or not found in mainland fresh waters.

**Legal status** National Nature Reserve, established in 1958.

**Tenure** Private ownership 647 ha, of which 628 ha are managed under a Nature Reserve Agreement with the owners; 1,030 ha are owned by the Nature Conservancy Council.

**Management practices** The surroundings of the lochs have been grazed for many centuries by sheep and cattle. The sandy grasslands provide permanent pasture and some areas are cultivated, mostly for oats, rye and potatoes. The ecotone between grassland and moorland contains some enclosed patches of cultivation. The moorland itself is a sheep walk, has been burnt and has extensive peat banks. The fresh waters are managed as a sea (migratory) trout/salmon fishery. Wildfowling takes place on the western section of the reserve. The establishment of a small plantation of native hardwoods is referred to under Ecology.

**Threats** None reported.

**Scientific research** A study of the population dynamics of the native Greylag Goose was carried out in 1968 on behalf of the then Nature Conservancy (see Newton, I. 1969 in *Wildfowl* 20). Several botanical studies of the machair biotope have been undertaken.

**Principal reference material**

A reserve management plan and visitors' handbook have been published.

**34. THE SWALE and SOUTH SHEPPEY**

**Criteria for inclusion** 1a,b,c,e; 2a.

**Geographical location** 51°21'–25'N 0°44'–56'E 20 km east of Chatham, Kent.

**Area** c.9,102 ha.

**Altitude** Sea level to 5 m.

**Water depth** Mostly tidal (range of the mean above datum 4.8 to 5.7 m); ditches and fleets in fresh marshes up to 3 m.

**Wetland types** 3, 25.

**Ecology** Mudflats, saltmarshes and shell beaches on both sides of the Swale channel, with the adjoining grazing marshes on the Isle of Sheppey. The extensive intertidal flats on the south side of the Swale have the richest invertebrate fauna in south-east England; over 350 species have been recorded, some rare. There are also important populations of the eel-grass species *Zostera angustifolia* and *Z. noltii*. The saltmarshes along the north shore have a rich flora, including most of the British species of saltmarsh grass *Puccinellia* and glasswort *Salicornia*, and a wide range of succulents. The invasive rice grass *Spartina anglica* is also present. At Shellness to the north of the Swale rivermouth there is a large shell beach and spit system, with at least ten hooks enclosing saltmarsh basins, which contains a further range of plants, including some less common species. The grazing marshes are floristically poor, but the ditches and fleets contain a good range of aquatic plants, including the tassel pondweed *Ruppia spiralis*. Capel Fleet has some of the largest stands of sea club-rush *Scirpus maritimus* in Britain and notable populations of the local south-eastern species, salt meadow sedge *Cadex divisa*, tufted saltmarsh grass *Puccinellia fasciculata* and goose-foot *Chenopodium botryodes*.

The grazing marshes support a substantial breeding population of Anatidae (150–200 pairs) including Garganey *Anas querquedula*, Shoveler *A. clypeata*, Tufted Duck *Aythya fuligula* and Pochard *A. ferina*; colonies of Common Tern *Sterna hirundo* (100 pairs) and Black-headed Gull *Larus ridibundus* (1,600 pairs) are established along the Swale. In winter the area holds a total of c.7,500 Anatidae and 20,000 waders (c.27,000 in January 1972), with average peaks of 800 White-fronted Goose *Anser a. albifrons* (max. 1,100), 500 Brent Goose *Branta b. bernicla* (max. 1,000), 900 Shelduck *T. tadorna* (max. 2,000) and 5,000 Wigeon *Anas penelope* (max. 6,000). The concentrations of Oystercatcher *Haematopus ostralegus* (max. 3,000), Grey Plover *Pluvialis squatarola* (max. 1,000), Knot *Calidris canutus* (max. 10,000), Redshank *Tringa totanus* (max. 1,300) and Curlew *Numenius arquata* (max. 3,500) are regarded as internationally important.

The area is of considerable entomological interest, especially for Coleoptera; the saltmarshes are the main British locality for the Ground Lackey Moth *Malacosoma castrensis*.

**Legal status** The whole area has been notified as a Site of Special Scientific Interest. 420 ha of intertidal mudflat on the East Swale was declared a Local Nature Reserve in 1969.

**Tenure** The intertidal areas are partly owned by the Crown Estate Commissioners and the Medway Ports Authority, the rest is private. The Local Nature Reserve is leased by the Crown Estate Commissioners to the Kent Trust for Nature Conservation, who manage and warden the area on behalf of the Kent County Council. The grazing marshes are privately owned.

**Management practices** The primary aims should be to retain the grazing regime on the fresh marshes and to control the disturbance caused by sailing and power boating on the Swale.

**Threats** Drainage and conversion to arable land of the old grazing marshes are becoming increasingly prevalent. The Swale is likely to be affected by increased disturbance, and by industrial pollution from sites outside the area. Some decrease in the populations of the intertidal animals has already been noted.

**Scientific research** The rich invertebrate fauna makes the area an important research and teaching area for marine biologists, especially from the London colleges. The populations of waterfowl have been monitored for many years.

**Principal reference material**

Gilham, E. H. and Holmes, R. C. 1950. *The Birds of the North Kent Marshes*. London.

Harrison, J. G. 1972. *Wildfowl of the North Kent Marshes*. WAGBI Conservation Publication.

**35. UPPER SOLWAY including ROCKLIFFE and BURGH MARSHES, CAERLAVEROCK and BLACKSHAW BANK, and the NITH MERSES**

**Criteria for inclusion** 1a,b; 3b.

**Geographical location** 54°50'–55°00'N 3°03'–39'W The upper part of Solway Firth from the marshes to the south of both the Esk and the Eden rivermouths, c.10 km north-west of Carlisle (in Cumbria), west to Caerlaverock and its inshore tidal bank in Dumfries and the 'merses' along the Galloway or west bank of the river Nith estuary.

**Area** 29,300 ha.

**Altitude** Sea level to 10 m.

**Water depth** Tidal: neap and spring tide means are 6.9 and 9.2 m.

**Wetland types** 3, 8, 21.

**Ecology** As one of the largest areas of saltmarsh in Britain of the northern silt-over-mud type, its typical features are the pioneer growth of common saltmarsh grass *Puccinellia maritima*, some of the most extensive *Blysmus rufus* populations in Britain, extensive salt mud rush *Juncus gerardii* stands and good examples of the transition to brackish *Phragmites communis* marsh.

Large numbers of the Spitsbergen population of Barnacle Goose *Branta leucopsis* and of Pink-footed Goose *Anser brachyrhynchus* winter in the section of the wetlands included in the Reserve. The latter is also the most northerly recorded station in the British Isles for breeding Natterjack Toads (*Bufo calamita*).

**Legal status** Caerlaverock National Nature Reserve, established in 1957, gives protection to 5,406 ha.

**Tenure** Private ownership.

**Management practices** These are controlled by the Nature Conservancy Council under a Nature Reserve Agreement with the owners. Most of the marshland is grazed by sheep. Some local draining and construction of sea walls and embankments took place in the past. Controlled wildfowl shooting is allowed over part of

the area during the winter. Immediately adjacent to the Reserve the landscape and farming have been modified so as to attract wildfowl to a Refuge specially managed by the Wildfowl Trust. The Wildfowl Trust has provided extensive observation facilities which were used by over 1,000 visitors in the first winter of their existence. A small collection of pinioned British species of wildfowl can be viewed from an observatory, which also houses an educational exhibition on research and conservation.

**Threats** None reported.

**Scientific research** Work on the feeding habits of geese is being carried out by the Wildfowl Trust. As already indicated the Wildfowl Refuge and some 95 ha of adjoining arable land leased by the Wildfowl Trust and treated as part of the Refuge, are managed chiefly for Barnacle and Pink-footed Geese, and research is aimed at evolving management practices compatible with goose conservation.

#### **Principal reference material**

Harrison, J. G. (ed.) 1974. *Caerlaverock – conservation and wildfowling in action*. Published by WAGBI, Chester.

### **63. LOCH LEVEN**

**Criteria for inclusion** 1a,b,; 3a,b.

**Geographical location** 56°11'–14'N 3°20'–27'W Immediately to the east of Kinross (Tayside), about 19 km south of Perth.

**Area** 1,597 ha.

**Altitude** 107 m.

**Water depth** Maximum 25 m; mean 4.54 m.

**Wetland type** 18.

**Ecology** This loch is unique in Britain being both relatively large and shallow, with only rare stratification. It lies in a glacial hollow, filling two kettle-holes, and its waters are eutrophic. The increasing frequency of algal blooms has led to scientific study of the nutrient chemistry of its waters. The lake has long been one of the most renowned sites for the sport of trout (*Salmo trutta*) fishing. It is also noted for the presence in winter of large numbers of Pink-footed Goose *Anser brachyrhynchos*. The Mallard *Anas platyrhynchos* and Tufted Duck *Aythya fuligula* nest (about 500 pairs each) on St. Serf's and perhaps other islands, the latter species being almost entirely dependent on food supplies within the loch. Many other species of waterfowl visit the loch on migration and in winter, notably Whooper Swans *C. cygnus* and Goldeneye *Bucephala clangula*. In addition to trout, Perch *Perca fluviatilis*, Pike *Esox lucius*, Three-spined Stickleback *Gasterosteus aculeatus* and Brook Lamprey *Lampetra planeri* are plentiful.

**Legal status** National Nature Reserve and Wildfowl Refuge, dating back to 1964. Designated for the Ramsar (Wetlands) Convention list.

**Tenure** Private ownership.

**Management practices** Controlled by the Nature Conservancy Council under a Nature Reserve Agreement with the owners. The RSPB operate a centre, just outside the reserve (entry to which is restricted by bye-laws to three points),

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known as the Vane Farm Centre with information and educational facilities, a nature trail and observation hut. Fishermen take about 20,000 kg of trout annually.

**Threats** Eutrophication due to run off of fertilizers from farmland and input of sewage from neighbouring towns.

**Scientific research** A number of important limnological investigations were undertaken, including comparative studies on productivity, production processes, sedimentation, radiation, circulation, nitrogen and phosphorus budgets, phytoplankton and benthic algae fluctuations, macrophytes, Anatid population, biology and parasitology, and various management problems, under the auspices of the International Biological Programme. The loch was listed by Project AQUA as of great scientific importance.

### Principal reference material

Newton, I. and Campbell, C. R. G. 1969. Geese at Loch Leven. *Wildfowl* 20: 106.

Morgan, N. C. 1972. Productivity Studies at Loch Leven. In *Productivity Problems of Fresh Waters*, Z. Kajak and A. Hillbricht-Ilkowska (eds), pp. 183–205. Warsaw – Krakow.

IBP, 1974. The Loch Leven Project. *Proc. R. Soc. Edinburgh B* (74), 450 pp.

Le Cren, E. D. 1976. The productivity of freshwater communities. *Phil. Trans. R. Soc. Lond. B* 274: 359–374.

## 72. SILVER FLOWE

**Criteria for inclusion** 1a,b.

**Geographical location** 55°07'N 4°23'W Area just south of the Galloway/Strathclyde border, 17 km north of Newton Stewart, and flanked on east and west by the Rinns of Kells and Merrick hills.

**Area** 608 ha. See also under Legal Status.

**Altitude** 228–822 m.

**Water depth** Very variable but usually shallow.

**Ecology** Much of the information pertains to the forest and mountain-top, as well as wetland, areas of a complex which extends over a total of 3,105 ha. The upland area is part of a glaciated plateau with extensive corries and well developed peri-glacial features. The broad glaciated valley containing the Silver Flowe is floored with a series of patterned mires exhibiting a complete graduation from discrete valley mire to blanket mire. The series constitutes the least disturbed and most varied stretch of acid peatland in southern Scotland and is one of the most important blanket mire systems, as well as one of the best developed aligned hummock-hollow systems, in the whole of Britain.

The patterned mire is dominated by deer-grass/cotton-grass *Trichophoreto-Eriophoretum*, with an oceanic element indicated by the abundance of the mosses *Campylopus atrovirens* and *Sphagnum plumulosum*, great sundew *Drosera anglica* and liverwort *Pleurozia purpurea*. The eastern slopes, overlying granite, support a sub-montane vegetation including *Molinietum* and damp *Callunetum*. The Merrick summit plateau is composed of sedimentary rocks with a more grassy cover

dominated by mat grass *Nardus* and heath rush *Juncus squarrosus*. The extensive north-facing cliffs support a few notable montane species.

There is no information about what waterfowl use the numerous small lochs and streams of the area, but a few pairs of Peregrines *Falco peregrinus* and of Ravens *Corvus corax* are reported and, among the mammals, some herds of Red Deer *Cervus elaphus* and feral goats *Capra hircus*. The blue dragonfly *Aeshna caerulea* occurs in the pools of the mire system.

**Legal status** The Silver Flowe National Nature Reserve, 188 ha, *ipso facto* a Site of Special Scientific Interest, and a second SSSI higher up in the Merrick-Kells sector are leased by the Forestry Commission to the Nature Conservancy Council; the total area, inclusive of the Galloway Forest Park, and wholly owned by the Forestry Commission, has been designated as a Biosphere Reserve (3,105 ha).

**Management practices** Managed nature reserve. Grazed by sheep and burned in the past, now largely undisturbed. Formerly, also some gravel extraction from rivers. Extensive conifer afforestation outside the small NNR.

**Threats** None reported: most of the area is accessible only on foot, though a few Forestry Commission tracks have been constructed.

**Scientific research** Much research has been and is being carried out on the stratigraphy, hydrology and phytosociology of the mire systems. In addition there has been research on the contact metamorphism of the granite aureole.

#### Principal reference material

None quoted.

### 80. CORS FOCHNO and DYFI

**Criteria for inclusion** 1c,e; 2a,b; 3b.

**Geographical location** 52°29'–34'N 3°51'–4°03'W Area bordering the southern shore of the Dyfi estuary, 12 km north-north-east of Aberystwyth, together with the estuary itself and the lower course of the Dyfi river downstream of Machynlleth.

**Area** 2,497 ha.

**Altitude** Sea level to 15 m.

**Water depth** Mostly tidal: mean of spring and neap tides above datum is 4.8 and 3.8 m, respectively.

**Wetland types** 8, 22.

**Ecology** A wide range of features and habitats which have developed during the evolution of the Dyfi estuary complex. The main components are the tidal estuary itself, an area of sand dunes at its mouth, and part of the raised peat bog of Cors Fochno (Borth Bog) along its southern shore.

The plant communities of the estuarine saltmarsh have been modified by the introduction and spread of rice grass *Spartina anglica* (= *townsendii*), but still retain considerable diversity. The dune system has a full complement of typical plant communities. Cors Fochno is an actively growing *Sphagnum* bog, regarded as the best example of its kind in Britain. There is a small admixture of reed, ling, willow and birch *Phragmites*, *Calluna*, *Salix* and *Betula* spp.

The estuary supports a migrant population of up to c.7,000 waders and about

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3,000 wintering Anatidae, including c.2,000 Wigeon *Anas penelope* and 2–300 Pintail *A. acuta*. A small flock of c.60 Greenland White-fronted Geese *Anser albifrons flavirostris*, the only one remaining in southern Britain, feeds on Cors Fochno and roosts on the estuary. The Polecat *Mustela putorius* occurs in the dunes and along the edges of the bog, and Cors Fochno has a high entomological interest. There is a diverse invertebrate fauna in the littoral zone.

**Legal status** A National Nature Reserve was established in 1969, comprising 1,608 ha of the total area and essentially covering the Cors Fochno.

**Tenure** The Nature Conservancy Council owns 111 ha and leases the remaining 1,497 ha of the Cors Fochno NNR. The remaining parts of the total wetland area are partly in private and partly in public ownership.

**Management practices** The dunes and sandy shores attract large numbers of holiday visitors. The resulting erosion is a major problem which is met by rotational rehabilitation works. An information kiosk, displays, nature trail and other facilities are provided jointly by the Nature Conservancy Council and West Wales Naturalists' Trust. Access is unrestricted, except to Cors Fochno, where it is by permit only. The eastern third of the estuary, which is contiguous with the Ynysir Nature Reserve situated on the south bank and owned by the Royal Society for the Protection of Birds, is managed as a wildfowl refuge; shooting at the western end of the estuary is controlled by a permit system. A full time warden is employed.

**Threats** Dune erosion by man. Agricultural reclamation in peripheral areas of Cors Fochno.

**Scientific research** Many aspects of the structure and biology of the area have been and are being studied by university workers. The reserve is being used increasingly for educational purposes by schools, colleges and universities.

#### **Principal reference material**

There is a large body of published and unpublished material relating to the estuary complex. The Nature Conservancy Council has produced a number of descriptive leaflets, information sheets and, in association with the School of Biology, University College of Wales, Aberystwyth, an educational handbook for leaders of parties visiting the dune area.

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## SUMMARY OF WETLAND SITUATION

Since the end of the War in 1945, the majority of the larger wetland complexes in the Yugoslav Federation of Republics have been drained and put under cultivation or pastures. In several of the few wetlands that survive, suitable habitats for breeding waterfowl are seriously degraded but conditions for roosting and wintering birds sometimes remain viable. Efforts are now being made to improve the situation for nesting birds, especially at sites which are still rich in species, and a number of reserves have been established since 1965. The Yugoslav Waterfowl Commission is also taking care that adjacent feeding areas are included in reserves. The organization and detailed arrangements for nature conservation vary in each Republic or Province.

The Province of Vojvodina to the immediate north of Beograd (Belgrade) has a number of wetlands which at one time were among the finest in South East Europe. Fishing and hunting have long been economically important activities in the province and the wetlands included many shallow lakes, ponds and marshes, and seasonally inundated plains and forests situated between the meanders of the Dunav (Danube), Theiss (Tisza) and Bega (Begej) rivers, belonging geographically to the great Pannonian plain. Between 1951 and 1970 five reserves of limnological as well as zoological importance were established in this area: Obedska bara (1,000 ha) and Ludoško Jezero (318 ha), recently designated for the list of the Ramsar (Wetlands) Convention, of which Yugoslavia became a party in March 1977; Vojtina Mlaka (50 ha); Monoštor (1,000 ha); and Kozjak (44 ha). The relative situation of the three last-mentioned sites has yet to be determined and the same applies to three more areas totalling 1,026 ha reported in 1974 to be under consideration, of which the Veliki rit (500 ha) and the Mala bara (60 ha) are apparently established.

The Obedska bara and a sixth site, Carska bara, near the confluence of the Bega and Theiss rivers, are perhaps the best known areas. Their typical breeding birds are Bittern *Botaurus stellaris* (sporadic), Little Bittern *Ixobrychus minutus* (common), Night Heron *N. nycticorax*, Squacco Heron *Ardeola ralloides* (nesting commonly in riparian forests), Little Egret *Egretta garzetta* (common), Great White Egret *Egretta alba* (breeding in small numbers), Purple Heron *Ardea purpurea* (large colonies in reedbeds), White Stork *Ciconia ciconia* (common but slowly declining), Black Stork *Ciconia nigra* (breeding in small numbers), Glossy Ibis *Plegadis falcinellus* (common in 19th century but now only in small numbers at Obedska bara, breeding attempts in the early 1970s at Carska bara and near Uzdin having failed) and Spoonbill *Platalea leucorodia* (nesting in small numbers at Obedska Bara but no longer near Pancevo nor near Novi Sad, where formerly common). Several species of gulls and terns Laridae also nest when conditions are suitable.

In the Republic of Croatia several reserves were established between 1965 and 1970, of which Kopacki rit (17,700 ha) for both limnological and zoological reasons is undoubtedly of international importance. The waterfowl which nest in the area include Cormorant *Phalacrocorax carbo*, Greylag Goose *Anser anser*,



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*Egretta garzetta*, *Egretta alba* and at least until 1973 a pair or two of the White-tailed Eagle *Haliaeetus albicilla*, now rated as a vulnerable species in the Red Data Book. The Crane *Grus grus* visits the area on migration in November. Other reserves deserving mention are the Pod Gredom (600 ha), in the south in the lower Neretva river valley, and the Prud (250 ha), Rakita (300 ha), Krapje Djol (25 ha) and Podsused (600 ha); but their precise location has not been specified and their international importance remains to be assessed.

Two more reserves, established in the Neretva delta and therefore in the Dalmation region of the Croat Republic, serve to protect coastal saltmarshes of 1,200 and 700 ha in extent. Further inland, the Neretva river rises in and flows through the Republic of Bosnia and Hercegovina which has also established two reserves, Hutovo Blato (360 ha) and Bardaca (700 ha), in a lake and marshland area to the east of the lower Neretva just north of the Dalmation boundary. The delta region is certainly one of the most important sites for waterfowl in the Adriatic coastlands. Its breeding birds include several grebes Podicipitidae, Pygmy Cormorant *Phalacrocorax pygmaeus*, herons Ardeidae, Mallard *Anas platyrhynchos*, Garganey *A. querquedula*, Ferruginous Duck *Aythya nyroca*, and rails Rallidae. The marshes, wet meadows, salt pans and sandbanks of the whole delta/valley complex also provide suitable habitat for migrating and wintering birds, although hunting pressure is severe.

In the Republic of Montenegro, eleven glacial lakes on Durmitor and another on Biogradska Gora have been included in the National Parks. The Yugoslav sector of the great Skadarsko jezero on the Albanian border is partly protected and contains a small colony of Dalmation Pelicans *Pelecanus crispus*, and protection has also been given to some of the coastal wetlands and salt pans on the final 30 km of the Bojana river which forms the border with Albania before it enters the sea.

In the Republic of Macedonia the great lakes on the Albanian and Greek borders, Ohrid, Prespa and Dojran have been declared Natural Monuments implying some general measure of protection for the landscape. Some areas around these lakes and also the marshes of the Crna river, a tributary of the Vardar and known as a past nesting-place of pelicans, have been proposed as nature reserves. The former waterfowl reserve of Katlanovsko Blata 20 km south-east of Skopje was drained in the early 1960s.

Little is known of the exact status of the wetlands of the Republic of Slovenia, but about 5,000 ha are said to be protected as a nature reserve at Ljubljansko barje, and some 1,000 ha of mudflats and coastal wetland in the bay of Portoroz, about 25 km south-west of Trieste in the north-west corner of the Istra peninsula. Finally, in the Province of Kosovo some small lakes, gorges and springs, believed to be of considerable limnological and hydrographic interest, are reported to have been protected as landscape reserves; but the only waterfowl habitat known to be of importance, about 300 ha in the marshes of Radevo, is unprotected. Apart from the two autonomous Provinces of Kosovo and Vojvodina, it was stated in 1974 that there were no protected wetlands in the Serbian Republic.

## References

- Géroutet, P. 1965. Aperçus ornithologiques sur la Yougoslavie VII. La basse Neretva et l'Hutovo Blato. *Nos Oiseaux* 28(1).
- Kempff, C. and Wersinger, M. 1974. Notes ornithologiques sur le Deransko Jezero, le Lac Scutari (Yougoslavie), les Lacs Prespa et la Vallée d'Avas (Grèce). *L'Oiseau et R.F.O.* V, 44(1).

Vojislav Vasić, 1976. National Report on Yugoslavia. In *Proc. Int. Conf. on Cons. of Wetl. and Waterf.*, Heiligenhafen, Fed. Rep. of Germany, December 1974. Published by I.W.R.B., Slimbridge. Pp. 164–165.

## WETLANDS OF INTERNATIONAL IMPORTANCE

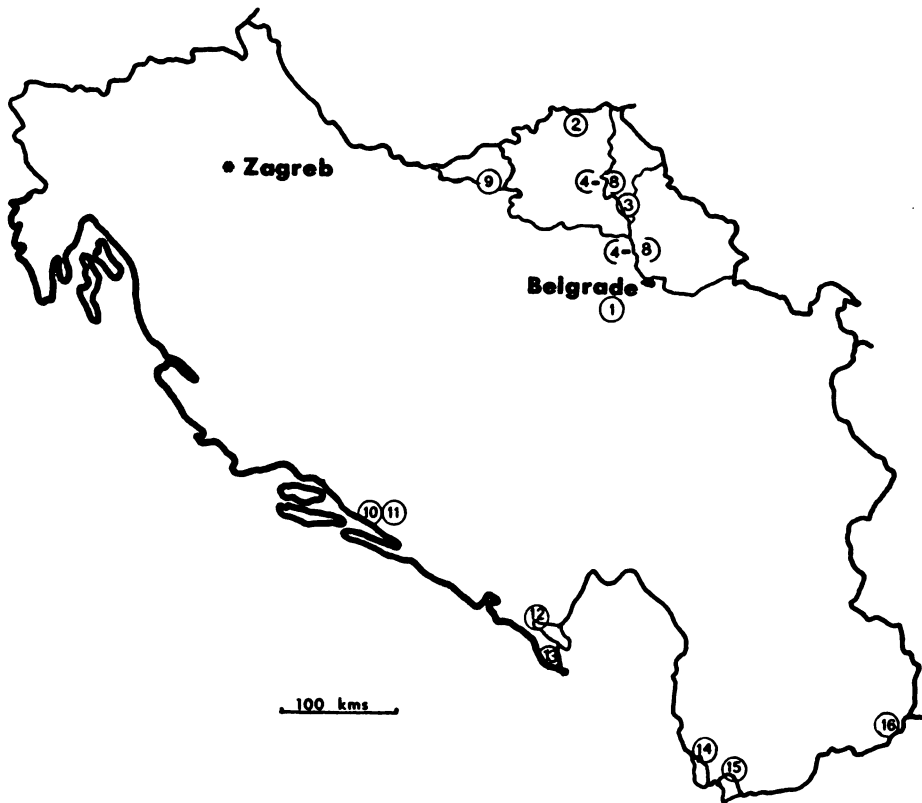
### \*Nominated for inclusion in the Ramsar Convention list

	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
<b>Province of Vojvodina</b>					
*1.	Obedska bara	44°43'N	20°04'E	17,501 ha	1b,c,d,e; 2a,b,c; 3a,c Nature Reserve (1,000 ha)
*2.	Ludoško jezero (Lake Ludas)	46°04'N	19°48'E	593 ha	1c,d,e; 2a Protected Ramsar Convention listed site
3.	Carska bara	45°11'N	20°22'E	1,500 ha	1b,c,d,e; 2a Unprotected
4.	Vojtina Mlaka			50 ha	1b; 2a Protected
5.	Monoštor	45°00'–30'N (sites numbered 4–8 inclusive)	20°00'–30'E	1,000 ha	Not assessed Protected
6.	Kozjak			44 ha	Not assessed Protected
7.	Veliki rit			500 ha	Not assessed Protected
8.	Mala bara			60 ha	Not assessed Protected
<b>Republic of Croatia</b>					
9.	Kopacki rit	45°36'N	18°54'E	17,700 ha	1b,c,d,e; 2a; 3a,c Protected
10.	Neretva Delta	42°58'– 43°02'N	17°27'–40'E	1,900 ha	1b(?),d,e; 2a; 3b Protected
<b>Republic of Bosnia and Hercegovina</b>					
11.	Hutovo Blato in the Neretva Valley	43°00'–03'N	17°45'–47'E	360 ha	1b(?),d,e; 2a; 3b Protected
<b>Republic of Montenegro</b>					
12.	Skadarsko jezero (see also under Albania)	42°10'N	19°20'E	Yugoslav part 22,500 ha (total 34,970 ha)	1c,d,e; 2a; 3b Partly protected
13.	Bojana river (lower reaches)	41°52'N	19°22'E	c.14 km of river	2a Border river with Albania. Partly protected
<b>Republic of Macedonia</b>					
14.	Ohridsko jezero (Lake Ohrid) (see also under Albania)	41°00'N	20°45'E	Yugoslav part 25,100 ha (total 34,800 ha)	1c,d,e; 2a Protected landscape

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	<i>Locality</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Size</i>	<i>Wetland criteria/ Conservation status</i>
15.	Prespansko jezero (Lake Prespa) (see also under Albania and Greece)	40°55'N	21°00'E	Yugoslav part 18,580 ha (total 28,300 ha)	1c,d,e; 2a Protected landscape
16.	Dojransko jezero (Lake Doiran) (see also under Greece)	41°13'N	22°44'E	Yugoslav part 2,700 ha (total 4,260 ha)	1c,d,e; 2a Protected landscape

**YUGOSLAVIA**



**DETAILS OF LISTED AREAS**

**9. KOPACKI RIT**

**Criteria for inclusion** 1b,c,d,e; 2a; 3a,c.

**Geographical location** 45°36'N 18°54'E East centre of the triangle formed by the Dunav (Danube) and Drava rivers and the Hungarian border, in the north-

east corner of the Slavonian region of the Republic of Croatia; about 16 km north-east of Osijek.

**Area** 17,700 ha (the size of the swamp itself was estimated at 6,000 ha by Project AQUA).

**Altitude** 82 m.

**Water depth** c.5 m.

**Wetland type** 18.

**Ecology** A swampy area between the rivers Drava and Danube, near their confluence, and fed by a tributary of the Danube rising in southern Hungary. The swamp communities of the area which are closely linked to those of the 400 sq. km floodplain of the Danube centred on Apatin, are of great ecological as well as ornithological importance, with special reference to their highly complicated mechanisms of organic productivity. The waterfowl nesting in the area include Cormorant *Phalacrocorax carbo*, Little Egret *Egretta garzetta*, Great White Egret *Egretta alba*, White Stork *Ciconia ciconia*, Greylag Goose *Anser anser* and the White-tailed Eagle *Haliaeetus albicilla* (reported still present in 1973, but generally rated a vulnerable species). The wetland is also frequented by migrating Cranes *Grus grus* in November or late autumn.

**Legal status** Protected (nature reserve).

**Tenure** Part State and part private ownership.

**Management practices** Some of the area is used for fishery purposes.

**Threats** None reported.

**Scientific research** A number of studies, particularly on birds, have been undertaken in the area.

#### **Principal reference material**

Rucner, D. 1962. Contributions to the knowledge of ornithofauna from Kopacki Rit and surrounding regions in Baranja. *Larus* 14.

## **10, NERETVA DELTA**

**Criteria for inclusion** 1b(?),d,e; 2a; 3b.

**Geographical location** 42°58'–43°02'N 17°27'–40'E The delta borders the Adriatic Sea for a distance of c. 25 km south-eastwards from the town of Ploče at the southern extremity of the Dalmatian region, Republic of Croatia; it extends inland for 20 km before the boundary of Bosnia Hercegovina and the lower end of the Neretva valley are reached.

**Area** The total delta area is estimated to be around 500,000 ha, of which c.1,900 ha are now protected.

**Altitude** 2–5 m.

**Water depth** Ranging from 1 to 27 m.

**Wetland types** 9, 17, 19.

**Ecology** A network of small karstic lakes, some permanent, others only temporary. The whole area has a very complex hydrographic system with some waters

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being oligotrophic and others brackish. It was formerly an important stopping-place for migrating birds but their population has declined with the human development of the area. However it is still notable for its species diversity, particularly along the coastal dunes and sandbanks. Known to be still nesting are several species of grebe Podicipitidae and heron Ardeidae, Pygmy Cormorant *Phalacrocorax pygmaeus*, Mallard *Anas platyrhynchos*, Garganey *A. querquedula*, Ferruginous Duck *Aythya nyroca* and various rails Rallidae.

**Legal status** Two areas, of 1,200 and 700 ha in extent, are protected nature reserves.

**Tenure** State ownership.

**Management practices** Freshwaters in the area are used for fishing and hunting, both being controlled. Water management includes flood prevention measures and some use of springs for water supply purposes.

**Threats** The extension and impact of the development associated with the town of Ploče; intensive hunting; and hydrographic control and regulation in the sector between the town of Opuzen (half way to Metković) and the river-mouth. These have all contributed to a decline in the migrant waterfowl frequenting the delta.

**Scientific research** Hydrographic studies and other investigations by the Institute of Biology in Belgrade and in Sarajevo.

### Principal reference material

Stancović, S. 1958. Limnologie des lacs karstiques. *Verh. internat. Ver. Limnol.* XIII.

## OHRIDSKO JEZERO (Lake Ohrid)

**Criteria for inclusion** 1c,d,e; 2a.

**Geographical location** 41°00'N 20°45'E South-west corner of the Macedonian Republic on the Yugoslav/Albanian border, 50 km west of Bitola.

**Area** 34,800 ha of which 25,100 are in Yugoslavia and 9,700 in Albania.

**Altitude** 695 m.

**Water depth** Maximum 286 m; mean 145 m.

**Wetland type** 19.

**Ecology** A very old lake of combined karstic and tectonic origin, being a collapsed limestone cavern or polje situated in an area of tectonic movement and now permanently flooded. Its waters are known to originate from underground drainage systems. The shoreline varies from reedbeds and sandy beaches to steep cliffs and the lake bottom shelves steeply. Vegetation includes lake-shore pondweeds such as *Potamogeton*, *Myriophyllum* and *Ceratophyllum*, together with a number of stonewort *Chara* species occupying different depths between 6 and 18 m. A number of rare and endemic species are present including 24 endemic ostracods, a relict gasteropod fauna of considerable interest, deep water amphipods such as *Synura ambulans* and others with affinities to cave fauna. The endemic Ohrid trout *Trutta letnica* is the basis for a local fishery industry. Due to the elimination of most lakeshore emergent vegetation, waterfowl populations are generally low though numerous species have been recorded on passage.

**Legal status** 'Natural Monument' giving general landscape protection.

**Tenure** State ownership.

**Management practices** The fishery on the Yugoslavian side is carefully managed to preserve stocks. The area is a noted tourist resort.

**Threats** Some danger of pollution from effluent derived from holiday home and other urbanization of the Yugoslavian shores. Any introductions of exotic species could have serious effects on the unique indigenous fauna.

**Scientific research** Intensive studies have been made over many years. The Hydrobiological Station in the Yugoslavian sector services both the fishery and other freshwater research.

**Principal reference material**

Green, J. 1960. The fauna of Europe's oldest lake. *New Scientist* 7(172): 522-524.

Stanković, S. 1960. *The Balkan Lake Ohrid and its living world*. W. Junk, The Hague (includes many references).

## ANNEX I

### HEILIGENHAFEN CRITERIA

#### 1. *Criteria pertaining to a wetland's importance to populations and species*

A wetland should be considered internationally important if it:

- a) regularly supports 1% (being at least 100 individuals) of the flyway or biogeographical population of one species of waterfowl;  
or
- b) regularly supports either 10,000 ducks, geese and swans, or 10,000 coots, or 20,000 waders (Limicolae);  
or
- c) supports an appreciable number of an endangered species of plant or animal;  
or
- d) is of special value for maintaining genetic and ecological diversity because of the quality and peculiarities of its flora and fauna;  
or
- e) plays a major role in its region as the habitat of plants and of aquatic and other animals of scientific or economic importance.

#### 2. *Criteria concerned with the selection of representative or unique wetlands*

A wetland should be considered internationally important if it:

- a) is a representative example of a wetland community characteristic of its biogeographical region;  
or
- b) exemplifies a critical stage or extreme in biological or hydromorphological processes;  
or
- c) is an integral part of a peculiar feature.

#### 3. *Criteria concerned with the research, educational or recreational values of wetlands*

A wetland should be considered internationally important if it:

- a) is outstandingly important, well-situated and well equipped for scientific research and education;  
or
- b) is well-studied and documented over many years and with a continuing programme of research of high value, regularly published and contributed to by the scientific community;  
or
- c) offers special opportunities for promoting public understanding and appreciation of wetlands, open to people from several countries.

#### 4. *Criteria concerned with the practicality of conservation and management*

Notwithstanding its fitness to be considered as internationally important on one of the Criteria set out under 1, 2 and 3 above, a wetland should only be designated for inclusion in the List of the Ramsar Convention if it:

- a) is physically and administratively capable of being effectively conserved and managed;

- and
- b) is free from the threat of a major impact of external pollution, hydrological interferences and land use or industrial practices.
  - c) A wetland of national value only may nevertheless be considered of international importance if it forms a complex with another adjacent wetland of similar value across an international border.

## ANNEX II

*CLASSIFICATION OF WETLAND TYPES*

(Based on the scheme developed by Y. A. Isakov, as modified by G. Eber)

**COASTAL AREAS***Open sea shallow waters*

- 1. Inter-tidal zone of open sea (shallow waters)
- 2. Permanent shallow waters in open sea

*Sea bays and straits*

- 3. Shallow sea waters, bottom uncovered at low tide
- 4. Deep sea bays (fjords)
- 5. Shallow sea bays (always covered)
- 6. Fresh and brackish water bays
- 7. Lagoons, both salt and fresh (including artificial lagoons)

*Mouths of rivers*

- 8. Tidal estuaries
- 9. Deltas

*Coasts*

- 10. Small islets
- 11. Continental and large island coasts (including coastal marshes, dunes, rocky or sandy shores)

**RIVER VALLEYS***Rivers and flood plains*

- 12. Lowland rivers (meandering), including flood plains and interior or dry deltas
- 13. Mountain rivers
- 14. Brooks

*Storage reservoirs*

- 15. Storages with relatively stable level of water
- 16. Storages with great changes of water level

**OTHER AREAS***Lakes*

- 17. Salt lakes (including periodical intermittently-fresh-water lakes)
- 18. Fresh eutrophic lakes (including periodical intermittent lakes never salt)
- 19. Fresh oligotrophic lakes
- 20. Fresh dystrophic lakes

*Mires*

- 21. Fen and transitional mires



ANNEX II

22. Peat bogs

*Temporary waters*

23. Temporary waters from snowmelt or rainfall (wherever situated)

*Artificial ponds*

24. Ponds (including fish, mill and farm ponds) and small reservoirs

25. Irrigation and drainage systems (including rice fields, drainage ditches and pits with water)

## ANNEX III

### INTERNATIONAL UNION FOR CONSERVATION OF NATURE AND NATURAL RESOURCES (IUCN)

#### ADDRESS

Avenue du Mont Blanc  
1196 Gland  
Switzerland

Telephone: (022) 64.32.54  
Telex: 22618 iucn  
Telegram: IUCNATURE GLAND

#### ESTABLISHED

1948

#### STATUS

Independent, international, non-governmental organization.

#### GOAL

To promote scientifically-based action directed towards the sustainable use and conservation of natural resources.

#### OBJECTIVES

- a) to ensure that development is sustainable, so that the potential of renewable natural resources is maintained for the present and future benefit of people;
- b) to ensure that areas of land or sea which do not have special protection (the vast majority) are managed so that natural resources are conserved and the many species and varieties of plants and animals can persist in adequate numbers;
- c) to protect areas of the land, and of fresh and sea waters, which contain representative or exceptional communities of plants and animals;
- d) to devise special measures to ensure that species of fauna and flora do not become endangered or extinct.

#### ORGANIZATION

At present, IUCN has 444 voting *members* in 106 countries, these members being States (52), government agencies (114) and non-governmental organizations (278). The elements of IUCN's structure are:  
the *General Assembly*, at which its members meet triennially to determine policies and the broad elements of IUCN's programme;  
the *Council*, elected by the General Assembly and meeting annually to review and approve the execution of the programme;  
the *Bureau*, a smaller body elected by the Council from among its members to act when the Council is not sitting;  
the *Commissions*, bodies of volunteer experts who make a major contribution to the development and execution of the programme; Chairmen are elected by the General Assembly; members selected by the Chairman and confirmed by Council. The six Commissions have as their respective subject areas: threatened species; national parks and other protected areas; ecology; environmental planning; environmental policy, law and administration; and education. The Commissions constitute a global network of more than 700 scientists and professionals;  
the *Director General* who is the chief executive of IUCN, and with the support of the *Secretariat*, plans and coordinates the execution of the programme.

### ANNEX III

#### ACTIVITIES

IUCN undertakes four kinds of activities:

*monitoring* what's happening in conservation and drawing conservation requirements to the attention of organizations that can undertake action on the ground;

*planning* conservation action at the strategic, programme and project levels which is scientifically sound and realistic in socio-economic terms, using the information obtained through monitoring;

*promoting* conservation action on the ground by governments, intergovernmental bodies and NGOs through the effective dissemination of information;

and *providing assistance and advice* necessary for the achievement of conservation action on the ground.

Its work is undertaken at a strategic level, for example through the publication and promotion of the World Conservation Strategy (WCS), through a three-year programme of activities, and at the project level. In respect of projects, IUCN helps design and manage the projects of the World Wildlife Fund (WWF), which, at any one time, represent several hundred field activities in conservation. IUCN also designs and undertakes projects of its own, many in collaboration with the United Nations Environment Programme (UNEP)

Gland, 23.6.80



