

Promotion of
the Establishment of Marine Parks
and Reserves
in the Northern Indian Ocean
including the Red Sea and Persian Gulf

Papers and Proceedings
of the Regional Meeting

held at

Tehran, Iran

6 to 10 March 1975

*Sponsored by the
Department of the Environment of the Imperial Government of Iran
and by IUCN
with the Co-sponsorship of UNESCO
and supported by the
Fund of the United Nations Environment Programme
and the World Wildlife Fund*



International Union
for Conservation of Nature and Natural Resources
1110 Morges, Switzerland
1976

The International Union for Conservation of Nature and Natural Resources (IUCN) is an independent international body, formed in 1948, which has its headquarters in Morges, Switzerland. It is a Union of sovereign states, government agencies and non-governmental organizations concerned with the initiation and promotion of scientifically-based action that will ensure perpetuation of the living world - man's natural environment - and the natural resources on which all living things depend, not only for their intrinsic cultural or scientific values but also for the long-term economic and social welfare of mankind.

This objective can be achieved through active conservation programmes for the wise use of natural resources in areas where the flora and fauna are of particular importance and where the landscape is especially beautiful or striking, or of historical, cultural or scientific significance. IUCN believes that its aims can be achieved most effectively by international effort in cooperation with other international agencies, such as UNESCO and FAO.

The World Wildlife Fund (WWF) is an international charitable organization dedicated to saving the world's wildlife and wild places, carrying out the wide variety of programmes and actions that this entails. WWF was established in 1961 under Swiss law, with headquarters also in Morges.

Since 1961, IUCN has enjoyed a symbiotic relationship with its sister organization, the World Wildlife Fund, with which it works closely throughout the world on projects of mutual interest. IUCN and WWF now jointly operate the various projects originated by or submitted to them.

The projects cover a very wide range, from education, ecological studies and surveys, to the establishment and management of areas as national parks and reserves and emergency programmes for the safeguarding of animal and plant species threatened with extinction as well as support for certain key international conservation bodies.

WWF fund-raising and publicity activities are mainly carried out by National Appeals in a number of countries, and its international governing body is made up of prominent personalities in many fields.

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FOREWORD

Marine parks and reserves are rightly becoming a very important subject of concern to many countries of the world and this recognition can only be described as long overdue. A careful look at the general and specific recommendations set out in these Proceedings will make it clear that the creation and adequate management of marine parks and reserves is indeed of great importance to the harmonious development of the northern Indian Ocean region, a development geared towards achieving scientific, educational, recreational and, of course, economic benefits. The conservation, for instance, of coastal breeding grounds for fish and other marine life is likely to be the key to successful fisheries production on a sustained yield basis for generations to come. Likewise, if we are to prevent the increasing deterioration which could have a lasting negative impact on one of our most important and precious resources, there is a need to have established appropriate baseline areas covering representative parts of marine ecosystems so that the level and effects of pollution can be monitored. These are only two examples; one could expand on many other aspects such as the protection of unique plants and animals, including scores of rare birds, certain mammals, reptiles and of course fishes, that are likely to disappear if insufficient care is taken.

Although marine parks and reserves, with the exception of those in Kenya, are relatively little known in the region, they have been a subject of concern expressed on many previous occasions and are likely to become a much more important feature of development planning based on sound ecological principles and guidelines. This was eloquently brought to the world's attention at the First World Conference on National Parks (Seattle, USA, 1962) when Recommendation No. 15 made a specific plea for the establishment of marine parks. It was picked up by the UN Conference on the Human Environment (Stockholm, Sweden, 1972) particularly in Principle No. 2, and a little later that year both the 11th IUCN General Assembly in Banff, Canada (Recommendation No. 11) and the Second World Conference on National Parks in Yellowstone and Grand Teton, USA (Recommendation No. 4) urged all Governments concerned to set aside representative parts of marine ecosystems as marine parks and reserves.

The concept is now an important aspect of UNESCO's Man and the Biosphere Programme, particularly through the creation of biosphere reserves which will fulfil such an important scientific role in maintaining natural diversity, the assessment of changes and the elaboration of better methods of management and other forms of human manipulation. It is inherent in FAO's Advisory Committee on Marine Research as well as in UNESCO's Intergovernmental Oceanographic Commission (IOC), and in the Recommendation of the Economic and Social Council of the United Nations concerning integrated coastal

area management and development, to mention only a few of the UN organizations involved in programmes of marine parks and reserves.

Finally, it has been discussed in some detail at various recent IUCN regional meetings, particularly at the Regional Meeting on a Co-ordinated System of National Parks and Reserves in Eastern Africa, held in Seronera, Tanzania (October 1974), at the Central American meeting on Management of Natural and Cultural Resources held in San Jose, Costa Rica (December 1974) and at the First South Pacific Conference on National Parks and Reserves held in Wellington, New Zealand (February 1975). I might add that the subject of marine conservation was prominently discussed at the first expert meeting for representatives of the Red Sea and Gulf of Aden countries which was convened by the Arab League Educational, Cultural and Scientific Organization (ALECSO) and which was held in Jeddah (Saudi Arabia) in November 1974, to consider the Red Sea Regional Programme for Environmental Studies. Many of the suggestions made in Jeddah are of great importance to our own regional meeting.

It is obvious that no regional meeting can arrive at all the necessary solutions but the Tehran meeting nevertheless brought many problems and potential solutions into focus. It emphasized the need to include marine parks and reserves in the general process of coastal development, both in its planning and its execution phases, and adopted guiding principles towards this end. The countries of the region now have valuable resources to carry out their own recommendations and also know that in this endeavour they will be supported by the various inter-governmental and non-governmental organizations that were instrumental in making the meeting possible, in particular UNEP and UNESCO in the UN system, and IUCN.

It is much to be hoped that the recommendations of this meeting will provide a useful precedent for other forthcoming regional meetings on marine parks and reserves and that our successful endeavour in pooling knowledge and expertise and discussing better methods of planning, developing and managing marine resources on a regional basis, will soon pay dividends for the benefit of our region, and indeed the whole world.

Eskandar Firouz
Director
Department of the Environment
Tehran, Iran

C O N T E N T S

	Page
Organization of the Meeting and its Working Groups	7
Agreed Principles and General Recommendations	9
Summary Record of the Meeting	17
Opening Address by H.E. Mr. Eskandar Firouz, Director of the Department of the Environment of Iran	21
Summary of draft thematic Papers tabled at the Meeting for preliminary consideration: G. Carleton Ray	26
Country Reports	
1. Bahrain: M.D. Nurun Nabi	40
2. Egypt, Marine Parks and Reserves on the Red Sea Coast: A.I. Beltagy	43
3. Ethiopia, The Dahlac Islands Marine Park: Allem Berhanu	45
4. Iran, Surveys of the Southern Iranian Coastline with Recommendations for Additional Marine Reserves: Fred A. Harrington Jr.	50
5. Kenya, The Establishment of Marine National Parks in Kenya: P.M. Olindo & W.W. Asava	76
6. Kuwait: N.A. Husain	84
7. Pakistan: Syed Qadir Mohiuddin	86
8. Saudi Arabia, Summary review of the work of the Marine Research Centre, Jeddah (October, 1974): A.R. Nawwab	89
9. Somalia: Muridi Ali Salah	98
10. Sudan: A.M. Salih	99
11. Yemen Arab Republic: Hussein Loulou	101

	Page
Consultants Reports and Regional Reports	
Mediterranean Area, preliminary report of a survey of existing and potential marine parks: Hedia Baccar	103
United Arab Emirates, report of a survey of marine habitats, 3-15 February 1975: Erik Carp	107
Red Sea: R.F.G. Ormond	115
Sri Lanka, SE and W India, Pakistan, report on existing and potential marine parks and reserves: Rodney Salm	124
Seychelles and neighbouring islands, existing and potential Marine Park Sites: Rodney Salm	129
Independent Reports	
Pollution Aspects, report of a preliminary survey of pollution problems along the Kenya coast: V.C. Anderlini	134
Pollution Aspects, further comments and suggestions: V.C. Anderlini	136
Conservation and Exploitation of Ethiopian and East African Coastal Resources: L.H. Brown	138
Appendices	
1. Reports of the Working Groups of the Conference	
a. Report of the Persian Gulf Working Group	144
b. Report of the Red Sea and Gulf of Aden Working Group	149
c. Report of the North West Indian Ocean Working Group	155
d. Report of the Regional and Parks Planning Working Group	162
2. Texts of Resolutions and Recommendations of International Conferences in recent years relating to Marine Parks and Reserves	
	164
3. Names and addresses of Participants	
	167

ORGANIZATION OF THE MEETING AND ITS WORKING GROUPS

1. The Department of the Environment of the Imperial Government of Iran and the International Union for Conservation of Nature and Natural Resources (IUCN) convened a Regional Meeting on Marine Parks and Reserves in the Northern Indian Ocean including the Red Sea and the Persian Gulf, with the support of the United Nations Environment Programme (UNEP) and the World Wildlife Fund (WWF) and with the co-sponsorship of the United Nations Educational, Scientific and Cultural Organization (UNESCO).
2. The Meeting was held in Tehran from 6 - 10 March 1975
3. The Governments of the following States were represented at the Meeting:

Bahrain	Kenya	Saudi Arabia
Ethiopia	Kuwait	Somalia
Egypt	Pakistan	Sudan
Iran		
4. The Governments of the following States were also invited:

India	Qatar	Yemen Arab Republic
Iraq	Sri Lanka	Yemen People's
Mauritius	Tanzania	Democratic Republic
Oman		United Arab Emirates
5. The Meeting elected Dr. G. Carleton Ray as President of the Meeting.
6. The Meeting elected as Vice Presidents Dr. Mohammad Reza Amini, Head of the Iranian Representation, and Dr. Ali Ibrahim Beltagy, the Representative of Egypt.
7. The following Specialist Consultants, sponsored by IUCN, presented reports:

Dr. G. Carleton Ray	Chief Consultant on Critical Marine Habitats (African Coast)
Dr. Hedia Baccar	(Mediterranean)
Mr. Erik Carp	(Persian Gulf)
Dr. Rupert F.G. Ormond	(Red Sea)
Mr. Rodney Salm	(Sri Lanka, India, Pakistan and islands of the North West Indian Ocean)
8. The Department of the Environment of Iran and IUCN provided the Secretariat of the Meeting. Dr. Derek A. Scott, of the Iranian Representation, was appointed as Rapporteur.

9. The following Working Groups were established by the Meeting:

1) Persian Gulf Working Group

Dr. M.R. Amini (Chairman)
Mr. M.H. Al-Attar
Mr. A. Al-Zaidan
Mr. E. Carp
Mr. N.A. Hosain
Mr. M.D. Nurun Nabi
Mr. A.R. Nawwab

2) Red Sea and Gulf of Aden Working Group

Dr. A.I. Beltagy (Chairman)
Dr. Hedia Baccar
Mr. T.G. Michael
Mr. A.R. Nawwab
Dr. R.F.G. Ormond
Mr. M.A. Salah
Mr. A.M. Salih

3) North West Indian Ocean Working Group

Mr. W.W. Asava (Chairman)
Mr. V.C. Anderlini
Mr. S.Q. Mohiuddin
Mr. M.A. Salah
Mr. R. Salm

4) General Principles Working Group

Dr. G. Budowski (Chairman)
Dr. K. Curry-Lindahl
Dr. A. de Vos
Dr. S. Morcos
Dr. G.C. Ray

5) Regional and Parks Planning Working Group

Mr. C. Eilian (Chairman)
Mr. B. Dolatshahi
Mrs. B. Khoshnevisan
Mr. M.D. Nurun Nabi
Mr. R. Salm
Mr. J. Wiles

AGREED PRINCIPLES AND GENERAL RECOMMENDATIONS

Upon consideration of the National, Regional and Technical Reports presented to the Meeting, and on the basis of the ensuing discussions, the General Principles Working Group drew up a series of Agreed Principles and General Recommendations relevant to the conservation of marine and coastal resources, and to the establishment of marine parks and reserves. These Agreed Principles and General Recommendations were approved by the Meeting.

Agreed Principles

I. Value of the Marine and Coastal Resources

Renewable (living) resources of coastal and marine regions are among the most valuable long-range national resources. The productivity of shallow seas is the greatest known. This justifies that the highest priority be given to their perpetuation and/or restoration.

II. Impacts on the Coastal and Marine Zone

The desire for immediate short-range gain, with insufficient attention being paid to ecological effects, has led to severe depletion of coastal and marine resources on a global scale. There is increasing evidence of the decrease in marine productivity while, at the same time, coastal development and marine pollution are rapidly and logarithmically increasing. Coasts are the most heavily populated areas on earth and receive the bulk of man's impact in terms of pollution, dredging, damming, watershed alteration, siltation, estuarine destruction, coral reef destruction, and coastal development for industry, recreation, waste disposal and tourism. Pollution in the open sea is rapidly increasing, especially through dumping and oil spillage. This poses serious threats to marine productivity, and the monitoring and mitigation of these effects is essential.

III. Nature of Coastal and Marine Systems

The coasts constitute transition zones between land and sea and as such do not divide aquatic and terrestrial systems, but unite them. Coastal marine systems thus derive much of their character from watersheds. In addition, marine systems are extremely large, and whole living components of them are extremely mobile. Shore biogeomorphic processes are among the most dynamic known and efforts to stabilize beaches, for instance, are largely both futile and expensive. Watershed alteration through overgrazing, damming and deforestation can alter coastal systems through changes in water clarity, nutrient exchange and siltation.

The comprehension of such 'down-stream' effects is vital in coastal and marine management.

IV. Planning and Development

Coasts and near-shore waters are divisible into:

- (1) critical areas which must be preserved in order to maintain the productivity of marine waters;
- (2) conservation areas where development is not yet great and where it can proceed in accord with ecological guidelines or where restoration is possible;
- (3) less critical areas which are either already heavily developed or which are not as important as others for productivity.

For all, the maintenance of high water quality is important. Development is not in itself deleterious, but when it precedes proper environmental evaluation severe consequences usually result. Marine parks and reserves are an integral part of regional land and marine planning and give us an essential guide for further coastal development.

V. Function of Reserves and Parks

Reserves and parks may be seen as tools which, among their many functions, serve:

- (1) to conserve and manage representative samples of marine habitats and ecosystems;
- (2) to protect endangered species and habitats;
- (3) to conserve and manage important breeding areas for economically important species;
- (4) to preserve aesthetic values for present and future generations;
- (5) to protect valuable archaeological, historical and cultural sites;
- (6) as sites for the interpretation of marine areas for the purposes of tourism, recreation and education of the public;
- (7) as sites for the education and training of reserve managers;
- (8) as sites for the establishment of research stations in which to learn of marine ecosystem processes;

- (9) as sites for monitoring the environmental effects of man's development and his various perturbations.

Reserves are not in competition with man's use of nature, but are to be viewed as companions to such use, in which maximum compatibility between man and nature may be investigated and achieved.

VI. Importance of a Reserve Park System

Marine ecosystems are large and most often of an international nature. It is usually not possible to incorporate ecosystems within single reserves. Thus the emphasis here is on a system of both national and regional scope. Habitats are reflective of ecosystem processes, and their diversity should be represented in toto within the system so as to be able to investigate and monitor man's activities and so as to preserve both habitat diversity and the reservoir of genetic materials within the entire ecosystem.

VII. Knowledge of Marine Systems

Increased study is essential for proper comprehension of marine ecosystems. A basic understanding of essential features of marine and coastal systems will involve long-term studies, but establishment of reserves and parks cannot await the results of such studies. From such studies will emerge better understanding of food and energy resources, shore processes, coastal development, and possibilities for restoration. Attention must be drawn also to false conceptions of the 'assimilative capacity' of receiving waters for effluents, to matters of site specificity, and to proper stewardship of our coasts and seas.

General Recommendations

1. National Parks and Equivalent Reserves as an Integrated Part of Regional Development of Coastal and Marine Areas

CONSIDERING the ecological and economic values of coastal lands as transitional areas between interacting terrestrial and marine ecosystems, including a wide range of highly productive renewable natural resources such as estuaries, mangrove forests, sea-grass beds and coral reefs, which are vital as spawning grounds and nurseries for fish and invertebrates which in turn at adult stages are the basis for commercially important fisheries as well as being a condition of existence for many other marine animals important as a protein resource;

REALIZING the unique physical characteristics of the coastal zone which make it a focal point for settlement and economic activity and that diverse activities on the

often congested coastal areas tend to conflict with each other and also interact and sometimes negatively influence a highly complex and sensitive environment;

RECALLING Resolution 1802 (LV) of the United Nations Economic and Social Council emphasizing the importance of an interdisciplinary approach in studying the problems of coastal area development, which implies the importance of ecological considerations;

CONVINCED that development activities must be undertaken in accordance with sound ecological principles if maximum short- and long-term benefits are to accrue to the peoples of the countries concerned;

RECALLING, also, resolutions concerned with marine parks and reserves made by international gatherings including Recommendation No. 15 of the First World Conference on National Parks (Seattle, U.S.A., 1962), Recommendation No. 11 of the Eleventh General Assembly of IUCN (Banff, Canada, 1972), Recommendation No. 4 of the Second World Conference on National Parks (Grand Teton National Park, U.S.A., 1972), as well as those from regional meetings, notably the Regional Symposium on Conservation of Nature - Reefs and Lagoons (Noumea, New Caledonia, 1971) and the Arab League Educational, Cultural and Scientific Organization (ALECSO) expert meeting (Jeddah, Saudi Arabia, 1974) for representatives of the Red Sea and Gulf of Aden countries on the Red Sea Regional Programme for Environmental Studies;

RECOGNIZING the usefulness of a network of national parks and nature reserves as samples of natural ecosystems, biomes and habitats for monitoring and comparison with areas influenced, altered or destroyed by human activities;

RECALLING Project No. 8 of UNESCO Man and the Biosphere Programme concerned with promoting the conservation of natural areas and genetic resources through the establishment of a co-ordinated series of biosphere reserves;

The Regional Meeting on Marine Parks and Reserves in the Northern Indian Ocean, held at Tehran, Iran, 6-10 March 1975:

RECOMMENDS to the Governments of the region and agencies concerned:

1. That in all regional and national development planning of coastal and marine areas, surveys to identify characteristic ecosystems, biomes and habitats of the region should be undertaken before any forms of land and sea use are decided upon;

2. That regional and national systems of national parks and equivalent reserves be established as soon as possible as a result of preceding surveys indicating cultural, educational, environmental and scientific values, tourist potential and other features favourable to promoting the development of the region;
 3. That such a regional system should be integrated in development and management programmes at regional and national levels.
2. Procedures Towards the Planning and Management of Regional and National Systems of Marine Reserves

CONSIDERING that the legal steps towards the establishment of marine reserves must necessarily be followed by adequate follow-up actions and in particular take into account the following aspects:

- (a) Existing and proposed development plans affecting coastal areas and other marine ecosystems, in particular land and water use patterns and their likely evolution insofar as they affect the physical and chemical properties of waters reaching the sea;
- (b) Use of the best management tools in satisfying different properties and functions of marine reserves such as monitoring, productivity, tourism and recreation, and other uses;
- (c) Dependence on a number of factors that are regional in origin and scope and therefore require a regional approach for management;
- (d) Need to win the good will and co-operation of local populations in the management of marine reserves;

The Regional Meeting on Marine Parks and Reserves in the Northern Indian Ocean, held at Tehran, Iran, 6-10 March 1975:

RECOMMENDS to the Governments of the region:

1. That planning for marine parks and reserves should be considered as an integral part of national and regional land-use planning, and that national land-use planning teams should include experts in marine and wildlife affairs; the selected marine parks and reserves should be planned by appropriate experts;
2. That adequate and periodically revised management plans be designed for each selected reserve, taking into account the evaluation of new data and giving full weight to changes among interacting factors,

new appraisals of uniqueness, depleted faunal and floral resources, interdependence with productivity and other relevant aspects;

3. That full use is made of such management concepts and tools as zoning, buffer zones, changes in jurisdictional status as well as various administrative devices;
 4. That methods for regional co-operation be devised in those management aspects that necessarily require a regional approach;
 5. That in achieving these objectives, maximum collaboration and participation be sought from local populations, in particular after such reserves have been established.
3. Research and Monitoring

CONSIDERING that research aspects related to marine reserves have national as well as regional implications and that there is a great lack of baseline information on physico-chemical conditions, biology, productivity and pollution and other degradations of marine environments;

TAKING INTO ACCOUNT that there is a particular need for continuous monitoring of environmental parameters and for environmental impact studies, which can be carried out under particularly desirable conditions if there is an adequate network of stations, including marine reserves, that are equipped for such activities;

The Regional Meeting on Marine Parks and Reserves in the Northern Indian Ocean, held at Tehran, Iran, 6-10 March 1975:

RECOMMENDS to the Governments of the region and concerned international organizations and institutions:

1. That marine research institutes, universities and other research institutions be involved in setting up marine reserves where research can be carried out, and be strengthened to collaborate in the collection of baseline information;
2. That continuing monitoring stations be established making full use of marine reserves;
3. That every possible attempt be made to co-ordinate and integrate such research and monitoring programmes through regional centres equipped with mechanisms for retrieval and dispersion of the information gathered for the benefit of the region.

4. Technical and Financial Assistance

CONSIDERING that there will be a growing need to establish marine parks and reserves and to promote research, planning, development and management programmes related to them, and that some countries of the region might have to rely on assistance in carrying out such programmes that have regional and world-wide implications;

The Regional Meeting on Marine Parks and Reserves in the Northern Indian Ocean, held at Tehran, Iran, 6-10 March 1975:

RECOMMENDS to the Governments of the region that they take full advantage of the technical assistance already available;

RECOMMENDS to the international organizations concerned, in particular those of the UN system, as well as other assistance programmes and non-governmental institutions, that they step up their technical assistance and provide the necessary financial support; and

RECOMMENDS to the Governments of the region that they encourage programmes and activities based on mutual assistance within the region.

5. Public Awareness

RECOGNIZING the impact marine national parks may have upon the social, economic and political base of a country;

CONSIDERING the need for public and institutional acceptance and understanding;

The Regional Meeting on Marine Parks and Reserves in the Northern Indian Ocean, held at Tehran, Iran, 6-10 March 1975:

RECOMMENDS to the Governments of the region that they consider at various stages of their planning programmes, efforts directed at interest group participation and information dispersal, particularly in connection with productivity, research, living laboratories, recreation and other uses, through adequate production of audio-visual aids and other tools in educational and interpretative programmes at all levels.

6. Training of Personnel for the Management of Marine Reserves

CONSIDERING that there is a need for trained personnel to undertake planning, management, and development of marine parks and reserves;

TAKING INTO ACCOUNT that in the majority of already established marine parks and reserves there is a shortage of trained personnel at all levels;

The Regional Meeting on Marine Parks and Reserves in the Northern Indian Ocean, held at Tehran, Iran, 6-10 March 1975:

RECOMMENDS to the Governments of the region:

1. That existing national training institutions (incorporating various aspects of marine parks and reserves) be strengthened and wherever necessary new institutions be established; and
2. That the fullest use be made of existing facilities and manpower of other institutions on a regional or multinational basis.

SUMMARY RECORD OF THE REGIONAL MEETING ON PROMOTING THE ESTABLISHMENT OF MARINE PARKS AND RESERVES IN THE NORTHERN INDIAN OCEAN INCLUDING THE RED SEA AND PERSIAN GULF

Thursday, 6 March

The meeting was opened at 10 a.m. by Mr. Eskandar Firouz, Director of the Department of the Environment. The text of his Opening Address follows this Summary. The meeting then elected Dr. G. Carleton Ray (IUCN Consultant on "Marine Habitats) as its Chairman and Dr. M.R. Amini (Department of the Environment, Iran) and Dr. A.I. Beltagy (Egypt) as Vice-Chairmen. Dr. D.A. Scott (Department of the Environment, Iran) was appointed as Rapporteur for the meeting.

Dr. Ray, after taking the Chair, briefly reviewed the activities to date of IUCN in the conservation of marine habitats and stressed the international nature of marine ecosystems and the consequent necessity of a regional and ecological rather than national approach to the main objective of the meeting. Mr. Erik Carp (IUCN Consultant on Wetlands) gave details of the IUCN project for a Directory of Wetlands of International Importance for which he is the Co-ordinator. This project overlaps to some extent its marine habitat project, as it includes marine wetland sites with a depth of less than 6 metres.

Dr. K. Curry-Lindahl (UNEP) and Dr. S. Morcos (UNESCO) described the tasks of their organizations and the necessity for gathering comparative data in order to encourage Governments to increase and maintain national parks. A statement by Dr. A. de Vos expressed the interest of FAO in marine resources and the establishment of marine parks. He particularly stressed the importance of training personnel for the management of such parks and reserves.

The Chairman then suggested the working methods for the Conference which would split up into regional Working Groups after the presentation and discussion of the National Reports and consultants' Regional Reports. He stressed the need to list critical areas, with attention given to jurisdiction, man's use of the site, recommendations and mechanisms for further investigations. It was agreed that management of marine parks as well as anti-pollution measures should be considered and that the proposed working arrangements were acceptable. In the context of an international approach to conservation of marine habitats, Mr. Firouz reviewed the co-operation between Iran and the USSR concerning environmental problems in the Caspian Sea area.

In the afternoon session, presided over by Dr. M.R. Amini, the National Reports of Ethiopia, Iran and Kenya and the Regional

Reports on the Persian Gulf and the Red Sea were presented and discussed, with the exception of the report on Kenya, discussion of which was postponed to the next day. In connection with the Persian Gulf, Dr. S. Sheibani (Observer) referred briefly to the programmes for control of oil pollution currently being developed by the National Iranian Oil Company.

Friday, 7 March

The Chairman, Dr. Carleton Ray, introduced Dr. Gerardo Budowski, Director General of IUCN, who expressed his pleasure at being present at this historic first regional meeting on marine parks. Dr. Budowski reviewed the present world situation in conservation of marine habitats. Establishment and development of the 115 existing marine parks and reserves had been rather haphazard, often as defensive measures. He emphasized the need for a progressive approach, including the possible alternative of creating marine parks and reserves which might help increase exploitable resources and provide recreation and tourism facilities.

With Dr. A.I. Beltagy in the chair, the meeting then continued discussion of National Reports. Reports of Bahrain, Somalia, Egypt and Kuwait were presented and discussed. The deferred discussion of the Kenya report, which followed, centred on problems of increased siltation due to watershed deterioration.

Mr. R. Salm (IUCN Consultant on Marine Parks) presented his report on marine habitats in Sri Lanka, India and Pakistan. He expressed serious concern about the destruction of coral reefs for commercial purposes, the export of coral fish, many of which perish during transport, and over-exploitation of turtle populations in several areas. He emphasized the need for the creation of dugong reserves and research on turtle populations.

During the afternoon, under the renewed Chairmanship of Dr. Ray, the Delegate from Pakistan presented Pakistan's National Report, following upon which it was agreed that, although the Mediterranean Sea was not of direct concern to the meeting, a short summary of conservation activities in this area would be useful. Accordingly, Dr. Hedia Baccar (IUCN Consultant on Marine Parks) reviewed potential Mediterranean marine parks areas and drew attention to some special features, including the archaeological interest of several of the sites. In the discussion, Dr. S. Morcos (UNESCO) referred to the serious environmental disturbances in the eastern part of the Mediterranean basin.

Mr. V. Anderlini (Observer) reported on the effects of pollution on the East African shores and future activities of the Mombasa laboratory in dealing with pollution problems.

The Chairman introduced his draft study of 'critical marine habitats', explaining the techniques of his survey, and also his draft paper on 'a preliminary classification of coastal and marine habitats'. He emphasized that these were very much first attempts for consideration and discussion in the light of which final versions would be prepared and published (see IUCN New Series No. 37 of 1976 and Occasional Paper No.14 of 1975) .

The meeting then formed itself into Working Groups: the General Principles Group, the Persian Gulf Group, the Red Sea and Gulf of Aden Group and the North West Indian Ocean Group, and, subsequently, an additional group on Regional and Parks Planning. Their terms of reference were to examine the aspects of establishing marine parks falling within their respective scope but in general covering site selection, present and future impact of man on environment, socio-economic aspects, present policies, training of park personnel, establishment of laboratories and research programmes and international agreements.

In the concluding discussion of the Session it was agreed that it should be indicated that countries invited to the meeting but unable to send delegates would be welcome to take part in the activities resulting from it at any time. They should also be invited to send reports for inclusion in the Proceedings.

Saturday, 8 March

An excursion by air to Bandar Abbas and visit by sea to the nearby island of Hormoz was cancelled due to weather conditions. The participants continued work on the Group reports. In the afternoon the drafts of Agreed Principles and General Recommendations were discussed and amended. It was agreed that the Recommendations, whether general or regional, should be sent to all Governments bordering the North West Indian Ocean, Persian Gulf and Red Sea and Gulf of Aden, and that the covering letter should draw attention to the Recommendations of special interest to the particular country. It was also decided that relevant Recommendations of previous international meetings concerning conservation of marine habitats should be attached to the report of the meeting as an Appendix.

Sunday, 9 March

The Working Groups continued their discussions and completed their reports. In the afternoon, under Dr. Ray's chairmanship, the Sudan Delegate presented the National Report of Sudan, and the Delegate of Saudi Arabia presented his country's National Report. Dr. K. Curry-Lindahl mentioned that unfortunately a special contribution by Dr. Leslie Brown on the coastal areas of Kenya had not been circulated and it was agreed that the paper should be included in the Proceedings.

The drafts of the Agreed Principles and General Recommendations and the Report of the Regional and Parks Planning Working Group were considered in detail and further modifications were approved.

Monday, 10 March

The Chairman presented the final version of the Agreed Principles and General Recommendations which were accepted by the meeting. The reports of the four regional Working Groups were presented by their Chairmen, discussed and approved, as was an annex on pollution problems prepared by Mr. Anderlini to the report of the Regional and Parks Planning Working Group.

Dr. Budowski expressed satisfaction with the results achieved during this first regional meeting on marine parks thanks to co-operation between national delegates and representatives of international organizations. He expressed gratitude to the Department of the Environment of Iran for their hospitality and excellent organization of the meeting.

The national delegates, representatives of international organizations and consultants all indicated satisfaction with the achievements of the meeting and expressed the hope that its outcome would provide a useful input to the International Conference on Marine Parks and Reserves to be held in Tokyo in May 1975.

After thanking the participants and the host country, the Chairman declared the Conference closed.

O P E N I N G A D D R E S S

H.E. MR. ESKANDAR FIROUZ

Director, Iran Department of the Environment

It is my great pleasure to welcome you to this Regional Meeting on the promotion of marine parks and reserves in the northern Indian Ocean, the Red Sea and the Persian Gulf. As you know, the meeting is being held under the joint auspices of the Imperial Government of Iran, the International Union for the Conservation of Nature and Natural Resources and the United Nations Environment Programme. On behalf of the Imperial Government of Iran, I wish to express our great appreciation at having the opportunity of acting as your hosts for this meeting, and hope both that you will enjoy your stay here and that we shall have a most successful meeting.

It was with great regret that for a variety of reasons we were compelled to change the venue of this meeting from Bandar Abbas on the shores of the Persian Gulf to Tehran. We lose, I am afraid, close contact with the real nature of our business here, but at the same time we are withdrawn from the temptation to take advantage of the warm sunshine and sandy beaches at the expense perhaps of our deliberations. We hope, however, that you will all be able to see a little of our southern coastline, and view for yourselves something of the progress which we are making in the conservation of our marine environments.

I would now like to give you a brief resume of conditions and activities here in our portion of the region under consideration. In this way I hope to draw your attention to what I see to be the main aspects and aims of the context in which we are meeting.

As you know, the Persian Gulf has a very long and colourful history of human occupation and interest based on its position as a vital link between the intercontinental commerce routes and trade centres of east and west. Centres of activity within the gulf itself have however shown many shifts - the ports of Khark Island and Bandar-e Deylam were of prime importance as early as the Pre-Achaemenian period; Siraf reached its peak in the Sassanid period, while Bandar Abbas did not gain eminence until the Safavid era. Today we see major centres at Abadan, Khorramshahr, Bushire and Bandar Abbas. Throughout history, however, the overall importance of the gulf for trade and commerce has remained unchanged.

On the other hand, the nature of the coastline is such that there has never been a high level of permanent human settlement. The hostile climate/ shortage of water for human consumption and irrigation, and poor sandy and saline soils, unsuited to agriculture, have precluded any large scale agricultural settlement, or indeed pastoralism. This has particularly been the case on many of the islands which lack a permanent supply of potable water. Thus, until very recently, the small rural human settlements along the Iranian coast were dependent very largely on a fishing economy. Now, of course, the discovery of oil deposits and consequent extensive developments of the petrochemical industry, coupled with an increasing appreciation of the strategic importance of the region, have engendered a massive cultural transformation. Here in the Persian Gulf we are now witnessing, in very vivid form, the unprecedented rates of urbanization and industrial expansion which modern technology has made possible.

It is for this reason that the subject of this meeting is particularly timely and appropriate. We must act swiftly and establish programmes to ensure a rational distribution of population and development in relation to resources, and to ensure that the unique features of the Persian Gulf are adequately protected. But in focusing attention on the shores of the Persian Gulf and the Makran Coast, we must not lose sight of the fact that activities quite distant from the coastal areas can have serious effects on the marine environments. Extensive land transformation, watershed degradation, pesticide utilization and release of effluents many hundreds of kilometres inland from the coast may have profound effects, even upon the ocean's benthic zone. Increased sedimentation rates, increased turbidity, increased organic content, and the disastrous increase in pesticide residues are doubtlessly causing gross, but as yet unrecorded, changes in our marine ecosystems.

Pollution from oil is clearly a problem which will continue to grow and which has no simple solution. Fortunately, there have not as yet been any major spills along our coasts, but already oil smears and globules of oil and sand have become a permanent feature of our beaches. The threat of a major spill is very real, and we must not decrease our vigilance.

The problems of flotsam and jetsam may to many seem trivial, for here as elsewhere there is the feeling that the sea's capacity to accommodate garbage and sewage is limitless. But for anyone who has spent a few hours "beach-combing" in the Persian Gulf the problems are very real. Already the amount of garbage littering our southern beaches is out of all proportion to the still relatively low human population along the coast. And in confined seas such as the Persian Gulf,

the Mediterranean and the Baltic, problems are compounded, owing to the relatively low rate of turn-over with the waters of the oceans.

In attempting to solve these problems, our Department of the Environment and many other agencies of the Imperial Government fully appreciate that we must adopt a much more global approach than might at first sight seem required. We are thus committed to programmes of a far-reaching nature - programmes aimed at conserving both our terrestrial and marine environments as an integrated whole.

Recent surveys undertaken by Department personnel have revealed the complexity of the southern Iranian coastline with respect both to its overall topography and to the diversity and abundance of its fauna and flora. At the same time we have established the rarity of certain ecological types, the biological productivity of which far exceeds the level which might be expected from their relative occurrence. Here I am speaking of the small but extremely important areas of emergent vegetation and rich intertidal mud-flats which occupy such a vital position in the productivity of ecosystems. Just as a large proportion of the North Sea Fisheries is dependent on the highly productive breeding grounds of the Wadden Sea, so too may much of the Persian Gulf fisheries be tied to a few relatively small coastal breeding grounds. Were the facts at our fingertips, we might well be able to justify protecting all such areas in the Persian Gulf. Until we have the full facts, we must give what justification we can.

In an endeavour to prevent indiscriminate and uncoordinated development of our southern coastline, a bill has been submitted to Parliament. If approved and enacted, this bill will effectively place a coastal strip two kilometres in width into public domain, and will give the Government full jurisdiction over land use practices in this zone. In addition, the bill includes a provision whereby all private exploitation and development within 60 metres of the high water mark will be prohibited. We hope that in this way we will be able to formulate and implement an appropriate land use plan for the entire coastline.

While at present most of our southern coasts are subjected to only minimal recreational use, it is anticipated that in the very near future pressures will increase manyfold, and it is becoming increasingly evident that areas must be protected and developed for recreation. The shifting population trends accompanying rapid industrial expansion and improved mobility of the populace serve only to accentuate this need.

The necessity of protecting some of our finer beaches for recreation is obvious. That of protecting our sand dunes

because of their instability is less obvious, but nonetheless very urgent. A large proportion of our coastal sand dunes has suffered excessive degradation through overgrazing in the past and has now reached a level of instability which results in serious sand-storm and shifting-sand situations.

Considerable attention has of course been given to the natural ecosystems of our coasts, and particularly to the more seriously threatened elements of the fauna and flora. Mangrove forests, sea-turtle nesting beaches, sea-bird colonies and coral reefs are just some of the features which have been considered in the selection of sites for protected areas.

Attention has already been drawn to the great international importance of several of our coastal sites as habitat for waterfowl. Four areas, namely the tidal mud-flats of southern Khuzestan, the Khouran Straits, the deltas of the Rud-i Shur, Rud-i Shirin and Rud-i Minab, and the deltas of the Rud-i Gaz and Rud-i Hara have been designated as wetlands of international importance and included in the list appended to the Ramsar Convention on Wetlands of International Importance especially as Waterfowl Habitat.

In the actual setting aside of areas as marine parks or reserves, we have realized that, administratively as well as ecologically, to achieve effective protection we must protect not only the particular stretch of coast in question but also a reasonably large area of terrestrial habitat inland from the coast. For enforcement effectiveness we must tie our reserves to clearly definable geographical areas, while for ecological reasons we must also take into account land use practices adjacent to the shoreline, and perhaps within entire watersheds.

Since 1956, Iran has been setting aside reserves to protect representative portions of the natural and semi-natural ecosystems to be found in Iran. At the present time the Department administers 57 such reserves, five of which may be classed as marine reserves either in part or in their entirety. Very briefly, these reserves are: 1) Shadegan Protected Area in Khuzestan, which contains some 75 kilometres of tidal mud-flats of great importance for wintering flamingoes and shorebirds; 2) Khark and Kharku Islands notable for their large breeding colonies of sea-turtles and terns, and an interesting introduced population of the Goitered Gazelle; 3) Sheedvar Island, off the west end of Lavan Island; again the site of very large sea-turtle and sea-bird colonies, and an area of excellent coral reefs; 4) Hara Protected Area in the Khouran Straits, with its very extensive and complex mangrove forests and large waterfowl populations; and 5) Bahu Kalat Protected Area which includes 55 kilometres of the Baluchistan coast abutting the Pakistan border, remarkable

not only for the strong oriental influence in its fauna and flora but also for its outstanding coastal scenery.

We see these reserves only as a beginning. Detailed surveys conducted during the last three years have greatly increased our knowledge of the fauna and flora of our southern coasts, to the extent that we can now pin-point with some confidence the areas most in need of protection. Thus we are presently considering a further six areas as sites for marine parks or reserves. These are: 1) a number of small islands, some largely sandy, others largely composed of tidal mud-flats, off the coast of southern Khuzestan: these constitute very important breeding grounds for sea-birds and a wintering area for large numbers of shorebirds; 2) the delta of the Halileh Rud and adjacent tidal mud-flats near Bushire, another area of great importance for breeding and wintering waterfowl; 3) a stretch of coastal sand-dunes and excellent beaches south from the delta of the Monde River to the Nakhilu Islands - an area with great recreational potential and also important for its large breeding colonies of sea-birds and possibly also sea-turtles; 4) Hormoz Island in the Straits of Hormoz near Bandar Abbas - one of the prettiest islands in the Persian Gulf; 5) a region of tidal mud-flats and small sandy islands at the deltas of the Rud-i Gaz and Rud-i Hara on the eastern shores of the Straits of Hormoz - an area containing perhaps the very finest stands of mangroves in Iran; and 6) one or both of the large bays with adjacent mountainous headlands at Chahbahar and Puzim in south east Baluchestan - two of the finest bays along Iran's entire south coast in a region with an extremely rich and diverse marine fauna.

You will however hear much more about these proposed reserves, and of course our existing reserves, during the coming days.

I shall draw my remarks to a close by expressing the hope that you will find time not only to discuss general principles and guidelines but also to agree on specific recommendations for our region. I also hope that the achievements of this meeting will serve as a model for the global discussions to be held at the Marine Parks Conference in Tokyo in the month of May.

SUMMARY OF DRAFT THEMATIC PAPERS
TABLED AT THE MEETING FOR PRELIMINARY CONSIDERATION

G. CARLETON RAY

The Johns Hopkins University, Baltimore, Maryland

The following summarizes two papers in preparation for IUCN, the titles of which are given below.

Critical Marine Habitats (published in IUCN New Series No. 37 of 1976).

There can be no doubt that the total impact of man's activities on the coasts and seas is impressive - and frightening - in a world which still deludes itself that the seas are a panacea to our overuse of the land. Inevitably, protection of coastal and marine systems will interlock with Law of the Sea, but in the meanwhile, part of the answer to marine conservation is national and regional efforts to establish parks and reserves. The limited size of such reserves in comparison to the huge extent of entire marine ecosystems, implies a loss of genetic and species diversity and that control of the fate of the reserve is not possible within the reserve itself; that is, what we will be left with in the end are a series of fragile, simplified, unstable "islands" in an altered seascape. Thus, very recently and largely through the rise of ecosystem science, we have come to know that what is really vital is the preservation of processes - evolutionary, genetic, and ecological.

A System of coastal and marine reserves is necessary to accomplish this task. In addition, previous concepts on conservation through parks and reserves rank high, but what has not been considered in nearly enough detail is how their establishment can make sufficient impact on man's perturbations so that present trends may be reversed or at least intelligently monitored. This clearly involves considering the long-range biological health of protected areas, their relationships to the marine and terrestrial ecosystems on which they are dependent, and their utilization for research and monitoring. Utilization for recreation, as implied by "parks", is certainly important, but remains subsidiary to these broader ecological objectives.

Classification of Marine and Coastal Habitats (published as IUCN Occasional Paper No. 14 of 1975)

It is widely recognized that a classification scheme for "biotic provinces" is a necessary first strategic step. The

scheme can be briefly summarized by stating that a tripartite classification appears advisable at this time: (1) by Zoogeographic regions; (2) by coastal biotic provinces; and (3) by habitats. Such a scheme is admittedly complex but until union of land and sea provinces has been accomplished by research, it is at least pragmatic.

BACKGROUND CONSIDERATIONS

The Nature of Coastal and Marine Ecosystems

Three considerations are paramount. First, no one owns most of the sea and this vast area of res nullius or res communis impinges in important ways upon areas of national jurisdiction (cf. Ray 1970). Second, our knowledge of marine environments lags far behind that for terrestrial environments. Third, ecosystems are the largest functional units of the natural world, characterized by recycling of materials and properties of homeostasis.

The following salient points on the nature of marine and coastal systems are adapted from Ray and Norris (1972) and Cronin (1974):

1. Size and Mobility.

The scale of marine systems confounds thinking based on terrestrial models. The largest ecosystems by far are marine and we cannot aspire to include them, in toto, in parks and reserves. Certain exceptions exist, of course, but this is the general pattern with which we must cope. Whereas large-scale mobility or migration of major ecosystem biomass is the exception terrestrially, it is the rule at sea. Whole fractions of ecosystems move great distances, limited only by behavioural and physiological tolerances, or by the sessile or sedentary habit of some species.

2. Ecotones and Transition Zone.

The shore and coastal zone do not separate land and sea, but unite them. Neither geologically nor biologically can the coastal zone be defined as a complete ecosystem; it is the interface between two systems and, characteristic of such ecotones or transition zones, is immensely productive as a result.

3. Boundaries.

The sea is not a continuum though the boundaries can be subtle. The sea's texture varies with eddies, circulation

cells, currents, upwelling, salinity and temperature; any of these may form boundaries in addition to physiographic boundaries by which terrestrial environments are largely separated.

4. Dimensionality and the Living Hydrosphere.

Life exists on land as a thin surface skin surrounded by an atmosphere which is uninhabited on a permanent basis; thus, terrestrial systems are largely two-dimensional. The sea is a "bouillabaisse" of organisms, nutrients, degradation products, inorganic chemicals and pollutants. This "living" quality of the hydrosphere, in contrast with the "abiotic" atmosphere, adds a third dimension of large scale to marine systems.

5. Physiological Continuity.

Most aquatic animals are not "sealed off", by virtue of a relatively impervious skin, as land animals largely are. Most aquatic organisms are in physiologic continuity with water and are generally very susceptible to foreign substances, pollutants or nutrients, which enter their bodies with facility, then quickly to be incorporated into the trophic structure. Exceptions, of course, are the air-breathing "reentrants", i.e. aquatic reptiles, birds and mammals.

6. Inverted Pyramid of Biomass.

Terrestrially, the greatest biomass is found in primary producers; much is locked into the "bottleneck of ecosystems", cellulose, which is slowly degraded and recycled. Aquatic systems, with the notable exception of algal beds, sea grass beds, and some reefs which are dominated by algae, do not have the greatest biomass at the lowest trophic level. Rather, Phytoplankton productivity compensates for the lack of biomass so that production on an annual basis is very great, but the amount of plant material present at any one time is usually far less in weight per unit volume of habitat than that of the consumer levels.

7. The "Sink", "Downstream Effect", and "Short-Circuits".

Ultimately, rainfall and land drainage carry terrestrial and atmospheric nutrients, pollutants and silt to the sea. Thus, the sea has been called a "sink". Forests, estuaries and marshes are natural "filters" which retard the process of passage of products, either harmful or beneficial, to the sea. The "downstream effect", as the name implies, refers to the mobility of silt, pollutants, nutrients and organisms over great distances and to the

effects in their wake. Organisms and their food chains move through oceanic features both laterally and vertically, often against currents, and provide "short-circuits" (Walsh 1970) to nutrient and pollutant transfer, the magnitude of which we have only begun to suspect. These are among the features which make the protection of marine environments so very difficult.

8. Eutrophy.

Oxygen supply is taken for granted in terrestrial environments, but it can be critical in the sea. Eutrophy refers to the over-enrichment of a body of water so that it becomes so productive that the biological oxygen demand may reach levels beyond the oxygen supply, thus depleting this vital substance and/or causing anoxic conditions. Large-scale die-offs of oxygen-dependent organisms may result. Particularly vulnerable are estuaries, lagoons, and the relatively stagnant bottom waters of fjords, enclosed seas and oceanic trenches. The danger to trenches may be a surprise to some, but the suspicion grows among marine scientists that the life of trenches is presently endangered by the degree of dumping that occurs in some of them. The Puerto Rico Trench, the Atlantic Ocean's only such feature, is already littered with trash (CR. Robins pers. comm.). Should organic wastes be dumped there in sufficient quantity, the poorly circulated waters could become anoxic and much of their characteristic biota would perish.

9. Dynamism.

Spatial and seasonal alterations of inshore features reflect some of the most dynamic of all natural processes, exceeded only by earthquakes, floods, violent storms and vulcanism. Shorelines, dunes, banks and shoals move to change the faces, even the boundaries of whole marine systems. Dredging, bulkheading, channelization, damming of rivers, and other attempts to contain or alter natural geomorphological processes, are usually doomed to failure and are creating great problems (Inman & Brush 1973). It is difficult to establish reserve boundaries which encompass such natural alterations as the movement of inlets, banks and beaches. It is also sometimes forgotten that natural geomorphological change creates new habitats critical to the existence of certain organisms; for instance, certain shore-birds depend on new or recently storm-scoured sand beaches. Such "sterile" beaches are not solely the habitat of the beach buggy!

APPROACH TO CONSERVATION

Study and Implementation

Marine and coastal conservation must proceed from a knowledge of marine ecosystems and their interfaces with the land. Such knowledge must derive from studies of processes under as controlled conditions as possible, mostly in reserves established for the purpose. There is no substitute, either in conservation or "enlightened" exploitation, for the comprehension of ecosystem processes if man wishes to maintain the productivity and integrity of the seas while he uses them.

However, we cannot await detailed study before taking strong and definitive action! Therefore, the following series of practical steps in the initiation of coastal and marine conservation, emphasizing reserves, on national and international levels, is suggested:

1. Survey and Description.

The Classification Scheme is used as a background on the basis that habitat variety is reflective of ecosystem processes. The initial survey thus becomes a summary of habitats and community structure within the survey area. It also becomes a catalog of perturbations so that it may serve to prioritize conservation action. It is to be a relatively brief collection of existing information. It should be as comprehensive of whole coastal systems as possible and should attempt to identify natural units irrespective of political or legal boundaries.

2. Selection.

Critical areas inclusive of all habitat types are designated according to agreed criteria (see below). Priorities must be worked out, designating the most critical areas, i.e. those which are not negotiable in ecologic terms.

3. Description.

Selected critical areas are described in a computer-compatible form and their purposes are determined, at least preliminarily (see below under Information Gathering and Function).

4. Recommendation and Report.

The Initial Survey is to result in a report delineating both critical habitats and also recommendations for coastal system conservation and management.

5. Implementation.

Authorities must put a coastal and marine conservation plan into action, either by executive action or enabling legislation. Both approaches usually are required, as for instance, executive action for the immediate protection of certain most critical areas or to cause cessation of harmful coastal practices, followed by more detailed, programmatic national legislation.

6. Detailed Study.

A national program will make it necessary to evolve detailed site specific guidelines and a research and monitoring program. Research must be carried out over a long period and dedicated to the mitigation of man's perturbations, to restoration, and to the development and management of parks and reserves. Such a study must not omit socio-economic issues, but the major thrust must be biocentric, not homocentric. Thus, the investigation of the scientific basis for natural area and ecosystem preservation may include man, but it must not tread in fear of socio-economic and traditional policies and practices which may clearly pose eventual threats. The practical side of this question concerns the high-priority effort towards the discovery of the legal and financial means by which preservation may be achieved.

Terminology

Definitions are important, but are to be taken with flexibility. It is not useful to quarrel over semantics though it is obvious that terms have quite different meanings according to language and local customs. The vital matters are that habitats be preserved, that the purpose of protected areas be well-defined, and that they be managed according to ecological knowledge and a set of enforceable guidelines.

Nomenclature falls into two categories, title and function. By "title" is meant simply what we call the area. Function is considered below. Dasmann (1972) considers aspects of both for terrestrial protected areas, but it is my belief that we can make a simpler effort here. Belying this is the summary by Björklund (1974) in which 52 "reserve names" are given! Nevertheless, a few examples may suffice to clarify. Blumberg (1973) describes "sanctuaries" in the Commonwealth of Massachusetts; these actually describe administrative zones for control or prevention of activities on the sea bed, such as construction, removal of sand or gravel, incineration, dumping and the discharge of coolant water. Thus, such a "sanctuary" is hardly complete, but serves critical control purposes. The U.S. Department of the Interior (1973 a,b,c) takes a broad view in defining an "ecological range" as encompassing

entire or nearly entire biotic units or ecosystems substantially unaltered by the actions of man; and "areas of ecological concern" as those which "contain resources that are part of the total ecosystem; and which if compromised, could endanger resources within the proposal." Clark (1974) identifies "vital areas", "areas of environmental concern", and "areas of normal concern" which he notes are analogous to the "preservation", "conservation", and "utilization" zones established by the State of Florida (see also Johnson 1973). Last, "research natural areas" describes both title and function and is a name extensively used in the U.S. It is even incorporated into the Federal Committee for Research Natural Areas which is currently attempting to identify places where study can be made of gene pools and the structure and function of natural communities to provide baseline data for long-term monitoring of environmental quality.

In short, names are important, but they should not becloud the major issue of ecosystem preservation through the establishment of a series of reserves. In coastal and marine systems, it is quite clear that single areas will not suffice nor will zonation always be practical in terms of areas with immutable boundaries.

For present purposes of this paper, four terms (titles) are paramount.

1. Reserve.

An inclusive term for any area which is set aside for any purpose and for which management guidelines are established. Most of Dasmann's (1973b) terms apply. Thus, an oil and gas "reserve" may incorporate only the single purpose of a moratorium against such exploitation for a region within which few other restrictions exist. Other reserves may emphasize scientific research (i.e. research natural areas) or sporting activities. "Strict" reserves may forbid all trespass except under permit.

2. Park.

A reserve in which recreation or public education is emphasized.

3. Core.

The park or reserve itself which incorporates the "critical marine habitat".

4. Buffer.

An area adjacent to or surrounding the core and upon which the core depends or vice versa, in the ecosystem sense;

an "area of ecological concern" as it is sometimes called. This is perhaps the most important term and is hardest to define. What is "critical" may not be known. Once a core area is acquired, it may prove not to be the critical one or, in the case of geomorphological change, it may move. The difficulty lies in the identification and prediction of natural processes.

Reserve Function

Protected areas or those managed along sound ecological principles serve a number of highly relevant purposes. First, they tell of natural processes and serve as control areas against which to measure man's perturbations. Ecosystem research is central to this task and reserves must be set up in some of the most productive and desirable places, in terms of value for exploitation, so that we may do research towards the development of predictive capability. Second, reserves serve to protect species and habitats which are endangered by man and which embody unique processes and/or genetic materials. Obvious candidate species are large vertebrates such as marine mammals, birds, turtles and crocodilians. Obvious candidate areas are productive estuaries, mangroves and coral reefs. Third, reserves serve as areas for public or advanced education and the continued appreciation of nature's amenities by mankind in general. There are several other functions, but what parks and reserves cannot do is survive intact outside the context of the ecosystems of which they are only a part. Thus, buffer areas must be established to include the support systems which usually derive largely from outside the core areas.

Broadly, there are three reserve types, according to the activities which occur within them: (1) natural areas which may be inclusive or exclusive of recreation, and which feature "naturalness" or pristine conditions; (2) study areas in which natural processes are investigated, but which may have been disturbed; and (3) experimental areas in which some degree of manipulative research is carried out in order to investigate ecosystem processes. Cronin (1974) considers the various uses of such areas, emphasizing scientific and educational purposes. These types may be broken down more finely, of course, and any single reserve may serve multiple uses. In the latter regard, great care must be taken so that aesthetic and extractive activities do not conflict: this is vital in the mitigation of differences between coral reef protection and fisheries exploitation, for instance.

We cannot emphasize too strongly the need for incorporation of research and education within reserves. The threat of man's activities to natural ecosystem health and stability pose critical problems for civilization's survival. Systems of national and international marine and estuarine ecological

reserves, embodying genetic and ecological diversity, should be subject to investigations on the scientific basis of preservation. Reserves should be "reservoirs of biological species, physical phenomena, naturally functioning communities, and existing habitats" (Lynch, Laird and Smolen, eds., 1974). Not only must rare and endangered species and habitats be studied under a variety of conditions, to evolve procedures for their continuity, but the structure and function of natural ecosystems must be studied, as opposed to those stressed by man's activities. From such study will emerge baseline data for long-range monitoring and a cadre of trained personnel to do the work. By means of educational programs, a better-informed public may prove able to make better and less costly environmental decisions.

Thus, the function of reserves is primarily preservation, but also incorporates education, recreation, and especially the potential for research in its fabric.

CRITERIA FOR SELECTION

The classification system is to be used as a primary reference for the development of a system of reserves which shall be inclusive of habitat types and reflective of ecosystem processes. It follows, necessarily, that we ask: How inclusive of habitat types are existing preserves? What among those habitats not already protected are suitable for preservation? This leads immediately to the development of criteria for further selection and for determination of reserve function.

Criteria may be used in at least two ways. First, they may be used to judge the quality or applicability of areas to fit the requirements and functions of reserves and, second, they may be used to prioritize most suitable sites within a series of candidates. In either case, we should be careful not to pick only the single most qualified or few top candidates for at least two reasons: first, we must incorporate considerable redundancy in a reserve system; secondly, no two areas are precisely alike. The latter point involves a distinction between what is "representative" and what is "unique".

The various criteria should not be applied with equal priority to all candidate areas for the simple reason that characteristics and functions will be quite different. Obviously the priorities of various criteria will shift according to the purpose to which a reserve is to be put. A good deal of judgement in their application is necessary. The following is a list of criteria derived from several sources (cf. Cronin 1974; UNESCO 1974). The criteria are here arranged in two sets.

A. Ecological criteria

1. Representativeness and/or uniqueness.

These two terms are actually the extremes of a spectrum. A "unique" area is one that is rare, whereas areas which are representative fit well into the classification scheme, i.e. may exemplify biome or habitat types, processes, transition zones, ecotones, or subclimax situations of either undisturbed nature or of interactions between man and nature such that some comparability between example areas is evident. Unique areas naturally rank high in priority as they are "one-of-a-kind". However, exemplary areas, i.e. the "best" sample areas among many representatives, rank equally high. In either case, extrapolation of the nature of ecosystem properties and processes to other areas should be attempted.

2. Diversity.

This criterion often influences the size of the area to be preserved. It means the inclusion of several habitat types and biotic associations, such as lagoons, estuaries, various benthic types, associated river drainages, etc., within a single reserve. Whereas diversity has high priority, its lack should not mitigate against inclusion, as certain areas are by their nature (tundra, sea grass flats, etc.) not as diverse as others.

3. Naturalness.

This is related to the degree of perturbation by man and, again, loss of naturalness should not mitigate against inclusion so long as some degree of restoration is possible. Care should be taken to include subclimax and transition zones and other areas which undergo natural change subsequent to natural disasters or perturbation. Care must be taken that "naturalness" not exclude man's use. Semi-"natural" systems which have become stable under long established use practices may be included. Naturalness should not come to mean "degraded", however.

4. Natural Unit: size and buffer zone compatibility.

Areas to be preserved should be sufficiently large or buffered to allow natural dynamic change, biological or physical; that is, in so far as possible, "natural units" should have high priority. Where a buffer area is involved, its use and properties must be compatible with the core reserve area. In effect,

size or extent shall be such that an effective conservation unit, biologically speaking, is created: i.e. what has been called the viability, defensibility or integrity of the reserve may be maintained. In the case of marine and estuarine systems, this inevitably involves the difficult problem of mitigating upstream effects, whether generated from land, river or sea. Hence, buffer zone compatibility ranks especially high in these environments.

5. Criticalness.

The degree to which important life stages or entire life histories of species are dependent on an area is an important criterion. Obvious cases are areas where rare or endangered species are present. Others include the feeding, resting or breeding areas essential to marine reptiles, birds or mammals. Examples are: Laguna Ojo de Liebre (Scammon's Lagoon), Mexico, for calving of Gray whales Eschrichtius robustus; Round Island, Alaska, for the resting of walrus, Odobenus rosmarus; the many essential feeding areas for shore birds and Sirenia; the many breeding beaches used by sea turtles. In emphasizing these critical areas, we must not forget those of a different sort, i.e. those which are critical in terms of productivity. Thus, sea grass beds and mangrove swamps are critical areas for detritus production and nutrient conversion to inshore production such as fisheries and coral reefs. So not only must the endangered, rare, aesthetically important species be considered, but we must also give increased attention to species of trophic significance.

6. Inclusiveness.

In some cases, undisturbed habitat types will not be available for protection or such sites will no longer be extant. Potential sites should be sought so that the reserve system shall be inclusive of all habitat types. In this case, restoration is important (B.4 below).

B. Practical Significance

1. Value for research or monitoring.

Reserves are an important resource for science and high priority should be given to scientists' use now and in the future. This will depend on at least three factors: high scientific interest, past history of scientific research, and proximity to a user group of scientists which will monitor the area, use it for education, and transfer the information gained to the

community at large as well as to management agencies. Lack of present scientist use should not necessarily exclude this factor.

2. Educational, Recreational and Economic Value.

Scientific or educational value should generally outrank purely recreational or tourist value, though the latter is often extremely important in economic terms. The reason is that recreation is not always in accord with the "conforming use" principle. Deleterious effects often result to stress reserves beyond their carrying capacity when purely recreational values are placed above ecological ones, i.e. when such areas are "developed" rather than properly managed. Education also emphasizes the public as a user group, but generally more care is taken to preserve values than when emphasis is on tourism.

3. Degree of Threat or Fragility.

Remote environments will not rank as high in priority as those close to possible perturbations of man. Also, areas which are highly fragile should be considered first.

4. Feasibility.

Is the site available? Can it be properly financed, managed, and brought under the jurisdiction of a stable agency with proper organic powers? If the site is potentially valuable, can it be restored? Such questions are central to the suitability of areas as reserves.

5. Redundancy.

Care must be exercised not to exclude areas with the statement- "we already have one of those!" Redundancy is important in the establishment of a reserve system.

6. National or International Value.

The Galapagos Islands is an example of an area of obvious international importance. Aldabra and the Bering Sea are others. Africa's parks are also national assets with international significance. Marine and estuarine areas should rank high in priority as reserve candidates because of their contribution to international fisheries production and as habitat for migratory waterfowl, for instance.

AREA DESCRIPTION

There are several stages in this process from the most preliminary and short-range to the long-range, scientifically detailed matrix of data necessary to develop precise guidelines for management and monitoring. Obviously, the first step is the simple process of listing candidate areas. The next step is the assembly of available information in a computer-compatible format which allows concise information transfer on a world scale.

Very often, reserves of large size, especially "natural" ones, will not be in proximity to "experts" who will be able to develop management guidelines much less maintain a long-range scientific program. It is part of the educational process to train such personnel and to develop such programs for this purpose. Therefore, after an area has been identified as having value or interest, facts of a very basic nature must be gathered as a prelude to the relatively detailed survey which will produce further information necessary for recommending a reserve and, if so, when and how. It is suggested that this fact sheet include the following information:

1. Name of area.
2. Geographical location (Nation, province, state, district, etc.)
3. Latitude, longitude (supply map or chart).
4. Surface Area (in square kilometers or hectares).
5. Type (from Classification code i.e., Zoogeographic and biotic, with habitat or habitats included).
6. Description
 - (a) Physical features - including water depths.
 - (b) Dominant biota (ecologically).
 - (c) Special scientific, recreational or other interest.
7. Conservation Status, degree of naturalness, degree and nature of threat (if any) and present jurisdiction(s).
8. Character and use of contiguous land or sea areas emphasizing effectiveness as buffer areas.
9. Proposed purpose or present use of area, including suggested zoning, if any.
10. Knowledgeable contacts.
11. References to literature, both scientific and popular.

This description list is closely in accord with IUCN's Prospectus for a World Directory of National Parks and Other Protected Areas (1973). It is essential that there be compatibility of descriptions so that computerization of data be possible. Darnell et al. (1974) give a model for such a system and point out the advantages that accrue through computer query. Answers to the following sorts of questions are obtainable:

1. What habitats are in any geographic area?
2. What areas are protected for a certain biotic province or habitat?
3. What is the state of research for a particular habitat?
4. Search for key words: e.g. algal reef, manatee, climax, successional, etc.
5. Which areas are in ownership, stewardship, controlled by administrative authority only?
6. What areas are most endangered?

Thus, it is a purpose of description that a worldwide system be integrated. In no other way can extensive marine eco-systems be comprehensively treated.

Country Reports No. 1

B A H R A I N

M.D. NURUN NABI

Ministry of Municipalities and Agriculture, Bahrain

Bahrain is a group of low-lying islands, largely of limestone outcrop and desert, between fifteen and twenty miles from the Saudi Arabian coast. Their total area is 255 square miles and the total population of the State is 225,000. The largest of these islands is Bahrain itself which is about 30 miles long and from 8 to 10 miles wide. The second most important island is Mubarraq which is situated to the north-east of Bahrain island. Half-way down the east coast of Bahrain a bridge joins Bahrain to Sitra island. Nabih Salih is a small island (area 200 acres) to the north of Sitra. Jidda, a small rocky islet off the west coast of Bahrain, is used as a penal settlement. Other islands, which do not have any significant human population, include Umm-an-Nassan (area about 7 sq. miles), a largely low-lying island to the north-west of Bahrain, and the "Howar" group (16 in all, largest 11 miles in length and a mile wide) near Qatar.

Bahrain is primarily a sea-faring State. The brilliant blue and green waters which surround the islands provide its people with fish caught from boats and in traps; fresh water from submarine springs; coral stone for building; and the pearl which made Bahrain so important in the past.

Bahrain State has a very long coast in relation to its size. Inshore waters are generally shallow giving up to 500 to 1000 feet or even more of tidal exposure in some places. People tend to go down to the shore in the evening (specially in summer), on Fridays and holidays. This applies especially to the south-west and north-west coasts of Bahrain island, where the breeze and views of the sea can be enjoyed and tents are put up for shade and picnic purposes. About a quarter of the west coast including some beaches and almost all of the north coast of Bahrain is privately owned. The Government has reserved about 125 acres of land in the north-west corner of the island to develop as a beach for public recreation. Consultants are at present being employed to suggest ways and means to establish proper public beaches and recreational areas near Zallaq (half-way down the west coast of Bahrain island) and on Umm-an-Nassan island. The Government is also taking measures to preserve the coast line as much as possible and keep it in Government ownership.

Along the north coast of Bahrain there is a narrow strip of land some 3 miles wide under cultivation, irrigated by natural springs and artesian wells, but the owners of sectors planted up with coconut palms are now tending to neglect them and the trees are dying in many places. To preserve the green character of Bahrain the Government decided to acquire 1150 acres of land to the west of the capital, Manama, which will act as a greenbelt. The palms here will be preserved. Within this area the famous Adari pool, which is a marine spring, is located. The shallow sea nearby is being reclaimed to provide an area of 35 acres for recreational purposes. The other palm areas along the coast of Bahrain island should be preserved also and special measures should be taken for that purpose. The waterless areas in the centre of the island have only a sparse, desert flora but nevertheless it contains about 200 species.

Human encroachment on the Shores of Bahrain

Manama and Mubarraq islands were connected by a causeway 1½ miles long and a bridge in 1930. The Bapco wharf extends about 3 miles into the sea from the east coast of Sitra island. The Mina Sulman Port and the Mina Sulman industrial area were reclaimed from the sea. Before that the towns of Manama, Mubarraq and Hidd were surrounded on three sides by sea; now, in accordance with a new development plan, all the sea around the towns is being reclaimed and the shore-line will be totally altered. Manama town is being connected to Sitra island by a causeway about 2 miles long, blocking a bay and with only 2 bridge openings. This bay is an important breeding place of shrimps. Whether shrimp breeding in the bay will be affected on the completion of the causeway has yet to be seen. An area to the north of Sitra island (about 300 acres) will be reclaimed for industrial development. All these reclamation areas are fish breeding places and in some of them fish traps are also established, so that both the breeding and catching of fish may be seriously affected by the above mentioned developments.

Fishing

Fishing and pearling have played a vital role in the economy of Bahrain since time immemorial. Fish is a staple food and fish oil is used for oiling the wooden boats. Most of the fish is caught in "hadhra", fish traps built from palm branches. Nets of various kinds are also used, including circular throwing nets and drifters for catching fish. The Bahrain Fishing Company is using modern trawlers.

Pollution

Oil tankers come to Mina Sulman port and the Bapco wharf, and inevitably cause pollution of the sea. Sewage is discharged

from the towns of Manama, Mubarraq and Isa into the sea. However, Government has plans for a new sewage treatment scheme and when this has been implemented, it is hoped in the near future, the present system of discharge of untreated sewage into the sea will be abandoned.

Country Reports No. 2

E G Y P T : MARINE PARKS AND RESERVES ON THE RED SEA COAST

A.I. BELTAGY

Marine Biological Station, Al-Ghardaqa, Red Sea, Egypt.

The Egyptian coast along the Red Sea falls naturally into three subdivisions. The first extends from Port Suez at the southern extremity of the Suez Canal southward to Ras Shukeir. The shores of this area, particularly in the Suez Bay and around Ras Gharib, about half way up the west coast of the Gulf of Suez, are badly affected by oil pollution. The Gulf, however, is probably the most productive fishing zone of the whole coast. The bottom is mainly calcareous sand and the coral formations are limited.

The second section extends from Ras Shukeir southwards to Al-Qoseir. This zone is very rich in its faunal and floral groups and parts of it are being studied extensively.

The third section is from Qoseir to the Egyptian southern border. This is rarely visited and much less studied, except for the two important fishing areas at Ras Banas and Marsa Alam.

For the time being, Egypt does not have any officially declared marine parks or reserves on the Red Sea. However, the area in the vicinity of the Marine Biological Station near Al-Ghardaqa may actually be considered as a marine park and reserve. The population of the town (Al-Ghardaqa) is probably less than 10,000, and there are no real problems in protecting the area. Studies of different aspects of ecology and oceanography have been conducted over the past 40 years or more. The boundaries of the coral reefs, especially the inshore ones, are marked, and the area is almost closed for commercial fishing and local fishermen.

A representative collection of faunal and floral specimens, built up since the establishment of the M.B.S., is kept in the station's museum. Tourism activities in the area are mostly arranged through facilities provided by the M.B.S. Also the station has a good aquarium which is open for visitors. In this way, protection of at least the nearby coral reefs is secured.

It is suggested that this area should be considered as a national park and reserve. Other areas may be considered after a brief survey of the third section of the coastal region has been undertaken and more is known about it.

Attention must be drawn to the fact that there exists a great danger of pollution, particularly oil pollution, in the Red Sea as a whole and specially in the northern part and the Gulf of Suez, due to new exploration for gas and oil and the expected tremendous increase in marine traffic, after the re-opening of the Suez Canal.

Country Reports No. 3

ETHIOPIA : A REPORT ON THE DAHLAC ISLANDS MARINE PARK

ALLEM BERHANU

Wildlife Conservation Department, P.O. Box 386, Addis Ababa

INTRODUCTION

When considering conservation the general tendency is to think in terms of terrestrial environment. The need to set aside areas for protection of marine life, particularly in shallow coastal waters, is however equally important, both for scientific and recreational purposes. Marine National Parks, especially in tropical waters, can play a valuable role as a tourist attraction. They can also fulfil a very important function as biological study areas and breeding reserves. Conversely, failure to set aside such conservation areas must, through industrial pollution, over fishing, destruction of the fragile aquatic habitats and other causes, lead to the eventual disappearance of much of the spectacularly rich marine life of the coastal waters.

The Dahlac Archipelago situated in the Red Sea is one of the most interesting and scenically attractive areas in the Red Sea which is well known as one of the richest areas in the world in terms of variety and abundance of marine life. The Dahlac Islands Marine National Park, thus, is aimed at serving as a recreational centre, and centre for scientific studies and at the preservation of marine life.

BRIEF HISTORY OF THE PARK

In early 1968, the possibility of establishing a marine park in the Dahlac area was discussed with Mr. Frank Minot, African representative of the AWLF, who suggested that his foundation might be prepared to finance a preliminary reconnaissance to determine which particular areas, if any, would justify more detailed investigation. In the later part of March 1968, this proposed survey was conducted by the AWLF group in collaboration with the Ethiopian Tourist Organization, National University and other government agencies such as the Fishery Dept., Ministry of Agriculture, etc. After a week's brief survey they came to the following conclusions:-

- a. The island of Sciumma and its surrounding reefs for a distance of one kilometre from the shore should be declared a Reserve wherein all forms of wildlife are protected and fishing is prohibited, whether by line, net, spear or other means.
- b. The killing of turtles and the taking of their eggs should be prohibited. Fishermen taking turtles in their nets should be required to return them to the sea unharmed.
- c. The killing of all birds (including the Arabian bustard) and the taking of eggs should be prohibited in the Dahlac Islands.
- d. The Dugong (a rare, sea-dwelling mammal found in these waters) should be fully protected.
3. The commercial exploitation of coral, which is at present apparently taking place at Dahlac Island, should be prohibited until a proper investigation has been completed.
- f. The use of explosives for fishing, blasting coral or any other purposes in coastal waters should be prohibited.

BRIEF DESCRIPTION

The total number of the islands including the coral reef isles, have been variously estimated anywhere between 130 and 360. Whatever their exact number, the islands are a study in geological, botanical and topographical contrasts. Some are rather big, quite populated and support a variety of fauna and flora ranging from camels and mangrove to striped gazelle and stunted acacia. Others are little more than tips of underwater mountains protruding above sea level. Only six are in fact said to be inhabited and no village is known to have a population of more than 300.

The islands which will be receiving the impact of tourism and recreation are an easy half to full day's travel by small boat from Massawa. They are varied in their topography and present an interesting and challenging complex for development. However, their resources are limited and utilization of them has already been excessive in several cases.

ECOLOGY OF THE INSHORE DAHLACS

The outstanding feature of the Red Sea, situated as it is in a desert area, is its extreme salinity. This is particularly

so because of the absence of rainfall or freshwater river input. The Red Sea derives its name from the seasonal blooming of plankton (Trichodesmium erythraeum) in the lagoons of the inshore area. Apparently the productivity of the Red Sea is very high "in terms of observable plankton".

Here arises the question on what the prime productivity and nutrition of marine life depend. Nutrition is derived in most places from debris, usually of plant material and rooted vegetation like mangroves. The sea around the Dahlac Islands abounds in such debris and would certainly assist in the productivity of the region. For this reason it is essential that extensive mangrove swamps in this region must be preserved.

"The clearest indication of the health of an ecosystem in inshore waters is a good quantity of rooted vegetation, mangroves and such other flora at the base of the food chain".

The Red Sea is noted for its coral formations but the Dahlac Islands in this respect are deficient. Yet there is a colourful variety of fish and the reefs in some places are quite attractive. All land in this region, including that of the islands, and the ecology of the biota in general are affected by lack of rainfall. The vegetation, therefore, consists of Salicornia, Cactus and similar plants, with trees like baobabs and acacia the common species. Intensive grazing and tree cutting must have denuded this region of its vegetation in the long past.

The present danger to the ecology of this region is wanton destruction of the reef, which results in the habitat of the fish being destroyed and their breeding affected. It is imperative, therefore, at this stage that shell and coral collecting be controlled. Only thus can the reefs be preserved.

Though fishing is done as a commercial enterprise it is not highly developed and presents little danger. Even if it is developed on a large scale, as long as it is carried on off-shore it would not affect the ecology of these islands. In all probability the development of the marine sector would help in the preservation and breeding of the fish life in this region and in turn be a boost to any fishing industry.

The development of tourism in this region is another factor which can affect the ecology through inadequate waste disposal, destruction of fish and shell collecting. Already the islands are cluttered with garbage. Stringent measures will be required to control sport fishing as well as waste disposal.

PRESENT EXPLOITATION OF THE DAHLAC ISLANDS

Human inhabitation of these islands goes back to early days of history. Man has been traditionally exploiting this region mainly for grazing and also for fishing, though not on a large scale. Of late, the tourist industry too has invaded the islands.

Subsistence grazing should not, normally, present a serious threat to the islands, as, by their very ecology, they do not present a serious attraction for grazing purposes. The scanty vegetation is hardly appetizing even to a goat. Still it has been a traditional practice and goes on. The inhabitants are accustomed to carry their animals from island to island according to whether the grazing is good and green or has been finished off. As a result the islands are practically denuded of what little vegetation they ever had.

The collection of coral and shell for commercial purposes is another activity that has been in practice from time immemorial. This has now extended to collecting tropical fish for the souvenir and pet industry. The manufacture of buttons from coral and shell had in the past abetted shell and coral collecting, but with the advent of synthetics collecting for this purpose has declined. But it still continues for the purpose of souvenirs and curios. The local fishermen using primitive methods collect shell and coral and sell them to wholesalers in the nearby port of Massawa. But it is not too late to control this trade as it has not reached such large proportions as elsewhere. Plans are already afoot to control these activities.

Fishing at present in these waters is not done on a large scale. But the chances are that it may very soon develop into a commercial activity on a large scale.

The flow of tourists into this region has grown of late. They go to the islands to enjoy the beaches or to do some fishing for sport. Apart from creating problems of waste disposal and excessive sport fishing, the tourist trade does not create any problem. On the other hand the tourist inflow would contribute financially to the development of the islands as a marine park.

CONCLUSION

The Ethiopian Wildlife Conservation Organization fully intends to develop the Dahlac Islands as a major marine reserve. Detailed plans for development have been prepared and funds have

been requested for implementing these plans. But any assistance to further the development of the Dahlac Islands as a marine national park would be most welcome and timely.

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Country Reports No. 4

I R A N : SURVEYS OF THE SOUTHERN IRANIAN COASTLINE WITH
RECOMMENDATIONS FOR ADDITIONAL MARINE RESERVES

FRED. A. HARRINGTON, Jr.

Department of the Environment, Box 1430, Iran.

INTRODUCTION

The Department of the Environment of Iran is, relatively, a newcomer to the marine sphere. Formed in 1974 from its predecessor, the Game and Fish Department of Iran, the direction of its personnel has been largely terrestrial.

Jurisdiction over the Iranian marine resources in the past was wholly the domain of the Southern Shilot in the Persian Gulf and the Northern Shilot in the Caspian Sea, two organizations under the Ministry of Agriculture, charged with regulating the commercial fishery.

Thus, the jurisdiction of the erstwhile Game and Fish Department and so, too, the investigations of its personnel, were confined to inland sport fisheries and terrestrial fauna and flora ... from the shoreline up, so to speak.

With the passage of comprehensive environmental protection legislation, the Department of the Environment not only resumes the inland responsibilities of its parent organization, but has extended its jurisdiction into marine waters by virtue of two legal mandates: 1) to monitor and abate pollution and 2) to administer National Parks, National Wildlife Refuges, National Nature Monuments, and Protected Areas.

We fully appreciate the need to protect the marine environment of the Persian Gulf. Four somewhat interrelated phenomena are most obvious to us:

1. The Persian Gulf has become the oil "life-line" of the world community. The movement of so many oil tankers through the Gulf presents a continued threat to marine life, and to the critically important fishery of the Persian Gulf.
2. With the ever-expanding petro-chemical industry on the Gulf shore and islands, a cultural transformation is taking place. The population of the Gulf coast is expanding rapidly. Bandar Abbas, for example, until

recently a relatively small port and fish-processing center, is slated to become a city of one million in the next two decades.

3. The demand for marine food products is increasing steadily. Traditionally, consumption of Gulf fish was confined to the coastal regions proper. With the improvement of refrigeration methods, a modern transportation scheme, and with a rapidly growing standard of living, the consumption of fish products is increasing in interior Iran. The government has shown an interest in the export potential of marine resources ... rightfully, too, in a protein deficient world.
4. The aforementioned increase in the standard-of-living of Iranian citizens is bringing with it additional leisure time and a demand for recreational and inspirational sites. Increasing interest is shown in the Persian Gulf for these purposes.

Government agencies must address the need to utilize the resources at the Gulf, in the light of improving man's lot aesthetically as well as economically. Protection and wise use of the marine resource is essential, if that goal is to be achieved.

Personnel of the Department of the Environment recognize the urgency of the situation, and in particular the need to maintain reserves to:

1. Conduct base-line monitoring and scientific investigations.
2. Protect representative, as well as unique or rare, fauna and flora.
3. Protect important spawning or feeding sites, or other sites of critical importance in the food regime of marine organisms.
4. Accommodate the forecast recreational demand.

As we in the Department turn our attention to the sea, we are appalled by the lack of information upon which to base decisions.

Not even the most preliminary inventory of marine life, save commercial fish, has been made. Published information is usually outdated, often inaccurate, or entirely incomplete. For example, the only publication on marine flora known to us was prepared following a brief visit to Bushire in 1939. On the shore the picture is not much brighter. Some authors have reported Rhizophora mangrove on the coast, and have gone

so far as to expound on its commercial importance, while others (correctly, we believe) state that there is none (rather, it is Avicennia).

The Department has placed a high priority on recruiting marine biologists and developing the necessary support facilities to conduct marine studies. Steps have been taken in both directions. A laboratory has been established at Bandar Abbas, and a marine research station is being built on neighboring Hormoz Island. Personnel have been recruited to staff each.

It will, of course, be a number of years before an adequate data base is established, upon which to draw conclusions. Meanwhile, time is short. The Department is going ahead with the establishment of reserves, based upon the best information available; indeed, just as in the case of five coastal reserves that have already been established.

Personnel of the former Game and Fish Department have been conducting aerial and ground surveys of the region for a number of years. The purchase of two aircraft by this Department greatly enhanced our knowledge of the region in a relatively short period of time. In the past, emphasis was placed on bird and mammal surveys. A substantial record of the terrestrial fauna has been assembled in the process.

For the past two years, in the month of January, flights were conducted along the entire coastline in order to typify the geomorphology, hydrology, flora, fauna, cultural features and recreational potential of the region. Members of the Parks, Ornithology, Mammal, Wildlife, Freshwater Fishery and Arid Lands units participated in various portions of those surveys.

PROCEDURES AND LIMITATIONS

Unfortunately, no standard method of coastline evaluation exists, and no universally approved terminology. We found it necessary to improvise.

Aerial surveys were conducted at altitudes of 10 to 100 meters, and at speeds of 80 to 150 kilometers per hour. For the most part, this permitted detailed analysis of geomorphology, flora and cultural features. Reasonably accurate counts of birds and mammals were likewise obtained. Over clear water, turtles, porpoises and whales could be readily observed, but classifications were usually impossible. We did not evaluate other forms of marine life, except to indicate the locations of major schools of fish, and distributions of larger fish species.

The total Iranian coastline is likely over 3000 kilometers in length. Precise measurements will require up-to-date aerial photography, to delimit all bays and estuaries in detail.

Our observations were recorded with reference to a kilometer scale superimposed on the Iranian K551 series map (1:250,000). The 2,126 kilometers of shoreline thus delimited were classified into various geomorphological, floral and other categories. The 285 kilometer coastline of Qeshm Island was treated statistically as part of the coast, bringing the total to 2,411 kilometers. Due to its size and proximity to the coast, Qeshm Island possesses characteristics which are both continental and insular. The smaller, uninhabited and relatively unknown islands were visited in order to evaluate their resource potential.

The observers greatly benefitted from the knowledge of the coastline obtained by earlier ground and sea surveys, including surveys of breeding birds, spawning turtles, the flora and a brief survey of the sport fishing potential.

COASTLINE CHARACTERISTICS

General

Climate.

Tropical to sub-tropical and generally hostile to human settlement. Summers are extremely hot (up to 45°C); winters are mild, with minimum temperatures ranging from about 50°C in the west to 10°C in the east. Rainfall is generally sparse, ranging from 100 to 300 millimeters. Most precipitation occurs from November to April.

Fresh water.

A precious commodity in the Gulf region. Only the rivers originating in the Zagros Mountains and entering the sea west of Bandar Abbas are perennial. Residents rely on wells, springs and stored rainwater in the hot summer months. This, traditionally, has limited population expansion in the coastal region. Nearly all agricultural activity relies upon winter precipitation. The few perennial rivers which exist are extremely brackish by the time they reach the sea, and thus unsuitable for irrigation.

Geology.

Predominantly limestone, with some shales and salt-domes.

Communications.

Only about ten per-cent of the coast is served by all-weather roads in reasonable proximity to the shoreline. The route from Jask to Chah Bahar has no identifiable road at all. In winter, access is impeded by mud, and the swollen rivers may isolate parts of the coast for several weeks.

Sectors.

For the purposes of subsequent discussions, the Iranian coastline will be treated in ten segments, from west to east, each with somewhat different characteristics:

1. Arvand River (Iraqi border) to Cape Bahrgan (193 kilometers)

This region is typified by vast alluvial plains. Shoreline relief is typically a narrow or indistinct beach with vast silt or sandy tidal flats, occasionally up to 10 kilometers wide. Numerous small islands exist, and additional islands are forming as a result of deposition from the several large rivers which enter the sea here. Vegetation is sparse, and shoreline cultivation is confined to a few small hamlets. Shipping traffic is high, to and from the ports of Khorramshahr, Bandar Mashur and Bandar Shapur.

2. Cape Bahrgan to Bandar Dillam (75 kilometers)

This short segment is typified by broad plains with sparse settlement, sandy beaches, and extensive sandy tidal flats.

3. Bandar Dillam to Bushire (187 kilometers)

The coastline becomes more complex and more populous. Extensive plains with some cultivation of cereals and dates are broken by low mountains and sand dunes. Oil industry facilities are numerous. Bushire Bay contains extensive tidal flats. Otherwise, the coastline is somewhat rolling to dissected.

4. Bushire to Bandar Asalu (329 kilometers)

A substantial range of low mountains forms south and east of the Bushire peninsula. The coastline is dominated by a narrow strip of rock and gravel outwash plains, containing sparse agriculture. Continuing south-east, the Mond River delta forms vast sandy islands and sand-spits, with little human activity. Subsequently, the coast again becomes a narrow rocky outwash plain with mountains behind.

5. Bandar Asalu to Bandar Lengeh (316 kilometers)

This segment contains the most dissected relief, with

extensive limestone mountain ranges and high cliffs. Approaching Bandar Lengeh, wide plains are interrupted by salt domes. Settlement is sparse.

6. Bandar Lengeh to Bandar Abbas (190 kilometers)

The dissected relief gradually gives way to broad plains. The predominant feature of this segment is the delta of the Mehran River, which forms extensive silt flats, upon which grows a substantial community of mangrove (Avicennia officinalis).

7. Bandar Abbas to Jask (335 kilometers)

Broad plains in the first half of this segment give way to extensive sand dunes. The sea is relatively shallow until reaching Cape Mobarak. Upon entering the Gulf of Oman, offshore depths increase to over fifty meters.

8. Jask to Chah Bahar (380 kilometers)

Broad sandy beaches and vast sand dunes, interspersed with rocky cliffs, impart a special beauty to this sparsely populated region.

9. Chah Bahar to the Pakistan border (121 kilometers)

Heavily dissected coastline with cliffs and columnar silt formations, interspersed with narrow sandy beaches, characterize this segment. There is very little human activity.

10. Qeshm Island (285 kilometers)

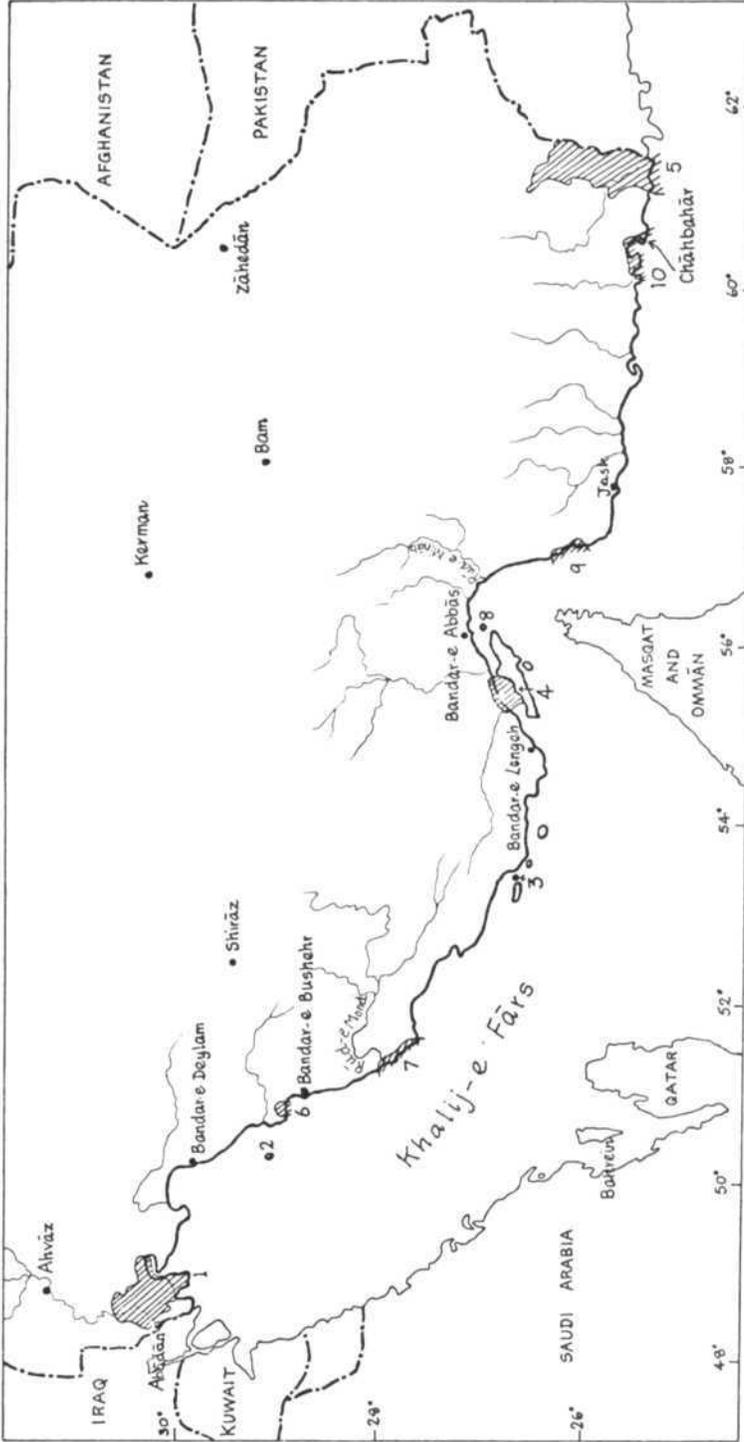
Lying in the Strait of Hormoz, this large, moderately-populated island constitutes an excellent representative of most coastal features, with rocky and sandy coastline, extensive plains and tidal flats.

Protected Regions

The Department of Environmental Conservation administers five "Protected Regions", which exist partially or wholly within the Gulf Region. Under the new law, these will be reclassified as National Parks, Wildlife Refuges, Nature Monuments or Protected Areas, in accordance with criteria approved only quite recently. These reserves are, from west to east:

1. Shadegan Protected Region - (Khuzestan)

This 290,000 hectare reserve was established in 1972, primarily as a sanctuary for wintering migratory



MARINE RESERVES OF IRAN

- | | | | |
|-----------|--------------|-----------|------------------|
| Existing: | 1 Shadegan | Proposed: | 6 Hafe Rud |
| | 2 Khark | | 7 Mond Delta |
| | 3 Sheedvar | | 8 Hormoz I. |
| | 4 Hara | | 9 Gaz (Hara) Rud |
| | 5 Bahū Kalāt | | 10 Pizom Bay |

waterfowl. Recent winter counts show hundreds of thousands of waterfowl utilizing the freshwater marshes and bare coastline. Seventy-five kilometers of shoreline are encompassed by the reserve, not including numerous estuaries.

2. Khark and Kharku Islands (Khuzestan)

The area comprises 2438 ha in the form of two islands off the coast from Bushire, first protected in 1960, primarily for the benefit of the island's small herd of goitred gazelles (Gazella subgutturosa). At the present time the large island, Khark, is a major oil terminal. The lesser island, Kharku, is of special interest because of its breeding birds.

3. Sheedvar Island (Fars)

This small island of 160 hectares was identified as unique from a standpoint of breeding terns (est. 500,000) and spawning sea turtles a number of years ago, and has received full protection since 1972.

4. Hara Protected Region (Bandar Abbas)

This 82,360-hectare reserve lies in the Straits of Khoran, between Qeshm Island and the coast. It contains the largest stand of Avicennia mangrove on the coast (est. 6,600 hectares). It encompasses 92 hectares of shoreline, including that on Qeshm island and the mainland.

5. Bahu Kalat Protected Region (Baluchistan)

This large (394,750 hectares) reserve was protected for a number of reasons ... to protect Iran's only population of crocodiles (C. palustris), to encompass important Oriental faunal species, to protect important Saharo-Sindian floral components, and to encompass important wader habitat on the coast. It also includes strikingly beautiful scenery, 61 kilometers of coast and a small, rocky island of importance to cormorants.

During the coastal surveys, emphasis was placed on evaluation of the reserves in relation to the coast proper, in order to determine any inadequacies in representation.

Coastal Morphology - Inland

In classifying the coastline (as herein distinct from and immediately behind the shoreline), the following categories were recognized:

1. Flood Plain

Extensive broad plain behind the shoreline subject to occasional inundation by sea water, not being protected by a berm.

2. Plains

Broad expanses of undissected, albeit occasionally well-drained relief.

3. Dunes

Substantial sand hills apart from those associated with a shoreline, beach or berm.

4. Dissected

Rocky hills, low to high cliffs and mountains. Three sub-categories were recognized:- a) up to 10 meters, b) 10 to 100 m, and c) over 100 m.

5. Undefined

Rivers and estuaries.

Table 1. Coastal Morphology - Inland

Segment	Flood Plain	Plain	Dune	Dissected			Un- defined	Total (km)
				Light	Moderate	Heavy		
1	21	163					9	193
2		75						75
3		93	69	18			7	187
4		172	109	48				329
5		114	21	48	71	62		316
6		147	13	6	18		6	190
7		210	118	3	3		1	335
8		58	235	11	67		9	380
9		7	23	37	53		1	121
10		149	16	90	30			285
Total	21	1188	604	261	242	62	33	2411
% of coast	.01	.49	.25	.11	.10	.03	.01	1.00
In Reserves	4	163	5	12	38	0	6	228
% of category	.19	.14	.01	.05	.15	.00	.18	.09

Table 1 presents the respective totals by segment. Plains constituted about half (49%) the coastline total. The large segments in the west and near Bandar Abbas contributed the greatest share of that percentage.

The relatively large percentage of sand dunes (25%) is of significance from a regional planning perspective. While excellent vegetation occurs on dunes in some areas, the greater part of them are unstable, often threatening villages and agricultural land. The presence of such a high percentage of dunes is a reflection of vegetation abuse in the coastal region. Dunes are not at all well represented in the reserves (only 1% of the total).

The greater part of the dissected relief (23%) occurs between Bushire and Bandar Lengeh, and on the Baluchistan coast, with all heavily dissected relief (3%) occurring between Asalu and Lengeh. More dissected relief might be added to the reserves.

Coastal Vegetation

Flora of the coastal region is the subject of another report to be presented at this meeting. However, a few comments on current vegetation trends are worth making here.

In general, the coastline vegetation is sparse and shows considerable past and present abuse. Vegetation in the western plains has been reduced to a very low density of halophytes. In the confined outwash plains of the central section, the once-extensive forest has been reduced to a remnant. Even the sparsely-populated Baluchistan coast shows heavy grazing in relation to plant density.

It is the occasional exception to the trend which merits discussion. In the Kuh Namaki region west of Bandar Lengeh, an excellent remnant of the coastal Acacia forest exists. Other tree genera, such as Tamarix and Heliotropium are represented as well.

Three excellent remnants of sand-dune vegetation can be found along the Baluchistan coast, at Bandar Tank, Konarak, and Baris. In addition to the shrub genera, Calligonum, Haloxylon, Ziziphus and Ephedra, numerous important grasses are represented including Cymbopogon, Aristida, Oryzopsis and Eragrostis. Such sites deserve special protection at this time, in order to preserve viable remnants of the flora for scientific investigation, and to provide a substantial source of seed for future re-vegetation programs.

Shoreline Characteristics

For the purpose of this survey, the shoreline was defined as the high water mark during tidal fluctuation.

1. Shoreline Profile

Five categories were recognized:

- 1) Abrupt - the sea encounters vertical or near-vertical cliffs or rocky outcrops at the high-water mark.
- 2) Narrow Beach - normally over five per-cent gradient
- 3) Broad Beach - normally less than five per-cent gradient

Note: The distinction between Narrow and Broad beach may seem somewhat arbitrary, although in actual practice the difference was distinct. Narrow beaches are those, when viewed in relation to the tidal or littoral zone, appear somewhat concave, whereas Broad beaches appear flat to convex.

- 4) Indistinct - no distinct beach or berm exists. The shoreline blends gradually into wide tidal flats, normally with less than one per-cent gradient.
- 5) Undefined - Rivers and estuaries.

Table 2 presents the profile data. Most of the Abrupt profile (11%) is found in the central portion of the coast and in Baluchistan. Indistinct shoreline (14%) is chiefly associated with Khuzistan and the plains east of Bandar Abbas. The greater part of the shoreline (74%) consists of a distinct beach, usually of sand.

Profile is rather well represented in existing reserves.

Table 2. Shoreline Profile

Segment	Abrupt	Narrow Beach	Broad Beach	Indistinct	Undefined	Total (Km)
1		57	63	64	9	193
2		56	2	17		75
3		90	59	31	7	187
4	2	200	95	32		329
5	119	160	37			316
6		99	20	65	6	190
7	3	62	183	86	1	335
8	66	73	232		9	380
9	38	42	40		1	121
10	33	90	116	64		285
Total	261	929	847	341	33	2411
% of coast	.11	.39	.35	.14	.01	1.00
In reserves % of category	.13	.04	.09	.23	.18	.09

2. Shoreline Texture

Six categories were recognized; in order of increasing particle size: 1) silt, 2) sand, 3) gravel (small rock particles, up to about 5cm in diameter), 4) rubble (larger, loose rock particles) 5) rock (solid rock formations), and 6) undefined (rivers and estuaries).

Table 3. Shoreline Texture

Segment	Silt	Sand	Gravel	Rubble	Rock	Undefined	Total
1	62	122				9	193
2	10	65					75
3	31	149				7	187
4	17	241	65	4	2		329
5		177	8	23	108		316
6	65	102	7	7	3	6	190
7	86	245			3	1	335
8		305			66	9	380
9		82			38	1	121
10		199			40		285
Total	317	1687	80	34	260	33	2411
%	.14	.70	.03	.01	.11	.01	1.00
In Reserves	78	109	0	0	35	6	228
% of Category	.25	.07	.00	.00	.13	.18	.09

The shoreline is predominantly a sandy one (70%), with the vast sandy beaches of Baluchistan contributing heavily to the high percentage. The rocky shoreline is found largely in the Asalu to Lengeh segment and along the Baluchistan coast. However, even where substantial cliffs exist, they are frequently bordered by a sandy fringe at the high water mark.

Virtually all the gravel and rubble shoreline is associated with the alluvial outwash plains at the base of mountains in the west-central portion. The alluvial plains of Khuzestan in the west, and between Bandar Abbas and Minab in the central portion, contain most of the silty-texture shoreline.

It would appear that additional sandy-texture shoreline needs representation.

3. Emergent Vegetation

Two broad categories were recognized: 1) Salt Marsh, consisting of emergent grasses, and 2) Mangrove, consisting of fringes or forests of *Avicennia*. A total of 214 kilometers, or less than 10% of the shoreline displayed emergent saltwater vegetation.

Salt marsh was confined to three small sites, about one and two hectares of Phragmites, respectively, along the Khuzestan coast, and about 60 hectares in the Hale Rud delta near Bushire. The latter is actually an extensive freshwater marsh, with only the fringes exposed to tidal flooding. At present no salt marsh is contained within Protected Regions.

An estimated 8,900 hectares of Avicennia mangrove forest exist along the coast. Rhizophora, reported by some authors, was not seen, and we do not believe it exists on the Iranian coast. The westernmost extent of mangrove is a 100-hectare stand near Bandar Asalu. That stand has been badly cut and is rapidly disappearing. By far the largest stand of mangrove (about 6,800 hectares) is in the Khoran Straits. The entire stand has been included within the 82,000-hectare Hara Protected Region.

Three broken fringes of mangrove exist in protected estuaries east of Bandar Abbas (app. 300 ha), east of Jask (app. 200 ha) and within the 395,000-hectare Bahu Kalat Protected Region, near the Pakistan border (app. 200 ha). About 80% of coastal mangrove is contained within Protected Regions. However, the finest stand, in terms of tree size and density, is a 900-hectare remote stand at the mouth of the Hara River, south of Minab, and is not protected at this time.

The value of mangrove to the productivity of the marine ecosystem is well known. Throughout its range in Iran, however, it is diminishing. Owing to the rarity of emergent vegetation, all mangrove should be protected.

Table 4. Inter-Tidal Zone Texture

Segment	Silt	Sand	Rock	Indistinct or none	Total
1	164	20		9	193
2	16	50		9	75
3	42	42		103	187
4	18	63	23	225	329
5		13	31	272	316
6	78	61	19	32	190
7	2	238	4	91	335
8		81	5	294	380
9		7	2	112	121
10	86	72	77	50	285
Total	406	647	161	1197	2411
% of total	.16	.27	.07	.50	1.00
In Reserves	162	7	0	59	228
% of Category	.40	.01	.00	.05	.09

Fully half the shoreline, it was found, contains a substantial tidal zone. Detailed surface examinations may add considerably to that figure, since detailed observations of tidal fluctuations were not possible in the course of the aerial surveys. Not surprisingly, in view of the shoreline texture, the greater part of the tidal zone is also of sand.

Most silt tidal flats exist in the western sector, and in the Khoran Straits north of Qeshm Island. These are key feeding sites for a number of shore birds, and presumably of great value to the fishery.

Rock tidal areas, including exposed coral, are not well represented. Only seven per cent of the shoreline exhibited this type, and nearly half of that percentage was recorded on Qeshm Island. There are no coral barrier reefs of any note on the coastline.

The Protected Regions do not represent the inter-tidal zones well. Additional sand and rock should be added to the system.

Littoral Zone Characteristics

1. Depth and Profile

In order to estimate the extension of the littoral zone, the depth and profile of the sea floor was estimated, where possible, 1 meters off shore. In turbid waters, the estimate was assisted by reference to shoreline or tidal zone profile, and to coastal maps, the accuracy of which was found to be somewhat limited. Due to the imposed constraints, the categories were limited to: 1) less than one meter (less than 1% profile), 2) one to three meters (1 to 3%), and 3) over three meters (over 3%). Table 5 shows the shoreline waters to be quite shallow, with about three-quarters of the profile less than three per cent. The reserves contain none of the deeper water.

Table 5. Depth of the Sea at the 100-meter Mark

Segment	(1 meter	1-3 meter	3 meters)	Total
1	165	25	3	193
2	66		9	75
3	58	55	74	187
4	74	121	134	329
5		29	287	316
6	135	50	5	190
7	246	77	12	335
8	62	260	58	380
9	8	113		121
10	184	47	54	285
Total	998	777	636	2411
% of coast	.41	.32	.26	1.00
In reserves	155	73	0	228
% of category	.15	.10	0.0	.09

2. Turbidity

The surveys were conducted in what is likely the season of greatest turbidity in the Persian Gulf. Due to the winter precipitation, heavy silt loads are deposited by coastal rivers from December through March. In addition, high winds accompanying those storms create turbid conditions where the shoreline is of a silty texture. Both conditions were evident at the time of the most recent surveys.

Five turbidity categories were recognized, from lowest to highest:

0. Perfectly clear - no particulate matter, visibility unlimited
1. Relatively clear - blue water, minute quantities of particulate matter, visibility good.
2. Slightly turbid - water a pale blue, visibility poor but objects discernible to a depth of about two meters
3. Moderately turbid - water a pale green, visibility very poor
4. Highly turbid - water a murky, pale brown, observations impossible
5. Extremely turbid - water a deep brown.

Table 6. Turbidity

Segment	0	1	2	3	4	5	total
1				5	175	13	193
2				32	43		75
3				168	14	5	187
4		23	61	239	3	3	329
5		2	186	122	6		316
6		18	4	162	6		190
7		17	41	269	8		335
8		30	207	143			380
9			113	8			121
10		54	71	160			285
Total	0	144	683	1308	255	21	2411
% of coast	-	.06	.28	.54	.11	.01	1.00
In reserves	0	0	53	100	71	4	228
% of category	-	.00	.08	.07	.26	.19	.09

No perfectly clear water was recorded. Indeed, 66% of the shoreline was categorized by water which was moderately to

extremely turbid, in which observations of the sea floor were impossible for the most part.

The sea was most turbid in the west, due to river effluent and the high percentage of silt tidal flats, becoming clearer as we proceeded eastward. The clearest water was seen on the outside of Qeshm Island.

Turbidity is chiefly associated with the shoreline, however, and blue water was evident two to ten kilometers off shore from Cape Bahrgan eastward.

The high percentage of turbid water is important from a standpoint of impeding photosynthesis of marine flora, hence decreasing productivity of the littoral zone. During the dry summer months, it is likely that shoreline turbidity is somewhat less.

The reserves are characterized in the main by turbid water. Some clearer shoreline should be acquired.

3. Marine Fauna

Fauna of the Gulf region will be presented elsewhere. I will simply mention here a few observations on the major faunal groups.

A. Sea Turtles

Sea turtles are fully protected under the Game Law.

In flying west to east, the first evidence of turtles has been south and east of the Mond River. While high turbidity discourages observations west of that point, turbidity also tends to suppress the aquatic macrophytes, upon which the turtles feed. Dead turtles were frequently seen washed upon the beach from the Mond River eastward, whereas none were seen west of that point. Thus it is likely that turtles are rare in the western portion of the Gulf, except in the vicinity of off-shore islands.

Turtles occur in significant numbers in three coastal areas, Siraf to Bandar Lengeh, Qeshm Island (and other off-shore islands in the Hormoz Strait), and Bandar Tank to the Pakistan border. They are most frequently seen along rocky coastlines. We have observed them at regular localities in approximately equal densities for the past four years, and have thus identified approximately 180 kilometers of primary turtle habitat. The sighting of turtles 854 times during the most recent surveys suggests a mean of 4.7 kilometer in suitable habitat, ranging from 3 per km near Siraf to 9 per km on the south shore of Qeshm Island. At select locations, densities of 30 per km

have been recorded. Much higher densities are suggested at the spawning grounds of Sheedvar Island and elsewhere.

B. Marine Mammals

Nine species of Cetaceans are known from Iranian waters.

Porpoises (species undetermined) have been observed with regularity during the coastal surveys, from Lengeh to the Pakistan border. They are regularly observed on the north and south-east shores of Qeshm Island, just west of Jask, and in the Bay of Bahu Kalat near the Pakistan border. Groups of over 40 have been seen in the latter two localities.

Whales (species undetermined) have been seen less frequently, from Bandar Abbas to Chah Bahar; however they have been seen with some regularity at Cape Mobarak, west of Jask. In February, 1972, a herd of 30+ was seen on several successive days east of the Cape, and 5 to 10 in more shallow waters north of the Cape.

We have not observed dugongs on the coastline.

Human Activity

In the course of the surveys, the shoreline was classified according to four "disturbance" categories, primarily in an attempt to gauge the potential impact of man on the coastal fauna:

- 0- No evidence of human activity
- 1- Low density - limited fishing, pastoral activity, etc.
- 2- Moderate density - small villages, coastal roads and commerce, intensive fishing, navigation facilities, agricultural activity, etc.
- 3- High density - active ports, cities, larger villages.

Only 30 km of the coastline showed no human activity - a particular stretch of Khuzestan shore. Due to an unusual pattern of tidal flats and estuaries, the shoreline is accessible from neither land nor sea, except with extreme difficulty. Elsewhere, even on the seemingly most remote expanses of coastline, careful observation produced evidence of man - nets, boats, trails on the cliffs or footprints on the beach.

Due to the poor road system along many parts of the coast, the shore itself frequently becomes the main transportation and commerce route, especially in the Baluchistan sector, where large camel caravans are a common coastal feature. In some cases, motorcycles are replacing camels.

Table 7. Coastal Disturbance

Segment	0	1	2	3	Total (Kilometers)
1	30	152	11		193
2		66	5	4	75
3		64	102	21	187
4		104	219	6	329
5		191	120	5	316
6		25	138	27	190
7		128	195	12	335
8		336	38	6	380
9		103	13	5	121
10		135	147	3	285
Total	30	1304	988	89	2411
% of Coast	.01	.54	.41	.04	1.00
In Reserves	0	127	51	0	228
% of Category	.00	.09	.05	.00	.09

54% of the coast showed slight disturbance/ 41% moderate, and only 4% high disturbance. Thus, man is distributed rather ubiquitously throughout the coastal regions, but high density settlement and coastal disturbance is not excessive at this time. A significant amount of disturbance characterizes the reserves, but primarily in Hara P.R., where there is a great deal of fishing activity along the northern edge.

Pollution

In view of the fact that the Persian Gulf is a major oil-shipping route, it is perhaps surprising that we detected very little (visual) evidence of oil spills. At the entrance to the Bay of Bandar Shapur, a major oil terminal, an area of approximately four hectares of sandy beach was coated with oil. Elsewhere, small balls of sand and oil/ rolling on the beach, would seem to somehow symbolize the condition and the threat. We do not, however, have data on the invisible sub-surface conditions.

The amount of garbage on the beach is worthy of note. Plastic containers and other non-biodegradable items form a mass of litter throughout the coastal region, which appears to be entirely out of proportion to the amount of settlement of the Iranian coastline.

Salinity measurements suggest a limited exchange of water between the Persian Gulf and the ocean proper. Therefore pollution problems are likely to be compounded in this "confined sea". Owing to the increased pesticide use along the major coastal rivers and increasing effluents from a growing petrochemical industry, it is imperative that steps be taken to prevent serious damage.

Islands

A. Major islands

In addition to Qeshm, seven larger, populated islands exist between the Strait of Hormoz and Bandar Asalu. These are Hormoz, Larak, Hengam, Farur, Kish, Hendarabi and Lavan, aggregating to about 41,000 hectares.

All are reasonably similar, being somewhat rocky, with sandy and rocky shorelines, sparsely populated, with little or no fresh water and limited cultivation. The sea is quite clear in their vicinity, however, and many contain substantial coral reefs. Hormoz contains important Hematite deposits.

Hormoz, as mentioned previously, is also the site of a marine research station, presently under construction. Protection of any one of these islands in its entirety seems not feasible, although important parts of at least one should be represented in the reserve system.

B. Minor islands

From the western portion of the Gulf to the environs of the Mond River are a number of small islands, which were visited in the course of the surveys. Whereas innumerable islands exist at high tide, we defined an "island" as a land mass not contiguous with the coast at low tide.

1. From the Arvand River to Cape Bahrgan

- a) Two small islands forming off the mouth of the Bahman Shir, consisting of silt.
- b) Four small islands at the mouth of Bandar Mashur Bay of about 500 and 3 x 50 hectares, respectively. The larger of the four contains a limestone shelf with some shrubs, but it is mostly bare sand with silt tidal flats. The three smaller islands are of sand with no vegetation, surrounded by silt tidal flats.
- c) A 50-hectare rocky island with shellfish beds and no vegetation.

- d) A sandy island of 150 ha with no vegetation and apparently swept by the sea during severe storms.
- e) Bune Island - apparently growing in size due to silt deposits. It contains about 300 ha of good vegetation on sand, with evidence of a large colony of breeding birds.
- f) Dara Island - limestone outcrops and sand, with some vegetation. Probably of importance to breeding birds.

2. Bay of Bandar Rig

The island in the center of the bay is small, sandy, highly disturbed by fishermen, and of no particular interest.

3. Bay of Bushire

- a) Two new islands are forming off the sandspit at the north edge of the bay.
- b) A sandy island of 50 ha in the north-central part of the bay.
- c) Shif Island, of about 1500 ha, contains a large village and is highly disturbed.
- d) Sheikh Zangi Island, for all intents and purposes, has become a part of Bushire.

4. South of the Bushire peninsula

Two small silty islands and one sandy island exist, each without vegetation, and each about 10 ha.

5. South of the Mond River delta

In this beautiful area of vast sandy peninsulas not unlike many National Sea-shores in the United States, there are four uninhabited islands which, judging by maps of the coast, are shifting about. These are:

- a) A large sandy island of some 1500 ha, dumb-bell shaped, with scattered vegetation. It is separated from the shore by a 100-meter wide tidal channel.
- b) A small sandy island of some 100 ha, no vegetation.
- c) Nakhilu Islands - about 200 ha of sand with excellent vegetation and evidence of breeding sea birds. It has a marine light installation, which is apparently unmanned.

- d) Amalakoram Island - about 300 ha of excellent grass and shrubs on sand. It has evidence of a large bird colony in summer. There is a wish-bone-shaped island forming between Amalakoram and the mainland, but as yet both are quite distinct from mainland tidal flats.

It would seem appropriate to protect representatives of the unpopulated islands for scientific investigation and to insure protection of breeding birds, as well as to provide recreational sites in some cases.

Summary of the Reserve "Deficiencies"

In terms of coastal or ecotone criteria, of course, additional reserves were deemed necessary to:

1. Encompass more sand dunes, with a view to stabilizing these.
2. Encompass more dissected relief.
3. Add more sandy-texture shoreline.
4. Represent the small amount of salt marsh extant on the coast.
5. Increase the amount of Avicennia contained in reserves, towards protecting all mangrove eventually.
6. Add more inter-tidal zone, and especially that of sand and rock.
7. Represent the limited amount of deeper water.
8. Acquire additional clear water.

PROPOSALS FOR ADDITIONAL MARINE RESERVES

The analysis of the coastal survey data has pointed to the need for a number of additional sites to protect representative and unique features. In addition to survey data, we were influenced by:

1. Cultural patterns of the coast.
2. Recommendations of Tourist-Consult, Inc.
3. An analysis of the aesthetic appeal of various portions of the coast.
4. The views of numerous departmental personnel, consultants and ministerial personnel.

Five additional areas are herein proposed for protection in the framework of reserve criteria of the Department of Environmental Conservation. That is, for the moment at least, they would become terrestrial reserves, with off-shore waters encompassed within the boundaries.

1. The Hale-Rud Marshes (Fars)

Protection of these marshes would, for all intents and purposes, encompass all the salt marsh vegetation on the coast. A reserve of about 20,000 hectares, including 20 kilometers of coastline would be required. There is no settlement within the region, and little human activity, due to its present inaccessibility.

2. The Delta of the Mond River and Peninsulas to the South
(Fars)

Protection of this unit would encompass an extensive sandy area, the islands of Nakhilu and Amalakoram, and adjacent terrestrial plains vegetation. The nation stands to gain, respectively, an area of spectacular scenic appeal, which will be one hour from Bushire by asphalt road once the coastal highway is completed; important bird colonies and, likely, turtle spawning sites, as well as the attendant marine fauna; and a herd of 300-plus goitred gazelles, with a sizeable population of wintering Houbara Bustards on the plain. The reserve would add 80 km of coastline to the reserve system.

3. The Shoreline of Hormoz Island (in part or in total)
(Bandar Abbas)

This, the site of a marine research station, merits special attention from a scientific viewpoint. It fills the need to represent the larger island environment, deeper waters, low turbidity water, as well as rock tidal zone and coral.

4. The Rud-e-Gaz (Rud-e-Hara) Mangroves (Bandar Abbas)

This unit would include the finest mangroves on the coast, and about 20 km of tidal flats to the south, the sum of which has been identified as one of the most important sites for waders (shorebirds) on the entire Iranian Coast. This would add 45 km of protected shoreline.

5. Chah Bahar and/or Pizom Bays (Baluchistan)

These bays contain unique features, especially the important sea-grass beds of Chah Bahar Bay, as well as the bay's beautiful coral. The bay averages about 6 m in depth, and is normally beautiful, clear water, one of the few sites on the coastline suitable for scuba diving. This is the only site proposed for protection by the Tourist-Consult group. Chah Bahar Bay cannot, in terms of our criteria, become a National Park, due to the presence of a great deal of coastal development, including a large military installation. However, it might reasonably constitute a Protected Area, whereby pollution and other standards are enforced to protect the unique features of the bay. Pizom Bay, a smaller and somewhat similar bay is

relatively free from settlement, contains excellent sand-dune vegetation, and from the aesthetic point of view merits National Park status. It is our intent to encourage recreational use of Chah Bahar Bay in order to enhance public appreciation of the marine environment in this beautiful setting.

6. Other sites, to be appended to extant reserves

Several of the islands between the Arvand River and Cape Bahrgan merit appending to Shadegan Protected Region. Most important among these are Bune and Dara Islands. At this time no islands are protected in the western Gulf area.

Tables 8 to 13 present a statistical summary of features represented in existing and proposed reserves.

Table 8. Coastal Morphology - Inland

	Flood Plain	Plain	Dune	Dissected			Un- defined	Total Km
				Light	Medium	Heavy		
Coastal Total	21	1188	604	261	242	62	33	2411
% of Coast	.01	.49	.25	.11	.10	.03	.01	1.00
In Reserves ¹	4	247	116	15	75	0	6	463
% of Category	.19	.20	.19	.06	.31	.00	.19	.19

¹ existing and proposed.

Table 9. Shoreline Profile

	Abrupt	Narrow Beach	Broad Beach	Indistinct	Undefined	Total Km
Coastline Total	261	929	847	341	33	2411
% of Coast	.11	.39	.35	.41	.01	1.00
In Reserves ¹	72	41	224	120	6	463
% of Category	.25	.04	.26	.35	.19	.19

¹ existing and proposed

Table 10. Shoreline Texture

	Silt	Sand	Gravel	Rubble	Rock	Undefined	Total Km
Coastline							
Total	317	1687	80	34	260	33	2411
% of Coast	.14	.70	.03	.01	.11	.01	1.00
In Reserves ¹	108	275	0	0	74	6	463
% of Category	.34	.16	0	0	.30	.19	.19

¹ existing and proposed

Table 11. Inter-Tidal Zone Texture

	Silt	Sand	Rock	Indistinct or None	Total Km
Coastline					
Total	406	647	161	1197	2411
% of Coast	.16	.27	.07	.50	1.00
In Reserves ¹	182	119	0	162	463
% of Category	.45	.18	0	.14	.19

¹ existing and proposed

Table 12. Depth of the Sea at the 100-meter Mark

	1 meter	1-3 meters	3 meters	Total Km
Coastline				
Total	998	777	636	2411
% of Coast	.41	.32	.26	1.00
In Reserves ¹	287	134	42	463
% of Category	.29	.17	.12	.19

¹ existing and proposed

Table 13. Turbidity

	0	1	2	3	4	5	Total Km
Coastline							
Total	0	144	683	1308	255	21	2411
% of Coast	0	.06	.128	.54	.11	.01	1.00
In Reserves ¹	0	20	84	275	77	7	463
% of Category	0	.13	.12	.21	.30	.30	.19

¹ existing and proposed

All shoreline features are well-represented in the existing and proposed reserve complex, except Rock tidal habitat, which would be present on Hormoz Island; heavily dissected terrain, which at present is somewhat self-protected; and gravel/rubble beaches, which are infrequent on the coast but not threatened at this time.

SUMMARY AND RECOMMENDATIONS FOR STUDY AND ACTION

Implementation of the foregoing proposals will serve to insure that Iran's Marine Park system is well on the way to representing the marine resources of the Persian Gulf. Further study, it is hoped, will serve to fill the gaps in our knowledge, particularly the off-shore fauna, and henceforth it is likely that the reserve scheme would be modified and appended.

Reserve establishment, of course, is only one step among many required to protect the marine environment. We have mentioned the high turbidity of coastal waters brought on by the heavy silt loads reaching the sea. This phenomenon merits urgent attention, well inland.

I would like to conclude this paper on a positive note. In the process of the coastal surveys we discovered the previously unknown marshes of the Hale Rud delta, the only significant marshes on the coast proper. Those marshes were unreported, because they likely did not exist five years ago. Local residents may have inadvertently discovered the solution to much of the turbidity along the coast. By hand and shovel they constructed a dam and diverted the channelled river bed onto adjacent outwash plains, in hopes of providing irrigation water for sparse wheat production. In that, they failed, but they succeeded in creating a vast marshy delta with beautiful lagoons, a haven for ducks, geese, cranes and other waterfowl,

not to mention wild boars, fish life and gazelles on the perimeter. The river effluent still reaches the sea, but the silt is filtered out in the marshes.

What the local residents have accomplished by hand in the Hale Rud can easily be duplicated by heavy machinery in short order, in identical situations on the Mond, Mehran, Shur and other rivers. Such schemes could likely decrease coastal turbidity significantly, while creating superior wildlife habitat and forage for livestock.

This is but one example of action which can and should be taken to improve the marine environment. I believe that protection of the marine ecosystems is still, with a bit of effort, within our grasp.

Country Reports No. 5

K E N Y A : THE ESTABLISHMENT OF MARINE NATIONAL PARKS

P.M. OLINDO & W.W. ASAVA

Kenya National Parks, P.O. Box 42076, Nairobi

INTRODUCTION

This paper deals with the establishment of Marine Parks in Kenya since 1962, when the First World Conference on National Parks was held. But since Kenya is anxious to obtain some technical know-how from other countries, mention may be included of areas outside our own territorial waters. Kenya established its first two Marine National Parks at Malindi and Watamu on the northern coast in 1968. This followed from a recommendation adopted by the First World Conference on National Parks at Seattle in July, 1962. The Republic of Kenya's action in 1968 was thus a very positive response and details of how it was realized will be explained later in this paper. At this juncture we wish to pay specific tribute to the Government of Kenya for the favourable climate it continues to foster for the establishment of National Parks in representative ecosystems.

INTER-DEPARTMENTAL CO-OPERATION

In Kenya, credit should definitely be given to the Game Department for doing the spade work in the location and initial identification of terrestrial National Parks and Reserves. Similar credit is extended to the Fisheries Department which located the present Marine National Parks at Malindi and Watamu and proclaimed them 'Fish Reserves' in 1963 and 1964 respectively; later agreeing to the proposal made by the Kenya National Parks to upgrade the two reserves to the status of Marine National Parks. The Fisheries Department also agreed that some 95 square kilometres of sea surrounding the marine parks should be declared as Marine National Reserves. The Department subsequently also gave its full support to the establishment of the Kisiti/Marine National Park near Shimoni at the southern end of the Kenya coast.

Complete protection is extended to the vegetation, fish, coral, shells, geological structures and other aspects of the environment within a Marine National Park. In the Marine National Reserves only specified methods of fishing are allowed and the use of spear guns, herbaceous tranquilization (fish poisoning)

and collection of shells are prohibited and these prohibitions are enforced. We are in fact contemplating negotiating the declaration of the inner reef along the entire coastline in Kenya as a Marine National Reserve except where National Parks have been established.

POLICING

One has to accept the fact that National Park status which accords protection to plants and animals in any given area, will naturally meet with some form of opposition either in a traditional form or in a commercial one. One may also expect resentment from the un-informed public who, for time immemorial have enjoyed unimpeded riparian rights of doing what they pleased and as they pleased with the beaches and the sea.

The initial establishment of Marine Parks in Kenya was sharply criticized by many on the grounds that our organization was assuming a 'police posture'. We have now had seven years to see our operations in action and time to exhaustively discuss the establishment of Marine Parks with fishing communities and property owners adjacent to the parks; and the parties concerned are unanimous that policing of either Marine or terrestrial National Parks and Reserves is essential if certain minimum standards of operation, activities, prohibitions and conservation are to be established and maintained.

Every effort is made in Kenya to promote, at a very high pitch, the conservation education, initially, of people living in areas adjoining the Parks and those who in one way or another have foregone one or several uses of the area so declared or whose tolerance, in the case of terrestrial National Parks and reserves, has been and continues to be instrumental in the continued survival of wildlife, by permitting seasonal migrations through their lands and thereby promoting a healthy situation in the way we know it today. These are the people who, in the dry and wet seasons, allow the free movement of animals and birds, allow migrating animals to share with domestic stock scarce supplies of water and grazing.

Similarly, surveys are underway with respect to marine Parks to establish which fishes, for example, are pelagic and which are resident and, in the case of the pelagic species, what their reproductive rates, numbers, social structure, etc. are. Whenever possible, under-water films and slides have been acquired and these materials are used in the conservation education drive. As we have intensified the education and effectively communicated our aims and objectives to our people and visitors, we have noted a proportionate drop or a marked trend away from the need to use law enforcement methods to achieve the objectives for which the parks are established.

We are of the strong opinion that the educational approach rather than hard law enforcement achieves the best long term results.

One of the reasons for establishing a National Park is to allow its controlled use - by people. Controlled use calls for regulations. Hereunder are some of the methods used in Kenya to ensure that, while protecting parks, these beautiful places are not completely closed to the public.

REGULATIONS

The marine parks are governed by a similar law (Cap. 377) of the Laws of Kenya and Gazette Notice 27, supplement Nos. 98 & 99, to that applying to the other Wildlife National Parks all over the Republic. But unlike other Wildlife Parks, the Parks' Authorities have given the following concessions free of charge, while reserving their right to restrict admission:-

- (a) Passage and anchorage of boats but a FREE PERMIT must be obtained first for the period required.
- (b) FREE swimming and water skiing; just off the beach one does not need a permit for this.
- (c) FREE walking, basking and picnicking anywhere along the beach.

The only thing that one pays for is SEEING what there is underwater. One is deemed to be 'seeing' when one uses any type of goggles, masks, schnorkels and glass-bottomed boats. For seeing in the above manner, visitors must have a ticket in advance at the following rates:-

Non-Residents of Kenya -- adults	----	K.Shs. 10/-	per person
	per day		
Residents -----	adults	----	K.Shs. 2/50
	per day		
Children under 14 years of age	----	K.Sh. 1/-	per child per day
Organized School Parties -----		Cts./50	per student per day.

Also available to Kenya residents are season tickets at the following rates:-

- (a) Quarterly ---- adults K.Shs. 40/- Children K.Shs. 10/-
- (b) Half-Yearly -- adults K.Shs. 50/- Children K.Shs. 15/-
- (c) Yearly ----- adults K.Shs. 70/- Children K.Shs. 25/-

Application forms which in all cases must be completed by the applicant are obtainable from:-

The Warden,
Marine National Parks,
P.O. Box 109,
MALINDI

or

The Director,
Kenya National Parks,
P.O. Box 42076,
NAIROBI

Other regulations, within these gazetted National Parks, make it an offence to:-

- (a) Go goggling or use a 'glass-bottomed boat' without an appropriate permit. This applies to boat Captains and Coxwains as well.
- (b) Reside in the Marine Park
- (c) Possess any weapon, explosive, trap or poison inside the Park.
- (d) Possess, kill, injure, capture or disturb any animal or take away or destroy any egg or nest.
- (e) Cut or set fire to any vegetation or damage any object
- (f) Introduce any animal or vegetation into the Park without a permit
- (g) Remove any vegetation or animal, alive or dead, or any object of geological, prehistoric or archeological, historical or other scientific interest
- (h) Destroy or deface any object, whether animate or inanimate, in the Marine Parks.

ENFORCEMENT

The two Parks are headed by a Park Warden responsible to the Director of Kenya National Parks. Under the Warden, there are: one Assistant Warden, one Junior Assistant Warden, a Sergeant, two Corporals stationed at Watamu and Malindi, respectively, and 26 rangers.

The work of this body of men is to enforce the law and assist whenever there is a misunderstanding of the regulations.

The two Parks are patrolled for twenty-four hours a day by two boats stationed at Malindi and Watamu respectively. Each Coxswain of a boat is accompanied by one ranger and there are usually three rangers on the beach. The boats can also be used to help those who are in trouble in the sea including fishermen.

USE OF BEACHES

The laws of Kenya allow access to the beaches to everyone, i.e. even the beach in front of private property is open to the public through public access roads set aside for that purpose.

Where there is private property adjoining Marine Parks, the landward boundary of the park is common to the beacons seaward boundary of the property. Whenever islands are involved, they have become part of the park or reserve concerned. Although the law requires that a fee be charged to enter a national park, the functional aspect of including beaches such as those referred to above within a National Park is achieved by discontinuing shell-collecting, destruction of corals or any other form of exploitation. It is common practice all over the world for the best beaches to be taken over first for human settlement; and Kenya is no exception. To allow neighbouring plot owners to realize their initial object of purchasing beach property, we allow free use of up to 100 yards of the sea at low tide. This arrangement has worked well. The initial worry of property owners to the effect that the declaration of marine parks in waters opposite their property would depress the market values has been proved completely wrong. In fact, property values have been enhanced, three to four-fold, and a tendency has even been noticed towards a stampede directed at the parks' Trustees by property owners, in areas where no marine parks and reserves exist, in order to get marine reserves established for their own sake and for the sake of the owners. Financial resources available to the parks' authority has not permitted us to respond favourably to all such demands. In fact, because of this situation we would definitely appeal for financial assistance to enable us to manage and develop the established and projected Marine National Parks properly.

We respect the right of all high seas boats to be in transit across a park. The criteria of a boat in transit is that it shall not anchor or moor in the park. Boats in transit are strictly required to refrain from any action that could be construed as a breach of park regulations. The park's law vests in the authority the power to withdraw for up to 12 months the right of transit or entry from any vessel in breach of the regulations. We are glad to say that this provision has been invoked in only a handful of cases since we started the marine parks system in 1968.

ESTABLISHMENT

The establishment of Marine National Parks would have been realized three years earlier had it not been for the need of a

mandatory amendment to the law. In effect, the amendment involved the re-definition of the term 'land' which was expanded 'to include land covered by sea or other waters'. Apart from this re-definition, the rules, values, practices applicable to terrestrial parks apply to Marine Parks except for certain specialized aspects of marine environments that would not apply elsewhere.

It has not been an easy job for the Parks' Authorities to establish a Marine Park anywhere without the community within that area complaining. Sometimes the community- near the intended Park area argues that the organization has more interest in the plants and animals that are to be protected than in human beings. In most cases the area is of known value to the community, hence it feels it is being chased away or having traditional rights denied. As mentioned above, fishing communities living near marine parks and reserves long ago realized the value of shells, corals and fish, but did not until recently believe that these resources could be exhausted unless control measures are taken. We are pleased to note that our policy of Conservation now enjoys growing popular support everywhere in the country.

RESOLVING OF DIFFICULTIES

Solutions to problems should always be sought within the area concerned and not at a distance from it. Educating of the local people of the value of establishing areas as Parks is very important. In Kenya, and we believe anywhere else, the first thing to do is to employ people from the area of operation so that they feel their welfare is catered for. The first rangers and captains were either fishermen or sons of fishermen within the three areas. Some difficulties were expected because, where kith and kin are concerned, a tendency by some of these rangers to be over-considerate was foreseen but a solution was found. After providing local employment, realistic transfers of staff from other parts of the country were effected to make the regiment strong while maintaining good public relations. These rangers are given training on the job.

As far as collection of shells and corals is concerned, there have been sufficient patrols and checks of boats to make sure that those who come and go in the Parks follow the regulations. At present, we are satisfied that most of the boats that enter the Park are not carrying any of the prohibited items.

The above solutions do not mean that there is complete freedom from other offences that can be committed without the organization's knowledge. The organization is doing all it can to make sure that boundaries are marked clearly, so that those

who intend to commit offences are fully aware of the limits and if they are taken to Court, there can be no ambiguity in the matter.

We have always tried and will continue to solicit more help from those who know more about marine life from other parts of the world and we expect this to be forthcoming. For example, right now, we do not have underwater trails, but we hope that as time goes on we shall have these established so that those who visit the Park will be able to enjoy using them.

RESEARCH

Very little is known about marine life on Kenya Coast and East African Coast as a whole. The few species of corals, shells and fish that are known have been identified by occasional gogglers and scientists but we still lack complete lists of what can be seen in the Parks. So far as we know the common corals to be found in the Parks are brain coral (Meandrina, Goniastrea), stag's horn (forma cervicornis), sea fan (forma palmate), finger (forma prolifera), fungus (Merulina) and Blue coral (Heliopora coerulea).

There are quite a few species of reef fish found in these three Parks belonging chiefly to the families: Acanthuridae, Apogonidae, Gobiidae-Pomacentridae, Canthigasteridae, Holocentridae, Balistidae, Chaodontidae, Solaridae-Muraenidae and Ophichthidae.

There are a few shells that can be seen easily such as cowries and giant clams. For other species of shells one has to dive to look for them. Although few species can be seen now we hope that with continued protection, these shells will increase.

With further research on the species of marine life that exist within these parks we shall eventually be in a position to list what we have got. A few organized biological expeditions have tried to draw up an inventory of species in our Marine Parks and we hope to get more people to do more research work in cooperation with us. Research is a wide programme that cannot be done within a limited period, hence our organization will seek both financial and scientific help in this venture.

FUTURE PLANS

At the time of preparing this paper, there are three Marine National Parks in Kenya, at Malindi, Watamu and the third one at Kisiti near Shimoni at the southern tip of the country. For the future, it is intended to establish a marine reserve

in the Lamu/Kiunga area on the north coast. Subsequently, definitive studies will determine whether some of the areas covered in the proposed reserve or left out of it should be covered as marine national parks. The areas around Lamu are excellent habitats for dugongs and marine turtles. Although these animals are protected by law, the areas where they are found are too far from administrative centres and by establishing these new Marine Parks/Reserves, the animals will receive full protection. This proposed addition should be realized during the year 1975.

In short, Kenya has moved fast to adopt recommendations made in meetings like the present one or like the Second World Conference on National Parks held at Grand Teton National Park, in September, 1972 (see Appendix 2 of these Proceedings for the text of the relevant recommendation). The first President of the Republic of Kenya, H.E. Mzee Jomo Kenyatta, is one of the best Conservationists in the world and has declared that the Natural resources of this country should not be tampered with. The statement is contained in the Nairobi Manifesto of 1963 which also covers marine environments and reads as follows:-

"The natural resources of this country - its wildlife which offers such an attraction to visitors from all over the world, the beautiful places in which these animals live, the mighty forests which guard the water catchment areas so vital to the survival of man and beast - are a priceless heritage for the future.

The Government of Kenya, fully realising the value of its natural resources, pledges itself to conserve them for posterity with all the means at its disposal.

We are confident of the co-operation of the other Governments of East Africa in this important task but, at present, we are unable, unaided, to provide the specialist staff and money which are necessary. We therefore invite other nations, and lovers of nature throughout the world, to assist us in honouring this solemn pledge."

We in Kenya wish to encourage other nations having shorelines to move fast and declare selected areas as Marine National Parks so that representative marine ecosystems are accorded adequate protection on a world wide scale. We are keeping the door of our country open for those who would like to pay us a visit to do so and advise us on what they feel would help to conserve and protect this important heritage.

Country Reports No. 6

K U W A I T

N.A. HUSAIN

institute for Scientific Research, P.O.Box 12009, Kuwait

The coastline of Kuwait is only about 170 km long. It is mainly sandy and muddy with very few inlets. The northern coast from Doha northward is bordered by extensive mud flats. These have been created by the flood waters of the Shat-Al-Arab. The southern coast from Kuwait city southward is mainly sandy.

There are a few islands scattered in Kuwaiti waters, the largest of which is Bubian, a muddy island with no inhabitants. The second in size and most important island is Failaka which is inhabited by a large number of people. The other three islands are small and uninhabited, the most important being Kubbar Island, which is a nesting ground for sea-birds and sea turtles.

Fishing is considered as the second most important source of national income after oil, but unfortunately this important resource has not been given enough attention. As a result, a great drop in the fish and shrimp catch has been noticed since 1969. The main reasons behind this drop are careless over-fishing and absence of protective regulations in regard to close seasons, mesh size, spawning areas etc... Also, continuous human activities along the coastline have resulted in disturbance of marine ecosystems. For example, the removal of large quantities of sand from the beaches for construction purposes has resulted in the destruction of some of the essential habitats of marine life.

Some parts of the Kuwaiti coastline are slowly being destroyed by the disposal of untreated sewage, while other parts of the coast are being polluted by industrial effluents, such as high concentrations of ammonia, mercury and chlorine and by thermal pollution.

Kuwait, being an oil producing country, is faced with the problem of oil pollution. The major sources of oil pollution are - shipping activities, accidental oil spillage, and disposal of ballast water in inshore waters regardless of the legislation which prohibits this.

All of the above-mentioned factors have deeply affected our marine natural resources and resulted directly or indirectly in the decline of fish and shrimp catches.

The Government of Kuwait, realizing the importance of fishing and fisheries developments, has now established two research institutions, with the objective of surveying and studying the natural fisheries resources and their development.

The two institutions are the Fisheries Department of the Ministry of Public Works and the Marine Biology and Fishery Division of the Kuwait Institute for Scientific Research.

Surveys conducted so far have resulted in the identification of the fishes of Kuwait and the completion of oceanographic surveys of Kuwait and the Gulf waters. The surveys have showed that there is good potential for developing the fish industry in the area. 350 species of fishes belonging to 95 families have already been identified and about 135 of these are edible.

Studies in regard to identification of the other elements of the Kuwait marine fauna are being conducted, but no reports have yet been published. In addition, the Government is engaged in pollution study and control.

At present there are no marine parks or reserves in Kuwaiti waters, but it is hoped that in the future, studies will show the necessity of establishing marine parks and reserves in the area in order to protect the biota. We believe that co-operation between the Gulf countries and the regional and international organizations is vitally important and hopefully will result in the conservation of our ecosystems.

Country Reports No. 7

P A K I S T A N : NATIONAL REPORT

SYED QADIR MOHIUDDIN

Assistant Director, Marine Fisheries Department, West Wharf,
Karachi

Pakistan with a coastline of about 550 miles has fairly large fisheries resources. The Sind coast from Karachi runs in a south-easterly direction and is characterized by a network of creeks ending in Sir Creek which forms a boundary between Pakistan and India.

The coastal waters are shallow, the 100 fathom line being situated about 60 miles offshore except at the mouth of the river Indus, where the sea-bed drops abruptly. The sea-bed is composed mostly of soft mud but a few stretches of sand are also present. Mangroves thrive very well, although only a few other tree species are present on this coast.

The Mekran coast extends westwards from Karachi to Gwatar Bay. This coast consists of large bays, the most important of which are Hawkes Bay, Ormara bays, Pasni bays, Gwadur bays and Gwatar Bay. Besides these bays, two very important backwaters exist on this stretch of coast: one is 55 miles west of Karachi and is known as Sonmiani Hor (it is about 40 miles long and 10 miles wide); the other is the Kalamat Khor, lying midway between Ormara and Pasni. The coast is devoid of vegetation except for occasional clusters of date palms. Hills of volcanic origin, rising to over 3,000 ft., run parallel to most of the coast. The sea-bed is again mostly muddy, but at places patches of coral are present. The 100 fathom line is sometimes not more than twenty five miles offshore and the sea-bed falls abruptly to a great depth. About 25 miles off the coast of Pasni there are some mud-islands known as Astola Islands.

A very large number of fishes (about 285 species) have so far been recorded from Pakistan waters. The Elasmobranch fish fauna is represented by 35 species of sharks and 28 species of skates and rays. The largest of these, and so far as is known the largest species in existence, the whale-shark (Rhinodon typicus), has only very rarely been caught.

Boney fishes belonging to the Family Carangidae form a great proportion of the catch on the Mekran coast. Similarly Snappers, belonging to the genus Lutjanus, are caught in large numbers during the cold season. Other important genera are

Leiognathus, Pomadasys, Spams, Sargus, Crinieus and Scatophagus.

Of the marine mammals, two sperm whales, Physeter catodon, were caught by the fishermen in 1953 off the coast of Karachi: Megaptera, popularly known as the humpback whale, has also been reported from the Mekran coast. Neomeris phocaenoides, the black finless porpoise, generally inhabits the tidal zones of the Indus river and the shallow waters along the coast.

Of the marine reptiles, five species of sea-turtle have so far been reported to occur in the territorial waters of Pakistan:

Green turtle (Chelonia mydas)
 Ridley turtle (Lepidochelys olivacea)
 Loggerhead (Caretta caretta)
 Leatherback (Demochelys coriacea)
 Hawksbill (Eretmochelys imbricata)

Crustacean prawns of commercial importance on the coast belong to the genera Penaeus and Metapenaeus, and spiny lobsters to the genus Palinurus.

The molluscs of commercial importance are window-pane oysters (Plocuna sp.) which are found in creeks and shallow waters along the coast, and the edible oysters, Ostrea gryphoides, O. cuculata and O. discoides, which are common in the creek system of Korangi.

The progress in the fisheries sector has been quite spectacular during the last two decades. The number of mechanized boats in 1955 was 54, whereas their number in 1973 rose to 1,613. Production rose from 45,960 metric tons in 1955 to 196,614 metric tons in 1973, and the foreign exchange earnings through the exports of processed fishery products rose from Rs 686,513 in 1955 to Rs 350,186,246 in 1973.

This rapid progress may be having an impact on the fisheries resources on which it depends. However, none of the stock of fish except the shrimps have shown any sign of depletion. Even in the case of shrimps, the catch is gradually increasing each year, but the catch per unit effort has shown a declining trend for the last few years. Basic biological and other data are being collected to assess the correct position and to adopt suitable conservation measures if necessary.

However, in the case of the green sea turtle, the Government of Sind, on the advice of the Zoological Survey Department of Pakistan, has imposed a ban on the killing of, or causing injury to, turtles at Hawkes Bay and sandspit beaches where they come to lay their eggs. The nesting sites stretch for 7 miles from Manora to the Hotel Splendid on Hawkes Bay. Nests are usually found in the areas where the sand is somewhat fine

and free from pebbles. The nests are located all along the beach, the majority of them at a distance of not more than 15 yards above the high-tide mark. Very few nests have been found below the high-tide mark. Mr. S.H. Zaidi of Zoological Survey Department who worked on the turtles of Pakistan is reported to have counted 2460 nests in the entire area in 1973. He has also observed that the frequency of nesting is highest on a one mile strip of coast adjacent to the village of Sandspit and extending towards Hawkes Bay. Penalties for killing or capturing the green turtle include imprisonment for up to ten years or a fine of up to Rs 1,000 or both.

Country Reports No. 8

S A U D I A R A B I A : REVIEW OF THE WORK OF THE MARINE
RESEARCH CENTRE, JEDDAH

A.R. NAWWAB

Marine Research Centre, Jeddah, Saudi Arabia

INTRODUCTION

In 1970, the Ministry of Agriculture and Water Resources entered into a five year agreement of co-operation with the University College of North Wales as part of a plan to increase Fisheries research and development in the Kingdom. Under this agreement a Marine Research Centre was to be established in Jeddah, consisting of a large laboratory in the Port and U.C.N.W. were to procure, on behalf of the Ministry, a research vessel. In addition, U.C.N.W. were to provide a team of three experts to be based in Jeddah and to provide opportunities for the training of Saudi graduates in the U.K.

Planning and construction of the Port Laboratory were delayed partly because of the difficulties of establishing a laboratory in Jeddah Port, which itself was rapidly expanding. However, the Ministry has continued with this project and the Port Laboratory is expected to come into operation during 1975.

It was recognised that while the Port Laboratory would provide an ideal base for the research vessel it would lack a supply of clean sea water. Consequently, it was decided to establish a small laboratory on the coast about 10 kilometres north of Jeddah. This would provide facilities whilst the Port Laboratory was being built and would also allow certain studies requiring supplies of clean sea water to be carried out. U.C.N.W. prepared plans and supervised the construction of the Coastal Laboratory which was completed in 1971. A permanent supply of electricity was not available and a diesel-powered generator was installed instead.

In 1972, studies aimed at assessing the shrimp stocks in the Saudi waters of the Arabian Gulf were started. As this work developed, it was recognized that a small laboratory should be established on the Arabian Gulf, at Dammam, and this laboratory subsequently came into operation during April, 1974.

STAFF

The number of Saudi Fisheries staff has grown from five in

1970, to a total of 10 at the present time, and consists of the Fisheries Director, 6 graduate officers (one of whom is currently receiving training at U.C.N.W.) and 3 technicians. The U.C.N.W. team which originally consisted of 3 experts was increased to 7 in 1972. In 1973, the Ministry of Agriculture and Water Resources engaged the services of 4 Egyptian experts on short-term contracts. In addition, since 1972, the Marine Research Centre has had the benefit of the advice and experience of the Fishery Advisor to the Ministry.

THE RESEARCH VESSEL FRV 1.

The vessel has an overall length of 22 metres and is rigged as a double beam shrimp trawler but is also capable of stern trawling. The vessel is powered by a 400 H.P. Kelvin diesel driving a fixed pitch propellor giving a free-running speed of about 10 knots.

The vessel is equipped with Kelvin Hughes echo sounders, types MS 39 and MS 44, and a Wesmar sonar, in addition to the usual navigation aids such as radar, auto-pilot and compass. New radio equipment is currently being installed and consists of H.F. and V.H.F. sets in addition to a short-range, portable V.H.F. system for use on small boats operating from FRV 1.

The vessel contains two small laboratories and a cold room which can be maintained at -10°C . Accommodation consists of a single 6-berth cabin for the captain, engineer and scientists and a 4-berth cabin for the crew.

The research vessel FRV 1 was built in Mauritius and arrived in Jeddah in October, 1972. It became fully operational in May, 1973. In the meantime, a training programme was carried out to familiarize the scientists and crew with the gear working systems.

Between May, 1973 and August, 1974, the vessel completed 11 cruises, 9 to the south and 2 to the northern part of the Red Sea. The southern cruises were mainly to the area between Al Lith and Gizan, the Farasan Islands and the Farasan Bank, while the northern cruises were to Yunbo and to the entrance of the Gulf of Aqaba.

PROGRAMME

The programme of the Marine Research Centre can be divided into shore-based and sea-borne activities, the latter being carried out aboard the research vessel FRV 1.

(a) Sea-borne activities

(1) Navigation

Passage from Jeddah to Gizan can be made either by the traditional deep-sea ship route down the middle of the Red Sea or via the inner passage which runs close to the coast from Al Lith southwards. These two passages are separated by the Farasan Bank, an area which remains largely uncharted. In the case of the deep water passage it is necessary to pass through the Farasan Islands in order to reach Gizan and this area abounds with features which are either inaccurately charted or not mentioned at all. As a result, it has been necessary to conduct preliminary survey work in order to ensure the safety of FRV 1, when operating in the south.

(2) Hydrography

Hydrographic data has been collected in both the northern and southern parts of the Red Sea. Measurements have been taken of water temperatures, salinity, currents, turbidity and bottom types, generally in areas of less than 200 meters depth.

There is a marked increase in temperature and decrease in salinity of the surface waters of the Red Sea from north to south. Inshore coastal waters protected by coral reefs have often been found to be from 2 - 3°C warmer than deeper areas further offshore, but between latitudes 19° and 21°N, this does not hold good, due it is thought to the absence of any large offshore reef system in this area, thereby permitting the less saline offshore water to mix with the more saline water close in-shore.

The entire coastline of the Red Sea is characterized by the presence of coral reefs, and the bottom topography of the inshore regions consists largely of irregular hard coral interspersed with smaller patches of sand and coral debris. The sea floor is often rugged with sharp coral peaks and pinnacles although, at the mouths of wadi basins, the sea bottom has been found to consist of soft sediments, ranging from fine clay to coarse sandy-mud with coral fragments, presumably deposited as a result of floodwater bringing these materials from the land.

(3) Exploratory fishing operations

The fishery resources of the Red Sea are based mainly on pelagic and demersal stocks of fish. Large shoals of sardines (Sardinella spp.), mackerels (Rastrelliger kanagurta, Scomberomorus sp.) and tunas (Euthynnus affinis) have been recorded by FRV 1 during several cruises, especially in open water areas up to 80 metres depth. The pelagic fish

category also includes barracuda (Sphyraena sp.) and jacks (Caranx spp.), which are generally found in association with coral reefs.

The demersal fish stocks are chiefly composed of reef-inhabiting species such as the snappers (Lutjanus spp.), groupers and rock cod (Epinephelus spp., Cephalopholis spp.) and the Emperor fish (Lethrinus spp.). Coral reefs also support large populations of small colourful fish such as wrasse (Labrus spp.), soldier or squirrel fish (Holocentrus spp.) and many others of too small a size for domestic consumption.

Soft-bottomed areas of sand and mud provide the habitat for a large number of small-sized fish such as grunts (Therapon spp.) mojarras or silversides (Gerres spp., Leiognathus spp.), mullets (Upeneus spp. Mugil spp.) and flatfish (Dasyatis spp.) and runners (Rachycentron canadus) are also caught in these regions.

The shallow coastal waters of up to 5 metres in depth, such as those enclosed by "sharms", support adult populations of some of those fish mentioned above but serve mainly as nursery grounds for the rearing of young fish.

To date, little attention has been paid to species of deep-water fish but large sharks (Carcharhinus spp.) and sea snappers (Pristipomoides spp.) have been caught at depths exceeding 100 metres.

Exploratory fishing has been conducted from FRV 1 in a number of areas of the Red Sea using a variety of fishing gears which are discussed under separate headings.

(4) Prawn trawling

Soft mud, suitable for breeding prawns, occurs near the outlets of wadis. FRV 1 has located a number of such areas along the Red Sea coast from Gizan to Khoreiba. These areas are generally small compared to the prawn grounds in the Arabian Gulf and it is unlikely that they could support a large commercial fishery. Until now, Red Sea prawn stocks have been fished only spasmodically but under an agreement with H.R.H. Prince Muttab, Japanese vessels have been catching prawns in the south.

FRV 1, which uses a 17 m headline length prawn trawl, has caught prawns in the areas of Gizan, Ras Abu Kalb, Long Island and Hali in the south. The best catches have been made during the hours of darkness. The major species of prawns found in the Red Sea are Penaeus semisulcatus, Metapenaeus monoceros, Penaeus japonicus, Trachypenaeus curvirostris and Penaeus indicus, with P. semisulcatus predominant. The spawning season has not been positively identified but is thought to

occur all year round in the Red Sea but with peaks during the period March-May, in contrast with the June-July spawning peaks in the Arabian Gulf.

The average catch in the Ferafer Island region, 16 km NW of Gizan, is about 5 kilogrammes of prawns per net per hour, compared with the average catch rate of from 30-50 kilogrammes of prawns per net per hour in the Arabian Gulf.

The poor catch rates from the Red Sea areas coupled with their small size indicate that these isolated resources could be very badly denuded if they were to be exploited by large vessels. However, they could support a small fishery based on a few modest vessels provided that adequate safeguards were taken to avoid the danger of overfishing.

(5) Demersal trawling

FRV 1 has also fished with a high-lift, 3-wing demersal polythene fish trawl of 23 metres headline length. The areas trawled lie between the Farasan Islands and the coast and in the inner passage at depths varying from 20 to 50 metres. The sea bottom in the regions trawled is mainly sandy but, even so, isolated coral pinnacles can cause extensive damage to fishing gear.

Demersal trawl catches usually consist of small fish rarely exceeding 20 cm in length such as silversides (Gerres spp., Leiognathus spp.), breams (Nemipterus japonicus), grunts (Therapon spp.), mullets (Upeneus spp.) and lizard fish (Saurida spp.). Large rays, such as Dasyatis spp. and Rhynchobatus spp. are occasionally caught and sometimes a few prime fish such as Lethrinus spp., Lutjanus sanguineus, Epinephelus spp., and Spilotichthys pictus are taken in the trawl.

Demersal fish are also taken in the prawn trawl and this trawl has been used for bottom sampling in areas where prawns are not available.

The quantities of small fish obtained have shown a wide variation from under 100 kg per hour to nearly 1000 kg per hour although the proportion considered to be suitable for marketing is usually less than 10%. However, it is possible that the fish could be used for the manufacture of fish meal although no plant currently exists in Saudi Arabia.

(6) Handlining

Handlining is the traditional method of fishing employed along the Red Sea coast of Saudi Arabia. It is practised in coral reef areas generally during the hours of darkness and yields

prime fish such as snappers (Lutjanus spp.), groupers (Epinephelus spp., Cephalopholis spp.), Emperor fish (Lethrinus spp.) and jacks (Caranx spp.), as well as occasional barracuda (Sphyraena spp.) and shark (Carcharhinus spp.).

Too heavy a concentration of fishing on a reef can very rapidly reduce the fish population. This is evident in the area around Jeddah where the combination of large market demand and accessibility of the reefs has caused a marked decline in the local fish populations as compared with those found in regions further afield.

Part of the work of FRV 1 has been to identify and take samples from potential new reef sites suitable for handlining. The Farasan Bank which is not much frequented by fishing vessels, contains many reefs, and a programme of work is in hand to chart these reefs and conduct exploratory handline fishing.

The average catch per hook per hour from a reef at Shib Ghufra, on the eastern side of the Farasan Bank, was 1.17 kilogrammes over a period of 18 hours continuous fishing. Some reefs on the Bank, however, particularly along the western side, have very steep edges descending abruptly to a depth of 400 metres. These are difficult to fish and although there may be many possible new sites on the Farasan Bank, some of them will be relatively unproductive as fishing grounds.

(7) Longlining

Both demersal and pelagic longlining have been carried out from FRV 1 but with very little success to date. In order to catch prime fish the lines must be positioned close to coral reefs and the gear has often been damaged or lost through snagging on the coral. Further trials are being carried out in soft-bottomed areas where large rays (Dasyatis spp.) and runners (Rachycentron canadus) are known to be present.

(8) Trolling

Trolling for pelagic fish such as tuna, barracuda and Spanish mackerel is carried out by towing hooks with natural or artificial baits, generally silver or white spinners, from a moving vessel. This method is employed by FRV 1 which usually trolls two lines. Trolling is not generally very productive and would not support a commercial fishery by itself but it can supplement another form of fishing such as handlining. One of its main advantages is that it is employed during daylight while a vessel is on passage and therefore provides a catch when the time might otherwise be unproductive.

In many parts of the world trolling is used in sport fishing and good catches are often made from fast boats. A small

active sport fishery exists in Ethiopia, but there appears to be little interest in Saudi Arabia.

(9) Attraction of fish by artificial light

The attraction of some species of fish to artificial light during the hours of darkness is well known and some commercial fisheries, such as the Mediterranean sardine fishery, are based upon this method.

Sardines are also found in the Red Sea where the local fishermen catch them in cast nets but utilise them only as hookbait in line fishing. FRV 1 has carried out some experiments using artificial lights and attracted quantities of sardines to the vessel on several occasions. At Safiq Island, Spanish mackerel (Scomberomorus sp.) were also attracted, presumably by the large concentration of feed in the vicinity. A total of 30 Spanish mackerel were subsequently caught using handlines.

The apparatus consisted of an underwater light of 500 watts and surface lights of 500 watts and 60 watts. The procedure was to attract fish initially from a wide area with the two 500 watt lights, switch them off, and hold and concentrate the fish close to the vessel with the 60 watt surface light. A photograph of an echo sounder trace of fish attracted to the lights near Shib Madkran shows that with the main 500 watt lights on, the fish congregated around the vessel but came no closer than about 7 fathoms. When the 500 watt lights were turned off, leaving the 60 watt light alone, the fish moved much closer and probably could have been caught in large quantities with a dip net. Samples taken with a cast net, rigged as a small dip net, indicated that the shoal consisted mainly of Sardinella gibbosa, with an average length of about 8 cm.

(b) Shore-based activities

(1) Survey of fishing centres

Surveys of the fishing centres have been made covering the entire Red Sea coast. These show that the main centres are at Jeddah and Gizan, but there are many small communities of fishermen all along the coast at the small towns and where suitable "sharms" exist. The fishery, as a whole, is based on wooden vessels, some of which are powered whilst others rely on sails or paddles. All fishing is by handline, set nets such as gillnets, trammel nets, cast nets and traps, and no trawling is carried out by local fishermen. However, H.R.H. Prince Muttab, who holds the concession for the exploitation of Saudi Arabian fisheries, has several large foreign fishing vessels operating in the Red Sea which are trawling for shrimp and demersal fish.

The local fishermen catch a large variety of fish as revealed

by a study of fish landed at Jeddah fish market during an eight month period. Much of this is sold in the coastal towns but the larger markets also supply the main inland centres of Mecca, Medina, Taif and Tabuk.

The fishing vessels generally use inadequate quantities of ice and never gut their catch. The fish is usually first sold by auction, based on volume, and then cleaned after sale to customers. Both the method of preservation of fish on vessels and the procedures used in the markets are in need of improvement, particularly with respect to the practice of cleaning fish, the use of correct quantities of ice and the introduction of proper hygiene.

(2) Experiments with set nets

Many fishermen use set nets in shallow water areas and the Centre has conducted experiments into the relevant effectiveness of gill, trammel and tangle nets at two coastal sites. The results are currently being analysed.

(3) Biological Studies

The Centre is carrying out a small programme recording the principal biological features of some of the more important commercial fish landed at Jeddah. This involves measurements of length and weight, determination of age and time of spawning. This work is based mainly on the Scombroid fish and an identification key has been established.

As part of the general work of the Centre a small collection of specimens has been established and some of these have been described. In addition, various studies have been carried out by visiting U.C.N.W. scientists on highly specialised topics associated with the marine animals found along the shores. While those studies are not directly relevant to the commercial fisheries, they do form part of a continuing scientific investigation of the marine life of the Red Sea.

(4) Dangerous Red Sea fish

The Red Sea contains numerous dangerous fish some of which can give fatal bites or stings. The Centre has listed the most common of these species and the Ministry proposes to issue this report in Arabic, giving details of the fish most commonly encountered.

(5) Jeddah desalination project

With the construction of new desalination plants in the Kingdom, the Centre has provided information on reef and water characteristics for use in design assessments.

These plants are often associated with the generation of electricity and one of the prime considerations is to provide cooling water having a fairly stable temperature. The studies have shown that this demands the siting of the inlet pipe with its terminal at a depth of at least five metres.

(6) Wadi Gizan fresh water fishery

The Government have constructed a large dam at Wadi Gizan to trap rain water for use in irrigation. Already fresh water fish (Dixognathus sp.) have begun to appear naturally in the lake and there is a possibility of establishing a fresh water fishery, particularly if a more suitable fish such as Tilapia spp. could be introduced. A preliminary study has been made to determine the physical features of the lake and to assess the prospects; more detailed studies are planned.

(7) Fish quality assessment

Fish sold on Jeddah fish market is either landed from vessels at Jeddah or brought by truck from other fishing centres. Studies are currently in hand to assess the quality of this fish and comparisons will be made between different methods of preservation employed before retail sale and also by the purchasers. A similar project involves monitoring the quality of frozen fish which is produced from locally landed fish by a small fish processing company in Jeddah.

These assessments will employ the traditional method of using "taste panels" but a direct measure of quality will also be made using a chemical method involving the determination of the quantity of ammonia released by the fish.

(8) Training of the Saudi Staff

A training programme has been organised for Saudi graduates and technicians working at the Marine Research Centre. Running for 8 months, under the direction of Dr. Bayaumi, this has consisted of a series of lectures, practical work, and demonstrations of the research methods employed by the research vessel FRV 1.

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Country Reports No. 9

S O M A L I A D E M O C R A T I C R E P U B L I C

MURIDI ALI SALAH

Director, Technical Department, Ministry of Fisheries and
Marine Transport, Mogadiscio

Somalia, which is situated in North East Africa, has the longest coast of Africa, totalling about 3000 km. Out of this total, some 1200 km in the north border the Gulf of Aden, and the other 1800 km in the east border the Indian Ocean. Unfortunately, fisheries and marine resources as a whole have been neglected, although they constitute the third main resource of the country after agriculture and livestock.

Until 1 April 1972, fisheries were dealt with by a small unit in the Ministry of Industry and Commerce, headed by one man and assisted by a U.N. Expert. Since that date, a Ministry of Fisheries and Marine Transport has been established and remarkable developments have been made. A joint enterprise was created on 1 January 1973 and after 21 months of operation, the enterprise has led to the establishment of a Company named SOMALFISH Co. About 20 Fishery Cooperatives have now been organized and set up along the coast. It is also planned to establish a repair base for ships, three cold storage plants, well-spaced along the coast, and a Fisheries Institute.

As you see good progress has been made and it is hoped that in the next few years Somalia will be able to implement the recommendations of the Stockholm Conference and the First and Second World Conference on National Parks in relation to Marine Conservation. In the meantime, F.A.O. is assisting in the overall development of Fisheries in Somalia by sending Experts and Consultants. A Regional Laboratory for pollution, in which Somalia is participating, will be established in East Africa, and will involve six countries. The site has already been selected at Mombasa, Kenya. Hopefully, operations will start at the end of this year.

Country Reports No. 10

S U D A N

A.M. SALIH

Assistant Director, Fisheries Administration, P.O. Box 336,
Khartoum

The Sudan coastline on the Red Sea is about 700 kilometres long, and lies roughly between latitudes 18° and 22° north. Two lines of reefs (inshore and offshore) run parallel to the coastline. These reefs are known to be among the finest in the world. They are rich in beautifully-shaped corals, fancy coloured fishes and rare shells. Such reefs, if well conserved, can be of great educational value and can also be the basis for a successful tourism industry.

At present there are no marine parks or reserves in the country, but steps are being taken to establish such parks and reserves in the near future.

Attracted by the beauty of the reefs, tourists from Western Europe and other countries have visited the Sudan Red Sea coast in increasing numbers during the last few years. Some of them unfortunately have caused great damage to marine life by using indiscriminate methods of fishing and also throwing into the sea all their rubbish and food wastes, thus causing pollution within the enclosed bodies of water inside the reefs. Experience in many countries has in fact shown that the uncontrolled activities of tourists may completely destroy marine life, and hence, a once-booming tourist industry.

In Sudan, endeavours are being made to reorganize the tourist industry on a sound basis which respects the environment, avoiding as far as possible the mistakes made by other countries. The Department of Tourism has already established centres along the Red Sea Coast where proper facilities are provided. Plans are being made for the establishment of more centres and provision of even better facilities. It is expected that the number of tourists coming to Sudan will increase every year. However, in order to protect marine life from the destruction which might be caused by the as yet uncontrolled and increasing activities of tourists, and in order to ensure the regular growth and continuity of this new industry, it has been felt that certain protection measures are essential. They have been achieved by making regulations prohibiting:

- 1) the use of spear-guns for fishing;
- 2) the collection of corals and shells;
- 3) the capture of aquaria fishes; and
- 4) dropping into the sea any litter or pollutant that might endanger marine life.

In addition, certain areas which are rich in corals and other marine life, have been declared as closed areas, i.e. in effect made into Marine Parks. In these parks fishing is prohibited and good facilities are provided for research workers, students and other visitors interested in skin-diving, underwater photography and observation of marine life.

Country Reports No. 11

Y E M E N A R A B R E P U B L I C

HUSSEIN LOULOU

Under Secretary, Ministry of Agriculture, Sana'a

The government has established a Department of Fisheries only recently; the establishment of marine parks, etc., is only in the planning stage. This should not mean that we are not interested in falling in line with your programme as early as possible. The seriousness with which the government is trying to tackle the problem of marine conservation in the Yemen Arab Republic, should lead to substantial progress in due time.

As a first step we have undertaken marine biological and oceanographic investigations in the Red Sea in collaboration with the FAO of United Nations alongside fisheries investigations. A research and survey vessel with a qualified skipper and marine biologist is now regularly carrying out surveys in the Red Sea and the results are published from time to time as FAO reports. A small, but well equipped marine biological laboratory and a museum has been established at Hodeidah.

The Yemen Arab Republic sector of the Arabian coast of the Red Sea extends from latitude 16°20'N to 12°45'N. The coast of the Red Sea to the south and north of Hodeidah is low, slightly undulating with accumulative formations in the form of sand banks, wide beaches and spits of land projecting into the sea. There is practically no run-off from the land, no permanent rivers or springs, merely occasional short and shallow wadis filled only during storms and after heavy rain in the mountains.

The southern end of the 2000 km long Red Sea is only 26 km wide at the entrance at Bab al Mandab, increasing northward to about 350 km at the latitude of Al Luheia. The total coastline is about 450 km and the area of the continental shelf is estimated as 17,700 square km. This shelf is known to contain rich resources of edible fish.

Over 32 species of fish and shell fish are known to inhabit the Red Sea. The coastal reefs shelter some of the best known varieties of fish and Crustacea of commercial importance, for example the lobster Palinurus and the swimming crab Portunus pelagicus.

To the north of Bab-Al-Mandab, the Red Sea basin is separated from the Gulf of Aden by a sill about 100 m deep. The greatest depths are nearly 2000 m in narrow elongated trenches with steep and irregular sides parallel to the axis of the Red Sea. These depths are reached by a series of steps of about 400 m each. But even on the shelf at 20 to 50 m the bottom descends by steps, though only of about 4 to 8 m each. Off Hodeidah reefs rising to about 2 m above the bottom have been frequently observed to occur on the edge of these steps. The shores are fringed by shallow reefs and corals (especially north of Kamaran). These and the steep slopes referred to make trawling impossible in the Red Sea. The two main groups of islands, SW and NW of Hodeidah, namely the Hanish (from 13°30' to 14°N) and the Zubair group (at 15°N), are 20 to 30 miles from the mainland respectively; there are also a multitude of small coral islands off the northern end of the coast.

The climate prevailing in the south-east coastal area of the Red Sea is rather similar to the climate of tropical deserts, with small amounts of precipitation and oppressive heat but the important difference that for the Red Sea humidity and monsoon winds are typical. Usually the summer monsoon gives way to winter in October (calm periods up to 28 percent). Precipitation on the coastal area is very low, rain falling on about 11 days a year in Hodeidah and amounting to a total of 84.7 mm.

The reefs and coral islands are a paradise for divers and the government is studying the possibility of conserving these areas as marine parks.

The fisheries of the Red Sea are an important natural resource. Plans for their development are being prepared, the YAR government having recently established a Department of Fisheries under the Ministry of Agriculture for planning, developing and monitoring this resource. The first and foremost task of this new department is to take steps to declare the territorial water limits (tentatively 12 miles) and to frame legislation for administering the fisheries. This will also facilitate the establishment of marine parks and reserves. Further plans will be formulated in due time to overcome the menace of coastal and other pollution.

Consultants' Regional Reports

M E D I T E R R A N E A N A R E A : P R E L I M I N A R Y R E P O R T O F A
S U R V E Y O F E X I S T I N G A N D P O T E N T I A L M A R I N E P A R K S

HEDIA BACCAR

IUCN Consultant, 52 bis Avenue Jean Jaures, Tunis

In January 1975 a project was initiated by the IUCN for a preliminary survey of existing and proposed marine parks in the Mediterranean with a view to suggesting sites for the protection of critical marine habitats. So far, the Spanish and southern sections of the Mediterranean coast, only, have been covered.

ALGERIA

A proposal for a marine park is now under consideration by the National Committee for the Environment. It concerns the Bay of Tipasa, 20 km west of Algiers and it would be combined with a terrestrial reserve of the Chenoua. The area has various interesting habitats and a great diversity of biomes, including especially several areas where the ocean floor is at a considerable depth. Tipasa was an ancient Roman port part of the remains of which are submerged by the sea.

MOROCCO

There are neither existing nor proposed marine parks or reserves along the Moroccan Mediterranean coastline, even though this sector of the sea ought to enjoy better protection, since it is one that has so far not been much affected by human activities. Several unique habitats fully deserve to be set aside as marine reserves.

A number of sites have now been listed and will be recommended for conservation in their natural state.

SPAIN

No marine parks exist so far but there is a proposal for the establishment of protected areas, which would include:

Medas island (just off the coast near Gerona, Cataluna);
Cabrera archipelago (off the southernmost cape of
Mallorca)

Alborán island (midway across the western end of the
Mediterranean between Almeria and Melilla).

(1) Isla Medas

Objective: to preserve and possibly reintroduce red corals and other species such as gorgonia, as well as molluscs, crustaceans and bottom fishes. It should serve also as a breeding ground to maintain the natural biological equilibrium and has a great potential for scientific study. The presence of submarine grottoes would be an attraction for tourists.

(2) Cabrera archipelago

The islands are situated about 8 to 21 km south of the southern tip of Mallorca in the Balearics and at present constitute a military area. Fishing and cattle raising are the two principal activities of the inhabitants. The Monk Seal (Monachus monachus) was exterminated by hunters by about the middle of the century but may be recolonizing the area since two specimens were reported in January 1975. Another very rare species is Audouin's Gull (Larus audouinii), of which a few pairs nest.

The creation of this reserve would certainly protect interesting and unique species of fauna and flora and could even lead to the recovery of the former Monk Seal population.

(3) Isla de Alborán

This is a military area on which at present no information is available.

EGYPT

No marine park or reserve exists at present along the Mediterranean shore. The coastline nevertheless offers unique ecosystems, including habitats affected by run-off water from the land and estuaries, as well as lagoons and coastal wetlands, rocky shores and sandy beaches. This variety in the physical features of the area results in an equal variety of marine animals. Changes in the environmental conditions due to the construction of the Aswan High Dam have, however, undoubtedly affected the physical, chemical and biological features of the area under direct effect of the Nile River.

A number of marine parks and reserves have been provisionally selected which would cover the various unique ecosystems.

LIBYA

The Libyan coastline offers great possibilities but at present there are no existing or proposed marine parks or reserves. An extensive survey of the biological as well as the environmental resources ought to be undertaken and the need for this has been duly emphasized to the authorities.

TUNISIA

Zembra, the group consisting of one large and three small islands NW of Cap Bon, has been selected as a suitable area for a marine park. The islands of Zembra and Zembretta are already natural reserves, following a proposal made to the Tunisian Government in 1973. The area offers an important feeding ground to a great variety of species. The principal habitat of the Monk Seal is Zembra, the largest of the islands.

A few notes are appended on countries bordering the Mediterranean which have not yet been surveyed.

LEBANON

The "Ile du Palmier" has been proposed as a potential site for a marine park combined with a terrestrial reserve.

GREECE

It has been proposed to establish a marine park off the coast of Rhodos (Rhodes) near Lindos in the south-east of the island.

YUGOSLAVIA

Two marine and island National Parks are in the process of being created: the Komati archipelago near Slbenik and the islands south-west of Senj in the Kvarner Gulf. Both areas have a high ecological diversity.

ITALY

A marine park was formally established off Castellabate (at the southern end of the Gulf of Salerno) in 1972. The Miramare Marine Park (near Trieste) followed in 1973, being established not only to safeguard marine life but also for scientific and monitoring purposes.

Further areas suggested as having a good potential for the establishment of marine parks include the sea round the Portofino peninsula south of Genova and Ustica Island 53 km off the Sicilian coast north of Palermo.

FRANCE

A natural marine reserve has been formally established off the coast between Banyuls and Cerbère (Pyrénées Orientales) at the western end of the Golfe du Lion.

The National Park of Port Cros, south-east of Hyère, has been extended off-shore in 1963 to cover a marine area surrounding the island.

Also worth a brief mention is the "zone de repeuplement" for sea-grass (Zostera) established off the coast near Beaulieu between Nice and Monte Carlo.

Consultants' Regional Reports

UNITED ARAB EMIRATES : REPORT OF A SURVEY OF
MARINE HABITATS CARRIED OUT DURING 3-15 FEBRUARY 1975

E. CARP

IUCN Consultant, c/o Station biologique de la Tour du Valat,
le Sambuc, 13200 Aries

The terms of reference of the survey were to -

1. establish contacts for the International Union for the Conservation of Nature and Natural Resources (IUCN) and the International Waterfowl Research Bureau (IWRB) with the authorities of the UAE for future cooperation in the field of conservation and of environmental problems;
2. carry out a survey of marine habitat and collect data on wetlands of international importance for the IUCN Directory of Wetlands of International Importance; and
3. collect data on wintering waterfowl in the scope of the programme of the IWRB Population and Distribution Division.

The present report deals only with the survey of marine habitat under item (2) above.

GEOGRAPHICAL FEATURES OF THE COAST

The coast from the border of Qatar with Abu Dhabi is almost entirely flat desert or semi-desert. Saltflats occur in several places. There are a few hills and rocky promontories reaching out into the sea.

Most of the coastal waters are shallow or very shallow. There are many areas with sea-grass beds, clearly visible from the air. East of the island Abu Al-Abyadh, towards Abu Dhabi, the sea is extremely shallow in places and mudflats are uncovered at low tide.

Abu Dhabi is a fast growing town built on a flat island now connected by a bridge with the mainland. Some of the shallow waters and saltmarshes around the island have been reclaimed in order to provide more space for building, port installations, industry, etc.

East of Abu Dhabi towards the border with the northern part

of the Sultanate of Oman the coast is characterized by several big complexes of islands, lagoons and creeks. Mangrove vegetation, which is found only in a few places west of Abu Dhabi (e.g. the island of Abu Al-Abyadh), becomes more common. East of Ras Ghanahah the desert reaches the sea in an unbroken line up to Dubai.

At Dubai and up to the border with the Sultanate of Oman the coastline is interrupted by several creeks and complexes of lagoons. This is the case near Sharjah, Ajman, Umm Al-Qaiwain, Al Jazirah Al Hamra, Ras Al Khaimah, Rams and the Khor Al-Khawir. The steep and rough mountain chain stretching along the Gulf of Oman reaches here the Gulf and Strait of Hormuz. The highest summit in this part of the relief is in Oman territory (Rus Al-Jibal, 2080 m).

The territory of the UAE along the Gulf of Oman between the two parts of the Sultanate of Oman has a beach of about 65 km in length. Seen from the air this beach looks sandy with stony ledges and shingle in places. There are however also long stretches of white or yellowish sand. Rocky promontories stretch out into the sea at several places, the most important being the one of Khor Fakkan which has a natural sheltered harbour for fishing and trading boats in a small bay. There is a small marshy area south of Fakkan on the eastern side of the mountains. The most important area is still further south, comprising the creeks near Kalba, which have the densest and tallest mangrove vegetation to be found anywhere in the UAE.

There are also some small rocky islands off the coast. Rain-fall along the Gulf of Oman coast is more abundant than on the western coasts and there are many gardens and palmgroves in the plain between the mountains and the shore, especially in the area of Fujairah. The islands of Al Qaffay, Arzanah, Qarnein and Zirkuh in the Persian Gulf were surveyed from the air. The first two are almost flat; Qarnein has three rather steeply sloping hills at the northern end. Zirkuh is mountaineous with a large flat area at the southern end.

SITES VISITED

Sewage Farm near Abu Dhabi

About 80 ha in extent, this is a favourable habitat for wintering flamingos of which 150 were present on 3 and 4 February, almost all of them immature birds. It is also suitable for waders of which a good variety of species was present: Dunlin (600), Little Stint (100), Ruff (15), Ringed Plover, Kentish Plover, Common Sandpiper, Redshank, Curlew, Snipe and Sanderling.

Khawr Ajman

Shallow lagoon (north of Dubai), of about 300 ha, separated from the sea by a barrier of sand-dunes. The lagoon is connected with the sea by several inlets. It is surrounded by semi-desert country. Digging of sand for construction purposes is in progress on the beach of the narrow sandy island forming the barrier. Some 5000 to 6000 waders of various species were observed on 6 and 8 February, feeding on the mudflats of the lagoon at low tide.

Lagoon of Hammanya

Formerly probably connected with the Khawr Ajman. The lagoon of about 200 ha in extent, has an outlet to the sea at Hammanya. Small numbers of Cormorants and Reef Herons, one Osprey and about 300 unidentified waders on 6 and 8 February. A new bungalow type village is being constructed at the entrance of the old village which is partly ruined. Some fishing by locals in the creeks.

Lagoons and creeks near Sharjah Carlton Hotel - Sharjah

Two tidal creeks with mudflats, uncovered at low tide and extending over about 100 ha. Small number of flamingos (50). Several hundred waders on 6 February, including Bar-tailed Godwit, Curlew, Kentish Plover, Ringed Plover, Greater Sand Plover, Mongolian Plover, Terek Sandpiper and Oyster-catcher.

Lagoon-complex of Umm Al-Qaiwain

Vast complex of lagoons extending over 1000 ha and connected with the sea. Several irregularly shaped islands with a bushy type of vegetation, almost certainly mangrove. One narrow sandy island, several kilometres in length, with low vegetation, separates the complex from the sea and is said to have a small population of gazelle. It can only be visited by special permission from the Ruler of Umm Al-Qaiwain. No gazelle could be seen during the survey by helicopter, but herons and groups of flying waders were noted. In general, the islands are probably excellent breeding grounds for herons, gulls and waders.

There is a yacht-club at Umm Al-Qaiwain and waterskiing is taking place on the lagoon. It is said to cause little disturbance.

Lagoon-complex between Al Jazirah Al Hamra and Ras Al Khaimah

A complex of lagoons of about 1000 ha in extent, with sandy islands, pools and a sand barrier separating the lagoons from

the sea. There is a stretch of high, orange-coloured sand-dunes between the coastal road and the sea. There are scattered Acacia or Prosopis trees in the surrounding semi-desert country and in the dunes. Some are very old. This area is one of the most attractive landscapes of the UAE, the high mountains forming a magnificent background. On holidays many people come out from the city to spend the day here. It would seem necessary to designate special picnic areas and parking lots in order to leave the landscape unspoilt. A Landscape Reserve in which building is prohibited or strictly limited, would be highly desirable. The islands are probably an important breeding area for gulls and terns. Several hundreds of waders were feeding along the shores of the lagoons on 7 and 8 February.

Lagoon of Ras Al Khaimah

Large lagoon of about 400 ha connected with the sea by a creek on which the town of Ras Al-Khaimah is situated. There are several islands of which the one near the town has vegetation (probably mangrove) around the high water line although the centre is bare.

About 6000 waders including Bar-tailed Godwit, Curlew, several Charadrius species and flocks of Dunlin were observed along the muddy edge on 7 and 8 February. There is some industry along the north-east side of the lagoon. Gulls and terns might be nesting on the islands but disturbance by the townsfolk is probably great. Many boats are in use to ferry people over the creek to the industrial area along the road to Mi'eiad.

Lagoon of Rams

The north-eastern part of this 1000 ha lagoon, which has two widely separated inlets, has an interesting vegetation, almost certainly mangrove, with fairly large trees standing in the water. It is probably an excellent breeding site for Ardeidae and Laridae. A long and narrow stretch of sand with sparse vegetation separates the lagoon from the sea. A group of ten flamingos was seen flying over the water during the aerial survey. About 500 gulls were roosting on the sandy island along the sea on 8 February.

Coastline of the UAE along the Gulf of Oman

During the survey by helicopter on 8 February, the entire coastline was followed from north to south at an altitude of approx. 300 feet. Few waders were seen along the beach. The most interesting place was undoubtedly the vicinity of the creeks near Kalba, with their dense tall mangrove vegetation. Many herons and some waders were feeding in this area. The site seems an ideal nesting place for Ardeidae.

Turtles are reported along this coast and might well breed on some of the sandy beaches. The small rocky islands off the shore offer possible nesting places for seabirds such as gulls and cormorants, and perhaps shearwaters. A visit to the area on the ground was planned for the day after the aerial survey but bad weather conditions made the crossing of the mountains impossible.

Islands of the Persian Gulf

The large island of Abu Al-Abyadh west of Abu Dhabi was seen from the air on 11 February. It is privately owned and there is a large house near the creek on the north side of the island. There is a bushy mangrove belt along this creek. Gazelle and ostrich have been introduced by the owner but additional food apparently has to be supplied, since the island is too small to support the animals naturally.

Al Qaffay is a fairly big island. From the air it looks sandy with a base of rock or coral. There are some lagoons and a patch of green vegetation.

Arzanah had about 500 Socotra Cormorants nesting in the south-west corner. A number of birds flew out to sea when disturbed but most stayed ashore, standing tightly packed. About 100 pairs of Red-billed Tropic Birds nest on the island (Stewart-Smith, pers. comm.).

Qarnein contains barracks and oil storage tanks, so human activities may well be a source of disturbance to the 100 or so pairs of Red-billed Tropic Birds which are said to nest and some of which were seen from the air in the north-east of the island. During the survey about 10,000 Socotra Cormorants were noticed tightly packed at the south-west corner of the island. Most of these stayed ashore when the aircraft flew over at low altitude.

The mountainous island of Zirkuh has very important colonies of Socotra Cormorants which were estimated at 20,000 to 30,000 birds during the survey. The biggest colony seemed to be situated in the east of the island but smaller colonies exist also in the west. The slopes of the mountain rise gradually and there seemed to be several concentrations of young birds which had moved uphill. A great number of silvery white juveniles were observed. It looked as if the breeding season was nearly finished but many young birds were still incapable of flight. It may be that there are also many moulting adults at this time of year.

At the northern tip of the island many Red-billed Tropic Birds were noticed diving away from the low flying aircraft. Other species observed included Grey Heron, Reef Heron, two Ospreys and Terns.

There is a radio communication station on the top of the mountain but the island is not inhabited.

The island of Dalma was not visited. Some 2500 Cormorants are said to nest on it but there is a small fishermen's village on the island which probably causes disturbance (Stewart-Smith, pers. comm.).

OTHER ANIMALS SIGHTED

Large areas of the sea are shallow and sea-grass beds occur in many places near the shore but also in other places far out into the Gulf. Many silver-grey coloured rays were seen near the shore, also several manta rays. Dolphins were seen at various points but especially between Abu Dhabi and Dubai. A small whale or big dolphin was seen near the mainland shore west of Abu Al-Abyadh. Sharks were seen on several occasions near the coast. Shoals of fish of about 1.5 m in length were seen near the mainland but also in deeper water. Flocks of gulls were hovering about shoals of smaller fish in deep water near Zirkuh.

Dugongs are said to have occurred in the past near Ras Al-Khaimah. According to local fishermen they have become rare. The meat is said to be tender and of excellent quality (Stewart-Smith, pers. comm.). A sighting of Dugongs was reported by Capt. Mark Legge of the Abu Dhabi Defence Force - 16 individuals including some young at the southern tip of Al-Ghubbah north of the island of Abu-Al-Abyadh in March or April 1974. The day following this observation a Dugong was found tied to the jetty on this privately owned island; it was alive and in good condition and set free later in the day.

Turtles were seen near the shore in several places all along the coastline of the Gulf. Breeding occurs on the sandy beaches between Abu Dhabi and Dubai but probably also in several other places west of Abu Dhabi. Egg collecting by local people was reported by Dr. O. Bulart, Director of the Zoo of Al Ain. There was no information available on the species occurring in the UAE waters.

A whale was found or captured by fishermen of Ras Al Khaimah on about 10 February, according to the newspaper of Abu Dhabi. From photographs provided by the Ministry of Information it has been tentatively identified as a Blue Whale.

OIL POLLUTION

Very little oil pollution was observed from the plane, with

the exception of small areas near the port of Abu Dhabi and the oil terminal between Abu Dhabi and the border of Qatar.

FISHING

Methods are mainly traditional (wiretraps). Shrimp and sardine fishing has some importance. Little fishing activity was noted during the survey. There were plans for cooperative fishing with other Gulf States including Iran under consideration at one stage but they never materialized. There are now plans to establish a fish meal industry.

RESEARCH

The fishery section of the UAE Department of Agriculture has recently acquired a research vessel which is to be fitted out in the coming months. A checklist of some fishes of the Gulf and the Gulf of Oman has been prepared by Dr. Rifat Ali of the Ministry of Agriculture's Fishery Department in Dubai.

CONSERVATION

The Ministry of Agriculture has recently been authorized to deal with matters concerning the conservation of nature and the environment. During discussions with H.E. Mr. Said Abdullah Salman, Minister of Agriculture, H.E. Mr. Hammad Abdullah Salman, Deputy Minister of Agriculture and Dr. Ezzedin Ibrahim, Cultural Advisor to the Ruler of Abu Dhabi, President of the United Arab Emirates, it was suggested that proposals concerning conservation should be included in this report.

The areas which seem to merit consideration for protection are as follows:

- 1) The Lagoon complex between Al Jazirah Al Hamra and Ras Al Khaimah.

This area should be a landscape reserve in order to safeguard a unique landscape of great scenic beauty. The area should include the entire lagoon with islands and sandbanks and the high orange-coloured dunes between the highway and the sea, as well as parts of the semi-desert area to the east of the highway with stands of *Acacia* and *Prosopis*. Boundaries of the reserve should be fixed by a park planner. People visiting the area should keep to roads and trails in order to save the vegetation. Picnic places should be in keeping with the

landscape, parking areas kept well out of sight and both be designed by a park planner.

2) The Lagoon complex of Umm Al-Qaiwain

This area seems a good sample of the lagoon complexes along the coast of the Gulf and is of importance to wintering waterfowl. Investigation of the islands and their vegetation would be necessary in order to determine their importance for breeding Ardeidae and Laridae.

3) The north-eastern section of the lagoon of Rams

Protection of the mangrove vegetation in this part of the lagoon, which seems a suitable breeding habitat for herons, can be strongly recommended but investigations on the ground will be necessary to fix the boundaries of the protected area.

4) The creeks near Kalba on the Gulf of Oman

Total protection of the dense and tall mangrove vegetation, constituting like (1) above one of the unique sites in the UAE, would be highly recommendable. Further investigation of its importance to breeding waterfowl still needs to be undertaken.

Island sites and biota calling for special protective measures are -

5) The island of Zirkuh, which may well be the most important breeding place of the Socotra Cormorant in the Persian Gulf, perhaps even in the world.

6) The breeding colonies of Cormorants, Red-billed Tropic Birds and other sea-birds, and the nest-sites of Ospreys on the islands of Arzanah and Qarnein, and perhaps other islands in the Persian Gulf still to be identified.

7) Protection of Dugongs and nesting beaches of marine turtles

The Fishery Section of the Ministry of Agriculture in Dubai will have a research vessel at its disposal in the near future, and it is recommended that one urgent task for which it could well be used would be to investigate the occurrence of Dugongs and Turtles in the waters of the UAE. Meanwhile, the hunting of the dugong should be strictly forbidden, and the areas where they are already known to occur should be declared protected areas. Similarly, it is recommended that beaches which are traditional breeding areas for turtles should be protected and the collecting and sale of eggs forbidden.

Consultants' Regional Reports

T H E R E D S E A

R.F.G. ORMOND

Department of Biology, University of York, York YO1 5DD

Attention should first be drawn to the reports of the meeting of Red Sea countries to consider a regional programme for environmental studies, held under the auspices of ALECSO in Jeddah, November 1974; and also to the report of the preceding meeting of European scientists at Bremerhaven arranged by UNESCO.

The physico-chemical oceanography of the Red Sea has several features which affect its fauna.

- i) The comparatively great depth tends to prevent the sedimentation and turbidity which restrict faunal development in the Persian Gulf and also the Gulf of Suez.
- ii) The high salinities and temperature reduce the numbers of Indo-West Pacific species groups represented in the Red Sea (for example, there are only 750 spp. of fish as compared with 2000 in the Indian Ocean).
- iii) The semi-enclosed position is partially responsible for the high salinity and water temperatures. It also promotes a high degree of endemism. 10-30% or more of the species in most families or phyla are endemic, an added reason for conservation of representative ecosystems. The semi-enclosed position also increases susceptibility to internally generated pollution.
- iv) The very low rainfall restricts the effects of inland terrestrial pollution and mismanagement on the sea. The very small freshwater input from rivers etc. allows well developed fringing reefs, corals especially. The latter are very sensitive to coastal dilution in other parts of the world. Rainfall does however increase in the southern portion of the Red Sea.
- v) The comparative calmness and lack of severe storms mean that coral growth is less restricted by exposure to wave action, and some features of oceanic reefs, such as algal ridges, spur and groove systems, are greatly reduced.

- vi) The small tide has an important shaping effect on the sublittoral communities.

The types of reef are as follows:

- i) Well developed fringing reefs: semi-continuously along both coasts; only in part of the southern portion; not in Gulf of Suez.
- ii) Incomplete fringing reefs: in inlets (called mersa and sharm) and partly enclosed bays.
- iii) Complex, fringing reefs: where the sea bed in some places slopes more slowly from the shore.
- iv) Especially in the central sections are reef complexes in a semi-continuous series along the coast and at around 3-10 km offshore; they have developed on a series of narrow underwater banks of tectonic origin. Along the outer edge of the banks are semi-continuous barrier reefs while behind them are often many islets.
- v) Smaller patch reefs, many of which show the richest coral communities.
- vi) In the southern third of the Red Sea, these tectonic banks are much wider giving rise to the Suakin and Dahlak archipelagos (west side) and Farasan bank and archipelago (east side). These contain many reefs and some islands. The islands have on some sides island fringing reefs, often partly affected by sedimentation or exposure.
- vii) The inner reefs are also partly restricted by sedimentation as well as stagnation. In shallow areas some of them form more or less circular pseudo-atolls.
- viii) Beyond the banks the sea bed drops rapidly to a stage at 500 to 1000 or more metres. From this arise occasional very steep sided, atoll like pillar reefs. These often have impressive coral formations.

To assess the distribution of fauna through the Red Sea, literature and data on occurrence of fish and corals have been examined. The results are partially affected by the uneven extent to which the Red Sea has been worked, but the following should be noted.

- i) Each section of the Red Sea has sets of fish species not found in other sections.
- ii) The Gulf of Suez has a third of its species of Mediterranean origin, coming through the canal. Only 7 of these occur south of the Gulf.

- iii) About 15% of fish species are probably endemic.
- iv) The coral fauna of the northern quarter of the Red Sea is reduced by cold winter temperatures and, in addition, in the Gulf of Suez by the effects of shallow water.

The regional development of rich coral reefs has been approximately assessed from the literature, available data and the reports of scientific colleagues. The impressions gained may be summarized as follows:

- i) Gulf of Suez: northern half, little or no coral; southern half, increasing, but only moderate development of not very rich reefs.
- ii) Gulf of Aqaba: some quite rich reefs but reduced fauna and simplified structure.
- iii) Regions immediately around and south of the Suez and Aqaba Gulfs: some really quite rich reefs, fauna still slightly reduced.
- iv) Southern Egyptian and adjacent Sudanese coast: many very rich reefs with a diverse fauna.
- v) Central Sudanese and central Saudi coasts: probably the highest proportion of richest reefs.
- vi) Southern section, inner reefs: increasingly reduced in richness by effects of more extensive shallow water and increased coastal drainage.
- vii) Southern section, outer reefs: less well known, certainly some rich and spectacular reefs; many may compare to more northern reefs, with fauna as diverse. Less upwelling may reduce richness slightly.
- viii) Northern Saudi coast: little information, probably not unlike southern Egyptian coast, but eastern sides of seas tend to have slightly less rich reefs than western sides and there is some indication of a slight effect of this type.

In summary, then, the Red Sea contains many rich reefs presently in good condition and unaffected by man's activity. The physical conditions of the area result in a somewhat lower diversity than, for example, in some West Pacific areas, but this is more than compensated for by the extreme diversity of reef life which the conditions also permit. This density of the best areas is equalled in only one or two other places in the world. In addition there is a comparatively high degree of endemism within the Red Sea part of the Indo-West

Pacific province. Both are important reasons why areas of these reefs should be protected from environmental disturbances which may develop in the near or distant future.

Turning to non-coral-reef biotopes of importance, there are comparatively few of these but the following points should be mentioned:

- 1) Turtles are not uncommon, including the hawksbill and green species. They nest on some of the remote islands where to date they have received comparatively little interference. Some of these islands should be included within the biosphere reserves proposed below.
- 2) Some of the islands are breeding sites for sea birds, including boobies and terns, and should where possible be included in reserve areas.
- 3) Manta rays and some whale-sharks occur in the Red Sea and have important breeding areas in some of the large bays. There is no indication that the population of mantas is declining, but whale-sharks are possibly less common, and cases are known of their death due to collision with shipping or to sport shooting. It is suggested that both species should be protected by national legislation and international convention throughout the Red Sea, and that some of the breeding areas be included if possible in the reserve areas.
- 4) Dugongs although their population has declined, still occur in the Red Sea in small numbers. They are mostly caught and drowned accidentally during gill-netting for shark. Only a few are reported taken each year. Attention should it is suggested be directed to assisting a possible larger dugong population in Somalia.
- 5) The Red Sea is outside the main mangrove area but occasional fairly well developed pieces of mangrove exist, which are among other things important for nesting of cormorants and herons. It is suggested that where convenient some mangroves should be included within the biosphere reserves and where necessary the best mangroves should be separately conserved as park areas.
- 6) The Red Sea is an important migration route between Europe and south and east Africa for many birds. Some sites, such as islands and mangroves, constitute important stopping off and rest points for these birds. The most important sites should be identified, where possible included in biosphere reserves, or alternatively be specially protected.

Regarding threats to elements of the fauna of the Red Sea the following may be mentioned. Most important are -

- i) The possibility of pollution from oil tankers and shipping following the reopening of the Suez canal. Every effort should be made by IUCN, UNEP and UNESCO to assist, advise etc. with the ratification of the convention proposed by the Jeddah meeting. A simple pollution monitoring programme should be initiated, as envisaged at Jeddah, as soon as possible. This could be done with comparatively little expense if planned in the right manner. At present and since the closure of the canal in 1967, such pollution has been minimal.
- ii) Depletion of areas close to centres of population by spearfishing, coral and shell collecting by tourists. Certain areas close to population centres are valuable to the economy for tourist development even though better areas exist further afield. The reefs in the region of Eilat have for example been much affected by tourists; close to Port Sudan this effect has been small to date but would very rapidly increase without control. As an example it might be mentioned that in one week after the opening of the first tourist village at Mersa Arus, north of Port Sudan, over a ton of fish was brought by tourist spear-fishermen to sell in the Port Sudan market. This amount was equivalent to that obtained by the local fishermen. Quite clearly the livelihood of local fishermen is threatened unless spear-fishing by tourists is controlled. Similarly collection of corals and shells should be under strict control, form a means of livelihood for local people and not be allowed free to wealthy tourists.

Longer-term threats, the development of which should be carefully managed are:-

- i) Collection of fish for Aquaria. Quite small-scale operations have begun in Port Sudan and Jeddah, though the former has currently been curtailed. The high mortality, over 90%, in the first year of operation from Port Sudan, and the enormous number of fish estimated at 200,000 per year required for profitable business, should be mentioned.
- ii) Pollution from new industry such as fertiliser plants, including ports and installations for Phosphate mining. Such effects are rapidly increasing in the Gulf of Aqaba, where they might well be studied as a model of what might happen in the whole Red Sea at a much later date.

- iii) Spread of beach houses. Strip development of houses and huts along the shore is occurring near Port Sudan and specially Jeddah. Domestic and boat waste in enclosed lagoons could deplete the attraction of such homes unless controlled, and further siting should be managed to give partial development in depth back from the shore, i.e. leaving open stretches near to the towns.
- iv) Fishery Development efforts are underway in Egypt, Saudi Arabia and Sudan. Clearly this is most desirable, but the resource should be managed, and reserve areas planned. The particular possibility of widespread unsightly damage from reef collecting of crayfish should be mentioned.

Little effects are foreseen from -

- i) Land pollution and mismanagement, freshwater run off being minimal, except in the southernmost section.
- ii) Traditional reef-based fishery for Trochus, etc. This is a very old, comparatively low intensity activity and the ecosystem may have adjusted to this level of interference.

I recommend in general terms the following measures:

- A. International agreement in the Red Sea to enforce the control of pollution by shipping. International agreement to protect the whale-shark and manta ray.
- B. Control at a national level by -
 - i) restricting by licensing spear-fishing, souvenir collecting and aquarium fish collecting;
 - ii) continuing to enforce existing bans on fishing with dynamite and poison;
 - iii) developing management of foreseeable effects of waste etc. from new industrial plants and operations, hotels and holiday housing.
- C. Establishment of coastal and marine parks and reserves as follows:
 - 1) To protect comparatively small areas close to centres of population. This is economically desirable in order to preserve touristic resources. It is also needed to permit scientific research reasonably near to scientific institutions. Because of the climatic

conditions and the limited development in the region, these institutions must be close to the centres of population.

- 2) To set aside a series of much larger areas as biosphere reserves, within which development should be minimal and core areas more strictly protected. The delineation of these reserves should be integrated with development plans so as to achieve overall optimum management of marine biological resources. The reserve areas would serve to protect basic populations of species exploited elsewhere and, from these populations, restocking of exploited populations could occur. In the more distant but foreseeable future the biosphere reserve areas would become important recreational amenities.

Measures are already underway to establish such parks in the areas of the Dahlak archipelago, Ghardaqa, and Port Sudan. The need is felt by some scientists in Jeddah for similar protected areas, especially by the coastal laboratory and at Shamm Bihar. Similar measures are certain to be required near Aqaba (Jordan) and Hodeida (Yemen Arab Republic) where laboratories are being established and tourism is likely to continue to develop. I recommend that IUCN and associated organizations make known to the governments concerned that expert advice based on experience in other areas can be made available to advise on drafting of park regulations, or siting of smaller parks where this has not yet been determined.

In respect of the establishment of small fully protected marine parks in Egypt, I would recommend that the following sites be considered: Gubal Island, part or all of the shores and reefs around Shadwan Island and Ras Mohammad, (all in the bay of Suez), and Ras Abu Hagar to the south of Qoseir.

A survey is required to advise on the establishment of the biosphere reserves. I recommend that these should be established one each in less inhabited regions as follows:

- i) Southern Egypt coast extending into Sudan. The region of the Qulan Islands north of Ras Banas looks interesting, and the area from the St. Johns Reef Group, through Siyal Island area, to Ras Abu Fatma extremely promising.
- ii) Northern Sudan coast. I recommend as a possible marine park area Mukawwar, Mesharifa and Maytib Islands, the outer reefs such as Arlington reef and the opposite coastal area around Mersa Inkafail. But fishing should not be restricted in the Mohammed Qol area or

between the coast and Mukawwar Island, and the reserved area would not include Dongonab Bay, or Mohammed Qol itself.

- iii) Southern Sudan coast and Suakin. I recommend that a smaller reserve should be established in a sector of the Suakin archipelago; this might be in the area including two islets and perhaps Eitwid and Green reefs. There is a fair amount of local and scientific knowledge about this area so that more extensive consultation and less new surveying is required.
- iv) Southern Saudi Arabia: two sections of the Farasan Bank, including -
 - a) the outer reefs to the north and west of Sarso Islands; and
 - b) reefs in the area of Dorish Island.

In each case thorough consultation with the Egyptian, Saudi and Sudanese fishery departments is essential since fishery developments are in progress in each of these regions.

With less urgency surveys aimed at recommending biosphere reserves should be carried out in -

- v) The central section of the north coast of Saudi Arabia.
- vi) The outer part of the Dahlak archipelago.
- vii) The coast of the Yemen Arab Republic.
- viii) The coast of Somalia. Information on Somalia was not collected for this report and comparatively little seems known. The survey should probably be extended over the southern coast "in the light of recommendations regarding east Africa", and should pay special attention to the possibility that large dugong herds could and should be rehabilitated and protected in certain areas.

In view of the imminent reopening of the Suez canal and the follow-up "Jeddah II" meeting planned for January 1976, there is a need for some preliminary results to be available by the end of 1975. These should cover the first 4 regions suggested for establishing biosphere reserves.

I would suggest that if possible at least some samples of sea water and specimens of appropriate animal tissue be collected during the preliminary survey from the likely biosphere reserve areas to give baseline values for concentrations of some pollutants.

There is danger that the urgency of the survey gives insufficient time to make the optimum arrangements for launch and other support facilities. Nevertheless a provisional survey should be undertaken to gather as much information as possible. Aerial surveys should be used where possible to supplement ground surveys.

Subsequent to the preliminary survey it might be appropriate for a more detailed survey of all the areas listed in the Red Sea to be undertaken. Plans should be carefully laid and local research facilities fully utilized. This would permit the involvement of scientists from other disciplines. This fuller survey could thus develop outside the scope of this report and involve such agencies as UNESCO, FAO and ALECSO.

Meanwhile however, perhaps in the summer of 1976, a further preliminary survey should be undertaken to assist the delineation of coastal biosphere reserves in the regions indicated in (vi), (vii) and (viii) above.

I also recommend the organization of a "Red Sea Ecosystem Management and Conservation Unit", by IUCN and UNEP in collaboration with UNESCO and ALECSO. This unit linking together scientists in different organizations would serve to collect, collate and disseminate information relevant to environmental management in the Red Sea. Considering the interest and enthusiasm in the area, such a unit could operate with comparatively little expense and good effect. It would serve to partner any similar units which might be set up under UNEP, FAO or ALECSO sponsorship relating to:

- i) physical and chemical oceanography;
- ii) biological resource development.

Consultants' Regional Reports

S R I L A N K A , S O U T H E A S T A N D W E S T E R N
I N D I A , P A K I S T A N

RODNEY SALM

IUCN Consultant, Vista do Mar, Glacis, Mahé, Seychelles

SRI LANKA

Existing marine parks, reserves and sanctuaries

Hikkaduwa sanctuary.

Declared a sanctuary under the Fauna and Flora Protection Ordinance, Gazette No.8675, 1940. The area between the beach and the offshore islets supports a variety of largely intact corals, but there is evidence of some damage to corals resulting through the carelessness of visiting boatmen and schnorkel-users. The Tourist Board has proposed that fishing within the sanctuary be prohibited under Section 33 (1) of the Fisheries Ordinance and that the collection of bêche-de-mer, corals and shells be prohibited under Section 10 of the Chank Fisheries Act.

Mt Lavinia Spiny Lobster Reserve.

This reserve has been established between the Mt Lavinia hotel and the Galle Buck lighthouse, Colombo, under the spiny Lobster and Prawn (shrimp) Regulations of the Fisheries Ordinance, Section 33.

Proposed marine parks, reserves and sanctuaries

Yala National Park.

It has been proposed that this be extended seawards to include the Little and Big Basses Reefs.

Wilpattu National Park.

It is proposed to make the entire area seawards of the Park, including Portugal Bay with its offshore islands, into a sanctuary for dugongs and turtles.

Potential marine parks, reserves and sanctuaries

The following criteria were considered in the selection of

potential sites: important feeding, breeding and nursery grounds of endangered species, unique or threatened habitats, and areas of geological, historical, aesthetic or recreational interest.

Turtles

Five species of turtle nest on the beaches of Sri Lanka. There is evidence that the flatback turtle, Chelonia depressa, may also occasionally stray into coastal waters. All five species and their eggs were protected under the Fauna and Flora Protection Ordinance, Schedule 3, but, as a large turtle fishery exists in the Jaffna area on the north-west coast, prosecution for turtle offences has been suspended. On the Yala coast, where the greatest concentrations of nesting Leathery Turtles are found, the turtles and their eggs are safe from humans, as the beaches are included in the National Park, but wild boar and monitor lizards unearth and eat the eggs.

Dugongs

This species is totally protected under the Amendments Act, 1970, of the Fauna and Flora Protection Ordinance, Schedule 3. Its principal habitats in Sri Lanka are the Gulf of Mannar, Portugal and Dutch Bays and Puttalam lagoon. This is one of the main shark and skate fishery areas and, although not deliberately hunted, dugongs are occasionally caught in the large mesh gill nets set for sharks and big fish.

Fish spawning, nursery and feeding grounds

Practically no information is available for Sri Lanka. Coral reefs, seagrass beds, brackish lagoons and mangrove areas all exist around the island. Trincomalee is reputed to have had some of the finest reefs, but these have been largely destroyed by Acanthaster planci, fishermen with explosives, careless divers and exporters of coral reef fishes. Dynamiting for fish is illegal. Exports of coral reef fish account for 56% of all foreign exchange gained through export of fish products. It is estimated that some coral fish exporters lose 75% of their catch through neglect.

Unique or threatened habitats

Little and Big Basses Reefs have spectacular coral formations. The reefs are accessible for a total of up to 6 weeks a year. Hikkaduwa, as has been mentioned, is a coral sanctuary. The Arippu and Vankaria reefs are constructed of attractive, diverse and mostly intact coral colonies based on sandstone reefs.

Coral is mined for the lime industry, however the new Coastal

Protection Act promulgated to combat coast erosion, will help prevent further depletion.

Practically all mangrove on the south-west coast has been destroyed.

Areas of geological or historical interest

Certain mineral or silica-sand beaches are being mined.

There are several shipwrecks around Sri Lanka some of which are centuries old. These provide important information about the several stages and rate of development of coral reefs, and are important fish nursery areas. They are, unfortunately, a great attraction for divers.

Areas of aesthetic or recreational interest

Trincomalee is to be extensively developed as a tourist resort. It is important that this development is carefully planned so as to have no further deleterious effects on the already decimated reefs.

INDIA

Existing marine parks, reserves and sanctuaries.

None.

Proposed marine parks, reserves and sanctuaries.

Krusadai Island.

The island has been proposed as a park by the Indian Tourism Corporation. It has an immensely rich and varied intertidal fauna and flora. Especially interesting is the occurrence of large numbers of the uncommon enteropneust, Balanoglossus. Collection of specimens is prohibited except in the case of officially authorised scientific studies. There is a marine research station on the island which cannot be used at present because of difficulties with fresh water supply. Turtles nest on Krusadai and the neighbouring islands.

Anjadiv Island.

Sparsely inhabited island and with largely intact vegetation. There are remains of an old Portuguese settlement and several cannons. The Goa Government plans to develop Anjadiv as a tourist resort.

Potential marine parks, reserves and sanctuaries.

The criteria taken into consideration here were the same as for Sri Lanka.

Turtles

Five species occur off the Indian coast and probably all nest on Indian beaches. In the south-east most turtles nest on the islands between Rameswaram and Tuticorin. In the west it seems that turtles nest sporadically along the entire coast. There is no legislation protecting turtles and about 4,000 are caught annually in the Gulf of Mannar alone.

Dugongs

The main grazing areas are over the shallow sea-grass beds in Palk Bay and the Gulf of Mannar. There is no deliberate hunting, but about 30 dugongs are caught each year in large mesh gill nets; their flesh is highly esteemed by villagers of Kilakkarai.

Fish spawning, nursery and feeding grounds

The estuaries of the east and west coasts have a total surface of 1.4 million hectares. The importance of these estuaries with their mangroves to fisheries has been realised and mangrove productivity is being thoroughly studied by several institutions. Estuarine reclamation and pollution is affecting productivity.

Main coral areas

On the east coast narrow fringing reefs are found in Palk Bay at Mandapam and Rameswaram Island, and in the Gulf of Mannar around the 21 islands between Rameswaram and Tuticorin. On the west coast, corals are found in the Gulf of Kutch, but these assemblages are unstudied.

Unique or threatened habitats

In Palk Bay and the Gulf of Mannar corals are removed at the rate of 250 cubic meters every day during calm periods.

Okha, in the Gulf of Kutch, is remarkably rich in intertidal organisms. Corals, estuarine crocodiles, otters, turtles, dugongs, dolphins and flamingos are all found in the Gulf and numerous birds nest in the mangroves, of which this is the best representative sample on the west coast of India. Mangrove trees are being cut for firewood and corals dredged to feed a nearby cement factory.

PAKISTAN

Existing marine parks, reserves and sanctuaries.

None.

Proposed marine parks, reserves and sanctuaries.

None, but see Country Report No. 7.

Potential marine parks, reserves and sanctuaries.

Turtles

Five species are found in the coastal waters of Pakistan, two of which, the Green Turtle and the Olive Ridley, have been definitely identified as nesting on the beaches of Hawkes Bay and Sandspit. Spectacular concentrations of more than 2000 nesting turtles per mile have been observed during the August-October peak. The beaches of Hawkes Bay and Sandspit are steep and composed of coarse brown sand with some submerged rocks offshore. The beaches are backed by a narrow, low primary dune behind which are extensive tidal marshes with stunted mangrove trees. Beach cottages have been built in a continuous string along the crest of the primary dune ridge and encroach the turtle nesting area.

All turtles and their eggs are protected under the Sind Wildlife Protection Ordinance of 1972, and the laws are strictly enforced. Dogs have been responsible for nest destruction, but some 300 stray dogs were shot last year (1974).

Unique or threatened habitats

The removal of mangrove vegetation east of Karachi from an area of 800,000 acres has been prohibited under the Forest Act of 1927. A vast acreage of mangrove habitat in and around Pitti Creek is to be dredged or filled in during the construction of the new commercial port for Karachi. The importance of these mangrove-fringed creeks to the Sind fisheries has yet to be determined.

Consultants' Regional Reports

THE SEYCHELLES AND NEIGHBOURING
ISLANDS : EXISTING AND POTENTIAL MARINE PARK SITES

RODNEY SALM

IUCN Consultant, Vista do Mar, Glacis, Mahe", Seychelles

INTRODUCTION

The islands on the Seychelles Bank are all granitic with the exception of two coral cays. The nearby Amirantes are also administered by the Seychelles and there is a proposal to include the islands of the British Indian Ocean Territories (BIOT) under Seychelles jurisdiction. The Amirantes are all low-lying coral cays. Desroches Atoll, the island closest of the BIOT to the Amirantes, is a true atoll with a sandy cay and a ring of submerged reef surrounding a deep lagoon. The other BIOT islands are raised atolls with coral reef exposed several metres above the sea and shallow central lagoons fringed with mangrove trees in places.

ACKNOWLEDGEMENT

The author is grateful for the assistance given to him during his survey by

Mr Serge Savy - Secretary to the Government (Natural Resources)
Mr Michael Mason - Acting Senior Conservation Officer.
Mr Kurt Buchanan - Park Warden (American Peace Corp Volunteer).

FINDINGS

Existing marine parks, reserves or sanctuaries.

Ste Anne Marine National Park.

Declared under the National Parks and Nature Conservancy Ordinance, Section 4 of 1973. This includes the islands of Ste Anne, Moyenne, Round, Long and Cerf, together with adjacent reefs and sea, and covers a diversity of marine habitats. Within the Park all fishing and collection of shells is prohibited.

Cousin Special Reserve.

Established principally to safeguard its nesting seabirds and the endemic Seychelles brush warbler which only survives here. The island is privately owned by the International Council for Bird Preservation. The birds of Cousin were protected under the Wild Animals and Birds Protection Ordinance 1961, but the recent redesignation of the island as a Special Reserve has resulted in extension of the boundary to include 200 metres of sea from the high water mark all around the island.

Proposed marine parks, reserves or sanctuaries.

The following areas have been proposed by the National Parks and Nature Conservancy Commission.

Port Launay Marine National Park.

This will include the reefs of Port Launay and Baie Ternay. The boundary is to exclude the beaches so they may be freely available for normal recreational purposes.

Curieuse Special Reserve.

This will include the reefs lying between Curieuse Island and Praslin. Traditional fishing methods will be permitted to continue.

Aride Island.

Privately owned by Christopher Cadbury and being run as a bird sanctuary. The National Parks and Nature Conservancy Commission have proposed that Aride be declared a Special Reserve. It would include the fine coral reefs around the island for a distance of 200 metres from the high water mark.

Potential marine park, reserve or sanctuary sites.

Important turtle nesting areas.

The green turtle, Chelonia mydas, and the hawksbill turtle, Eretmochelys imbricata, are frequently encountered in Seychelles waters. The leathery turtle, Deremochelys coriacea, is a rare visitor.

Eretmochelys nests on the beaches of the granitic islands during December and January, and the eggs of this species are not eaten. Adult turtles are caught for their scutes (tortoise shell) which are used in the manufacture of souvenirs for tourists. The flesh of Eretmochelys in Seychelles is poisonous so it is not eaten. Under the Turtles Ordinance of 1925 the harpooning of Eretmochelys under 24 inches in length

is prohibited. Export of rough or unworked tortoise shell is prohibited and it has been proposed that the export of stuffed turtles also be banned.

Chelonia mydas rarely nests on the granitic islands preferring the coral cays, Bird and Denis, on the Seychelles Bank, the Amirantes and the atolls of the BIOT. Chelonia has been totally protected by a law passed in August 1968.

Unique or threatened habitats.

The best representative sample of mangrove swamp on Mahé is the one on La Plaine Estate between Port Glaud and Port Launay on the west coast. Reclamation has caused severe damage to the swamp, but any further modification has now been prohibited.

Fringing mangroves are found in many sheltered bays around Mahé, but true swamps are uncommon. Curieuse Island has a fine mangrove forest in the turtle pond area. As the island is a Forest Reserve the mangroves are also protected.

Main coral areas.

The fringing reef off Mare Anglaise at Beauvallon, Mahe, is one of the finest intact stagshorn assemblages to be found around the granitic islands off the Seychelles. Two muddy streams discharging in the vicinity of the reef are a serious threat to the health of the corals. The area of Beauvallon and Glacis has four large hotels, three small hotels and a number of beach cottages for rent. Many of the tourists who visit this beautiful reef, collect corals or shells. Urgent action should be taken to safeguard the reef against the disastrous effects of both siltation and visiting marauders.

Exports of corals from Seychelles is prohibited under the Customs and Management Ordinance, but enforcement is difficult.

Additional conservation matters.

Collection of shells. Under the Protection of Shells Ordinance no shells may be collected from the following areas.

Mahé - Rat Island south to Point au Sel.

NE Point north to the northern boundary of the Carana Beach Hotel site.

La Digue - La Passe north to Grosse Roche.

Praslin - Anse Boudin east to Pointe Zanguilles.

Spearfishing is banned under the Speargun Regulations 1972 of the Fisheries Ordinance. Possession of Spearguns has been declared an offence and their import is prohibited. Tourists arriving at the airport with Spearguns have these confiscated by customs officials. They are returned to them on departure. The success of this ban is reflected in the remarkable abundance of large and unafraid, colourful reef fishes.

Coral fish export is prevented, except under licence, under the Customs and Management Ordinance. No licences have yet been issued.

The Amirantes

There are no marine reserves in the Amirantes. The coral reefs of the Amirantes surpass those of the Seychelles in extent and the size and fragility of the coral colonies. There are proposals to build airstrips on the islands of Remire and D'Arros. With development of the islands imminent and the promise of an influx of tourists, it has become important to take measures now that will prevent unnecessary destruction of the coral reefs. The reefs, which will certainly be the principal attraction of the islands, act as critical buffers preventing coastal erosion. Low sandy cays are all too easily eroded without such protection. The reefs are also essential fish breeding, nursery and feeding grounds.

The British Indian Ocean Territories (BIOT)

Aldabra Atoll is strictly controlled by The Royal Society.

The other islands are leased by private individuals and used for exploitation of copra or fishing. Cosmoledo has turtles nesting on the beaches, superb reefs and the best mangrove swamp - with nesting seabirds - of all the islands of the Seychelles, Amirantes and BIOT included.

Independent Reports.

POLLUTION ASPECTS : REPORT OF A PRELIMINARY
SURVEY OF POLLUTION PROBLEMS ALONG THE KENYA COAST

VICTOR C. ANDERLINI

Department of Energy and Environment, Lawrence Berkeley
Laboratory, University of California, Berkeley, California
94520

Over the last two years Dr. Robert Riseborough of the University of California and the author have been developing a preliminary survey of the coast of Kenya in the Malindi-Watamu Marine Reserve area and a little further to the north adjacent to the Sabaki River mouth. During June-September 1974, we conducted a preliminary survey of basic water quality parameters such as nitrogen (ammonia and nitrate), organic phosphates, salinity, sulfates and turbidity, and also made a brief survey of coliform sewage bacteria in this area.

The water measurements were performed on a Hach portable field spectrophotometer which was left with Dr. Mohammed Hyder and the biological staff of the University of Nairobi for use at the new Mombasa pollution laboratory.

The coliform bacteria samples were prepared and incubated using equipment donated to Bodega Bay Institute by the Millipore Corporation.

Biological samples were not collected for chlorinated hydrocarbon or trace metal analyses since at this time the coastal input of these compounds is not significant. It is hoped, however, that baseline samples will be collected from both the marine park area and from adjacent coastline and will be analyzed at the Mombasa pollution laboratory.

The main purpose of this preliminary survey was to gather basic water quality data which could be useful to a more integrated study of the effects of present and proposed development along the Kenya coast. To be valuable to those agencies in charge of balancing environment costs with economic and social needs, such a study should also include data on present economic conditions and a determination of present and proposed land use and ownership.

By combining these aspects, suitable biological, chemical, economic, and social data could then be tested by using an

appropriate ecosystem model. These models are useful, if good data are available, in predicting the possible effects of unrestricted development.

As previously mentioned the main purpose of the preliminary survey was to begin gathering basic water quality data and the testing of equipment. Another important purpose of this survey was to determine the practical aspects of conducting environmental research in this area and to determine the interest of local officials and residents in this type of study. The support and interest of local political leaders and the managerial staff of two of the larger hotels within the Watamu reserve region was most encouraging.

It is hoped to develop by this approach a method of survey that could be tested in Kenya and which would also be applicable in other countries undergoing similar development. For example, very high accumulations of pelagic tar balls of various sizes, up to 10 cm in diameter and in numbers up to 100/m² were observed in the Lamu-Kiunga region, where a project is under consideration for establishing an additional Marine Reserve (see Country Report No. 5). The potential threat posed by such accumulations to littoral species must be considered in view of recent work on the identification of petroleum hydrocarbon fractions in marine organisms. However, since returning to the United States we have developed a proposal for a study of the feasibility of local collection and utilization of this otherwise lost resource. If such a plan is feasible it could offer a relatively simple solution of this particular problem which would also be to the benefit of the local residents.

Independent Reports

P O L L U T I O N A S P E C T S : FURTHER COMMENTS AND
SUGGESTIONS

VICTOR C. ANDERLINI

Department of Energy and Environment, Lawrence Berkeley
Laboratory, University of California, Berkeley, California
94520

Widespread pollution of inshore marine coastal waters by industrial organic and inorganic wastes is presently not a serious problem in the North West Indian Ocean region. Localized pollution of marine habitats by inputs of sewage, organic and inorganic fertilizers, oil accumulations, heavy metals, pesticides and silt does occur in some regions.

An important function of existing and proposed national marine parks and reserves is to serve as baseline and monitoring sites. The nature of these marine parks and reserves allows the best possible assessment of potential perturbations on relatively natural systems. Use of these areas as coastal monitoring sites ensures not only the continued viability of the parks and reserves but can forewarn deleterious conditions developing in adjacent waters.

As new national marine parks and reserves are proposed and expert survey groups are established, consideration should be given to including researchers experienced in developing pollution monitoring programmes. These scientists should work with researchers from host countries developing programmes designed to meet specific local pollution problems.

Upon completion of the initial surveys and, hopefully, the establishment of new parks and reserves, basic, inexpensive water quality and sewage bacteria monitoring equipment could be made available to local or regional, marine park personnel training centers.

It is relatively simple to train these personnel in the standard methods of water quality monitoring. If this system could be established in the North West Indian Ocean region, valuable data could be collected concerning the inshore waters influencing the marine parks and adjacent coastal waters. This would also serve as a valuable data base for more detailed studies of either specific regions or for large-scale fishery resource surveys.

The establishment of a string of marine parks and reserves with associated water monitoring stations around the region would provide the basis for the first integrated approach to understanding inshore marine systems. There is no doubt that industrial and agricultural pollutant input will increase in the North West Indian Ocean, including the Red Sea and the Persian Gulf, as a result of development and diversification in all or most of the countries bordering upon the sea. Increased transport of petroleum hydrocarbons could also pose a potential pollution threat to sensitive coral reef habitats and species.

Intensifying agricultural development and the use of chlorinated organic compounds in combination with removal of land cover could result in increased inputs of these toxic materials into the marine waters adjacent to marine parks and reserves. It is essential that baseline data be collected on the present concentrations of these toxic compounds within indicator species. This is essential to determining present rates of input and in assessing future trends.

Standard methods of collecting and handling indicator species could be taught to marine park personnel and analyses could be performed at regional laboratories. Laboratories capable of performing analyses of petroleum and chlorinated hydrocarbons presently exist in Egypt, Iran, Kuwait and Pakistan. Additional laboratories in Kenya and India will be completed shortly and, in conjunction with the existing laboratories, should form an excellent network of regional analytical capability.

Independent Reports

CONSERVATION AND EXPLOITATION OF
ETHIOPIAN AND EAST AFRICAN
COASTAL RESOURCES

L.H. BROWN

P.O. Box 24916, Karen, Kenya

1. This paper covers mainly Ethiopia and Kenya, where the writer has been directly concerned with wildlife conservation for many years. The views expressed herein are personal but based on considerable experience of the coastal problems over the last decade, and on original research, especially on nesting seabirds in northern Kenya.

2. With small exceptions, protected in National Parks or reserves, the whole coastline of Ethiopia, Kenya and Tanzania is more or less exploited without thought for the conservation of resources on a sustained yield or long-term basis. The rate of exploitation has increased sharply in the last two decades, largely as a result of the development of the tourist trade which creates a demand for certain Crustacea and molluscs; but also through the introduction of nylon nets which are used deliberately to catch undersized fish, and which are also a main threat to the dugong population.

3. Exploitation does not affect or threaten all marine organisms equally, but is selective. It threatens especially large marine mammals such as Dugong dugong; marine reptiles, notably the Green Turtle Chelonia mydas; affects some birds, notably terns and gulls, Laridae, whose eggs may be taken; and has severely reduced the populations of some ornamental coral fish and of the more spectacular gastropod molluscs, e.g. Cypraea spp. Cassis spp. Triton, etc. The only more lowly invertebrate systematically exploited is beche de mer (Holothuridae). In no case is the existing exploitation based upon sound knowledge of populations or their dynamics and potential maximum yield.

4. The exploitation is of two sorts (a) for food by coastal peoples (turtles, fish), sometimes for bait to catch food (octopus); (b) for sale to tourists (gastropod molluscs, Crustacea, etc.). Small scale exploitation for food by traditional methods probably has relatively little effect, and the take could probably be increased. However, in recent years the introduction of nylon nets has increased the threat

to food species and led to over-exploitation of immature fish; blasting with dynamite destroys corals and all life on them; netting with nylon nets and using aqualungs and sale of ornamental fish have reputedly rendered some species scarce; spearfishing with aqualungs and other modern equipment has undoubtedly reduced populations; and the collection and sale of the larger gastropod molluscs has certainly rendered some species once abundant quite scarce. In addition, pelagic fishes such as marlin, sailfish and others, are reputed to be overfished offshore by commercial fisheries, mainly Japanese.

5. Positive steps to control or reduce exploitation have included:

(a) the conservation of several small areas of outstanding interest as National Parks or reserves;

(b) some legal protection (mainly unenforced or ineffective) to conserve turtles and gastropod molluscs; and

(c) some control of spearfishing.

In general, control outside National Parks is ineffective for lack of staff or funds. Only the close control exercised within National Parks and reserves has any real effect on the otherwise steady and continuous depletion of marine resources. At Kiunga, for instance the writer has seen a heap of Cypraea mauritiana ten feet long by three wide by two deep, simply piled to rot in the sun, later to be exported by the pound of shell. There are usually neither the means, and sometimes not the will either, to apply positive conservation measures the length of the coast. Nor are the basic studies at present available on which sound conservation proposals can be based.

6. Present National Parks and reserves include:

Ethiopia, none; Kenya, two, at Malindi-Watamu on the north coast and Kisite off Shimoni on the south coast; it is not known whether Tanzania has yet legally established any marine parks, though some are certainly planned. The total area so protected in the affected countries is very small, but important both as a tourist attraction and as study areas.

7. Proposed National Parks or reserves include or might include:

Ethiopia: A reserve or National Park has long been proposed for parts of the Dahlac Islands off Massawa, following on a report by Dr. Carleton Ray. The areas are not at present acutely threatened, but are subject to some spearfishing. No concrete progress has been made, and none seems likely in the near future.

Kenya: (i) Plans have been made for the establishment of a large park or reserve (or both) in the Lamu archipelago area. This would conserve inter alia the Kiunga islands which are important seabird breeding grounds; a tract of relatively unspoiled mangrove forest; and areas where small populations of dugong survive. The chain of coral islands south of Kiunga is an important breeding ground for several species of terns, notably the Roseate Tern Sterna dougallii, the White-cheeked Tern S. repressa and the Bridled Tern S. anaethetus. Tenewe Island south of Lamu is a breeding ground of the Sooty Tern S. fuscata and Noddy Anous stolidus. The Kiunga island colonies may be to some extent predated by local fishermen but Tenewe Island is normally protected by rough weather alone.

(ii) It is suggested that an additional National Park or parks, embracing characteristic tracts of presently heavily exploited fringing reefs and lagoons is needed, perhaps on the south Kenya coast. The fringing reef, with exposed surface at low tide and inshore lagoons rich in small fish and marine invertebrates, is the most characteristic East African reef habitat; yet no section of it is conserved. Perhaps an area north of Mombasa between Nyali and Mtwapa Creek, or to the south near Diani would be suitable. A giant hotel complex is planned for the Diani area; and this will make conservation of adjacent reefs imperative.

Tanzania: In a report by Dr. Carleton Ray a number of National Parks and reserves were proposed. These included Latham Island, an important breeding site of certain seabirds, including the Masked and Brown Boobies Sula dactylatra and S. leucogaster, the Swift Tern S. bergii, Noddies and perhaps other species; also various coral reefs off Tanga, Dar-es-Salaam, and Mafia Island; and tracts of the Rufiji Delta mangrove swamps for Dugongs. It is believed that the Tanzanian authorities are actively considering these proposals, but that their approach differs from the Kenyan in that strictly limited exploitation by traditional methods might be allowed in such areas.

8. The general conservation of coastal resources calls, however, for a much wider approach than the establishment of small National Parks and reserves. Threats arise to selected marine organisms through over-exploitation, while others are relatively unaffected. There is no need to prevent exploitation, merely to control it for the maximum benefit of users and countries, by e.g. limiting spearfishing, use of small mesh nylon nets, and by controlling the sale of gastropod mollusc shells. Unfortunately, little control is at present possible because of the lack of staff and funds. It may also be claimed that control is difficult or impracticable, or unpopular (as it certainly would be).

9. However, in fact, given the right equipment and personnel,

the control of over-exploitation of the coast resources should be relatively simple. The coast is a linear habitat; and most exploitation takes place at low tide, especially springs. Fast, light, shallow-draft boats, manned by good swimmers who know the coast well, and supplemented by legal control of sales on shore at fish markets, shell stalls, etc. could go far to control over-exploitation, probably at comparatively small expense. The fact is that at present patrol boats of the National Parks concentrate on collecting revenue from foreign tourists, and are seldom seen anywhere outside the regularly visited coral gardens. Allowing one control post on average per 40 kilometres of coast those areas of the Kenya coast outside existing or proposed parks and reserves could be effectively controlled by about 10-12 posts. Additional revenue could undoubtedly be raised to help meet the cost of such control from spearfishing licences, licence fees for fishermen, canoes, etc.

10. The rights and needs of local fishermen must be considered in this connection. No such control is likely to be popular, as it will inevitably interfere with long-established heedless exploitive practices. However, if the effects of control can be seen to be beneficial in the form of increased productivity and income for local people, then at least there might be some hope of reduced opposition, if not support. Control certainly does increase productivity, as is clearly demonstrated by the increase in size, number and variety of fish seen in the Malindi-Watamu National Park area following the full establishment of these parks about six years ago, and despite some continued poaching. For instance, on Big Three Reef in the mouth of Mida Creek, in January 1974, the writer counted about 3300 fish of 106 identified species; this was estimated to be equivalent to about 35 times the biomass of large herbivores per unit area in the Serengeti National Park. It is not known how far from the reef such fish may wander; but this sort of population is regularly present nowadays, and the largest fish reside on the reef.

11. It is felt therefore that there are good grounds for supposing that the imposition of unpopular control measures would result in greatly increased productivity and income for local fishermen. Purely negative prohibition of undesirable practices such as the use of small mesh seines could profitably be coupled with positive efforts to increase the total available habitat for food fishes and Crustacea. Apparently, all large concentrations of reef fish are found near existing coral heads, even if small; and there is the possibility that the population may actually be limited by availability of such habitat. Without any personal knowledge of the subject, the writer has understood that the provision of artificial reefs, by the use of old motor tyres, prefabricated hollow concrete structures, etc., can markedly increase fish populations by providing extra nurseries and shelter for young and old fishes.

It is suggested therefore that a typical stretch of fringing reef and lagoon should be selected, with a view to carrying out experiments towards positively increasing fish populations and productivity.

12. The measures suggested under paras 8-11 above would naturally involve setting up a new form of conservation service, presumably under the Fisheries Section of the Game Department in Kenya, or the Fisheries Section of the Ministry of Agriculture in Ethiopia. Funds would be needed initially for experimentation, research, and development; but at a later stage such a service might well become self-supporting in much the same way that Game Departments in Kenya and Tanzania are largely or entirely self-supporting and indeed revenue earning today. The indirect revenue derived from increased tourist attractions should be taken into account, also, in assessing the value of such services. At present, a great many tourists are themselves offenders against the tenets of conservation (principally in purchasing large gastropod mollusc shells); but many are also distressed by the obvious over-exploitation of coastal resources which is self-evident.

13. With regard to research, at present some limited research, chiefly directed towards threatened species, is being conducted in Kenya and no doubt also in Tanzania; none is in progress in Ethiopia, and probably little in Somalia. The East African Wildlife Society, through its Scientific and Technical Committee (of which the writer is chairman), has set up working groups inter alia on marine habitats. The Marine working group is in process of collecting and collating known data on various marine subjects and is liaising with, e.g., the University of Dar Es Salaam. It has available limited funds to support research projects; and is at present supporting research into the status of turtles in the East African waters, and also of dugongs. The Society tries to help in supporting the National Parks in their efforts to conserve marine and other resources, so far as its very limited funds permit. It should shortly be able, in collaboration with other East African conservation authorities, to say which habitats are most in need of conservation, and make constructive recommendations for positive action on the subject.

14. Short-term research projects would include surveys, aerial or otherwise of acutely threatened species such as dugongs and green turtles. Medium-term (2-3 years) projects could include, for instance, study of the life histories, breeding and survival rates of commercially exploitable demersal fishes, prawns, lobsters and molluscs of culinary value, such as oysters. Based upon such studies, practical proposals might be made on ways and means of increasing productivity and income for local fishermen.

15. A basic long-term project, perhaps taking 10 years, and involving many disciplines would be the mapping, charting and cataloguing of species in the entire East African reef system, which stretches from Somalia to Mozambique, and mainly consists of fringing reefs 1-2 km offshore, with deep water outside the reef and shallow lagoons contained inside it. Much of this might be achieved by aerial photography; and such a survey would provide the basic data for planning long-term developments towards greater productivity based on the short and medium term projects mentioned in para 14.

16. Finally, it should not be forgotten that the conservation of the coast is not merely a matter for coastal peoples; but that threats can arise several hundred kilometres inland, and can only be contained by vigorous action in these other localities. A classic example is the threat through silting to the Malindi reefs, caused directly by soil erosion from cultivated land in the upper Athi-Galana basin 300-500 km inland. This threat has greatly increased since 1961 because of the increase of cultivated land coupled with the near-total abandonment of soil conservation practices formerly enforced. There are doubtless other cases throughout East Africa; but not all potentially valuable marine areas are affected by such lack of conservation elsewhere. The Dahlac Islands in the Red Sea, for instance, are not affected at all, since no rivers of any size run into the waters in which they are situated.

17. The suggestions made in this paper have been made very largely in ignorance of detailed work which may be in progress elsewhere in the Indo-Pacific region, but as a result of some personal study of and thought about the marine resources of the Kenya coast; and in the hope that something useful might come of them in a positive way.

While accepting without reserve that the large number of local fishermen who make their living along the coastline have a prior right to the utilisation of the marine resource, the writer feels that neither their interests in the long-term, nor the National Interests of the countries concerned, through increased income from foreign tourist revenue, will be well served by continuing to allow the present uncontrolled and thoughtless exploitation of almost every sort of marine resource.

A P P E N D I C E S

1. REPORTS AND RECOMMENDATIONS OF THE WORKING GROUPS

The reports of the Working Groups, which were given the general approval of the Meeting, are summarized in a slightly shortened form, since to some extent they repeat material presented in the Country and Regional Reports.

a. Report of the Persian Gulf Working Group

Introduction

The Persian Gulf is a long, narrow, shallow body of water almost entirely surrounded by arid and semi-arid country, and situated in a subtropical zone with extremely high summer temperatures. Although connected with the Arabian Sea by the Straits of Hormoz there is little exchange of water between these two water bodies.

The warm, shallow waters of the Persian Gulf are of great importance as spawning and nursery areas, while several species of sea turtles breed on the sandy beaches. A small population of dugong survives at the eastern end of the Gulf. The region is of great importance for breeding cormorants, herons, gulls, terns and other seabirds as well as being an important wintering area for migratory Palaearctic waterfowl.

Its shallowness, the presence of oilfields under the sea floor and of installations for extraction and commercialisation of this resource, and the rapid urban and industrial development in many areas along its shores, all combine to make the unique ecosystems of the Persian Gulf extremely vulnerable to all forms of pollution and disturbance. Overfishing is already a serious problem in some areas and likely to extend to other parts of the Gulf. The Working Group appreciate that owing to the regretted absence of delegates from some countries bordering on the Persian Gulf and the Gulf of Oman, a large number of potential sites for marine reserves in the region may have been overlooked in this report. But it also feels that, bearing in mind the present and future impact of development and the need for further detailed surveys, the consideration given to the Persian Gulf is applicable to the whole region and underlines the need for creating marine reserves to protect various ecosystems.

Justification

The Working Group, in the limited time available, examined a number of aspects of present and future activities having direct or indirect influence on the Persian Gulf ecosystems.

Although oil and petrochemical operations have the major economic importance to the region, there is a growing trend towards development of various other coastal and marine resources of the area.

Because of the extensive development programmes and at the same time relative lack of scientific data, the Working Group strongly recommends the initiation of detailed oceanographical, biological and ecological surveys of the Persian Gulf and the Gulf of Oman at national and international levels in order to rectify the situation. There is little doubt that the help and experience of various International Agencies (e.g. UNEP, FAO, IUCN) would be of immense advantage in such studies and surveys.

With the rapid growth of the coastal communities, serious consideration must be given to solid waste disposal and sewage treatment facilities. The scarcity of freshwater, which to date has been a limiting factor in urban and industrial development of the area, is being overcome with the construction of desalination plants.

In response to the needs of the growing regional population, as well as for export purposes, both local and commercial fisheries are expanding rapidly in the area. Wise regional policies could prevent the disastrous effects of overfishing by a thorough evaluation of resources and the creation of marine reserves to protect spawning and nursery grounds. Plans for nuclear-power generating stations and a multitude of industrial complexes are in their final stages. Such industrial expansions require harbour and port improvements or enlargement, often also dry dock facilities. The problems related to increased shipping and industrial expansion need special consideration and in depth evaluation.

The Working Group members were also unanimous in their recommendations regarding the need for studies and action in connection with land use practices (e.g. overgrazing and watershed destruction) which may have direct or indirect influences on marine ecosystems.

Caspian Sea

The Working Group also briefly considered the socio-economic and ecological aspects of the Caspian Sea in the light of the Iran/USSR Agreement for the Prevention of Pollution of the Caspian Sea, and the bilateral steps taken towards this goal.

The industrial and urban pressures on this unique body of water have received full attention and are well documented in the protocols drawn up by the two countries. The Working

Group stressed the desirability and importance of surveys for the selection and creation of marine reserves in the Caspian Sea.

Present and Potential Marine Parks and Reserves in the Persian Gulf

BAHRAIN

At present the Government of Bahrain is considering the selection of sites for marine parks and reserves. However, the following areas which are threatened by big scale development call for immediate attention:

1. Khor Mugta Tubli, a spawning and nursery area particularly for shrimps.
2. Islands, other than Bahrain, Sitra, Nabi, Saleh, Muharraq, and Zida, which are not populated and of which the natural ecosystems are relatively undisturbed.
3. Khor al Qaliya, between Bahrain, Sitra and Muharraq islands.

IRAN

At present the Department of the Environment of Iran administers five reserves in the Persian Gulf, which could be classified either entirely or in part as marine. These are:

1. Shadegan Protected Area, in Khuzestan, which contains 75 kilometers of tidal mud-flats of great importance for wintering flamingos and shore-birds.
2. Khark and Kharku Islands, notable for their large breeding colonies of sea-turtles and terns.
3. Sheedvar Island, off the west end of Lavan Island, the site of very large sea-turtle and sea-bird colonies and with excellent coral reefs.
4. Hara Protected Area in the Khouran Straits, with extensive and complex mangrove forests and large waterfowl populations.
5. Bahu Kalat Protected Area which includes 55 kilometers of the Baluchestan coast abutting the Pakistan border; remarkable not only for the strong oriental influence in its fauna and flora but also for its outstanding coastal scenery.

In addition to these reserves the Iran Department of the Environment is proposing a further six areas as potential sites for marine parks or reserves:

1. A number of small islands, some largely sandy, others largely composed of tidal mud-flats, off the coast of southern Khuzestan. These islands are important breeding grounds for sea-birds and a wintering area for large numbers of shore-birds.
2. The delta of the Halileh Rud and adjacent tidal mud-flats near Bushire.
3. A stretch of coastal sand-dunes and excellent beaches south from the delta of the Monde River to the Nakhilu Islands; an area with great recreational potential and also important for its large breeding colonies of sea-birds and possibly also sea-turtles.
4. Hormoz Island in the Straits of Hormoz near Bandar Abbas.
5. A region of tidal mud-flats and small sandy islands at the deltas of the Rud-i-Gaz and Rud-i-Hara on the eastern shores of the Straits of Hormoz; an area with perhaps the very finest stands of mangroves in Iran.
6. One or both of the large bays with adjacent mountainous headlands at Chahbahar and Puzim in south-east Baluchestan - two of the finest bays along Iran's entire south coast, in a region with an extremely rich and diverse marine fauna.

KUWAIT

1. Jazirat Kubbar; a small island, 6 sq. km in area, located 30 km off Shuaiba Industrial Area. A sandy island with scanty desert vegetation, a large sea-bird community, and a nesting area for sea-turtles. The island is surrounded by reefs with an abundant marine fauna.
2. Khor Al-Ama and Khor Al-Mufattah. These two creeks, located in the most southern part of Kuwait are about 200 m wide and about 3 km in length. They constitute important nursery grounds for fishes.
3. Doha-Kadhima; located in the northern part of Kuwait Bay. An area of shallow waters with muddy bottoms and extensive mud-flats, which is a nursery ground for shrimps.

4. Ras Al-zur; located off Mina Saud, with a coral bottom and large communities of corals and fishes.
5. Failaka Island; a populated sandy island with surrounding shallow water and mud-flats. It is archaeologically important and a breeding ground for birds, shrimps and fishes.

UNITED ARAB EMIRATES

1. The lagoon complex between Al-Jazirah Al-Hamra and Ras Al-Khaimah. Coastal lagoon, sandbanks, high ridge of orange-coloured dunes, stands of old trees (Prosopis). Landscape of great scenic beauty.
2. The lagoon complex of Umm Al-Qaiwain (includes islands with mangrove vegetation).
3. The mangrove area in the north-east part of the lagoon of Rams (Khor Al-Khawin). Good growth of mangrove. Probably important for breeding Ardeidae (herons).
4. Large sections of the lagoon-complexes north-east of Abu-Dhabi towards Ras Ghanadah (vast complex of creeks, lagoons and islands with mangrove vegetation).
5. Abu Al-Abyadh and Al-Ghubbah (mangrove and sea-grass areas; dugongs reported in 1974).
6. The mangrove creeks south of Fujairah near Kalba (densest and tallest mangrove stands in UAE).
7. The island of Zirkuh (cormorant colony of 20,000 to 30,000 pairs; osprey nesting site).
8. All areas where the dugong still exists.
9. All beaches where sea-turtles breed.
10. All islands or coastal areas with large colonies of gulls, terns and herons, and other colonial breeding birds.

Action Plan and Recommendations

1. The countries of the Persian Gulf and Gulf of Oman should undertake national and international surveys to determine sites for marine reserves and to better understand the oceanography, biology and ecology of the area. Financial and technical assistance from international organizations should be requested when necessary.

2. Training of management personnel should be part of the programme for establishing marine reserves. Governments concerned should consider, in their national development programmes, land practices directly affecting marine reserves.
3. Governments of the region should draw up plans and legislation regarding coastal zones.
4. Governments concerned should, by creating public awareness, ensure that fullest use be made of marine reserves for research, monitoring, recreation, environmental education, etc.
5. At present there is no coastal plan or legislation concerning the use of coastal land in Bahrain. The Khor Al-Qaliya lagoon between the islands of Bahrain, Sitra and Muharraq is an important nursery ground for shrimp which will be closed off from the sea, except for a one mile wide inlet, by the Manama Muharraq and Manama Sitra causeways. The existing BAPCO wharf, a proposed drydock and other planned industrial developments will cause important changes in the ecology of the lagoon. With the approval of the Government of Bahrain, scientific studies of the marine life and ecosystems of the other uninhabited islands of Bahrain should be undertaken. In particular the effects of increased oil tanker traffic to the new OPEC dry dock should be closely observed.

b. Report of the Red Sea and Gulf of Aden Working Group

General Description and Hydrography

The Red Sea is a deep narrow trough approximately 2150 km long, extending from Lat 30°00'N at Suez to Lat 12°40' at Bab el Mandab. Its greatest width is about 340 km near Masawa with an average width of 280 km.

The shore is fringed by shallow reefs of a width varying from a few meters to more than half a km. The edge of these fringing reefs is just covered at low water. The fringing reefs may have steep edges going down to deep water of the open sea but more often, however, they slope gently into lagoons bordered by barrier reefs.

The southern half of the Red Sea is thickly beset with reefs of every description, extending far out sea-ward on both sides, leaving only a relatively narrow but deep passage in the middle clear for navigation. The north has far fewer reefs, but the entrances to the Gulf of Aqaba and Suez are guarded by a rich and intricate maze of reefs and islands.

Beyond the coral reef zone, the sea bottom descends very steeply in a series of steps each of up to 400 m. The bottom is highly irregular; steep-sided hills of considerable height are common. Some show at the surface as islands, such as the Brothers Islands; some reach just below the surface and are topped by living corals e.g. Abulkizan Reef and Panorama Reef. Many such reefs or islets rise from depths of 500 to 1000 m.

The Gulf of Aqaba resembles the Red Sea proper in being a narrow deep trough. It is separated from the Red Sea by a deep sill. The mountainous sides are bordered by very narrow and interrupted fringing reefs beyond which the bottom falls abruptly to the great depths prevailing throughout the Gulf.

In marked contrast with the Red Sea proper and the Gulf of Aqaba, is the Gulf of the Red Sea into which its surface waters extend. The depth, which is only about 80 m at the entrance, decreases gradually towards the head where sedimentation is continually going on.

The sides are for the most part rocky and bounded by interrupted fringing coral reefs of different widths, but as a rule these tend to be narrower and less vigorous in growth towards the north. In many parts, however, wind blown sand accumulates together with sand deposited by sea, especially on the eastern or Sinai side, where the fringing reef is thereby interrupted. Interruption is also caused by down wash from the sides which occasionally takes place in this part.

The floor of the northern end of the Gulf, the Suez Bay, is mainly mud deposits mixed with wind blown sand which in places forms spits of considerable extent. Where mud and sand are abundant, coral growth is limited to the free surfaces of boulders or rocky outcrops, forming scattered coralline patches. The bottom of the bay in many parts is very poor in life especially where it is stirred by ship propellers or disturbed by dumping of mud from dredgers. At the extreme NW end of the sea, the Bay of Suez is, of course, artificially connected with the Mediterranean, and a certain amount of water exchange, as well as faunal exchange, has since taken place. At the opposite end of the Red Sea the inflow of Indian Ocean waters is affected by a sill at a depth of 100 m about 125 km north of Bab el Mandab.

Salinity and temperatures of the surface water vary seasonally as well as geographically. Below 300 m depth, however, the waters in the Red Sea are nearly homogeneous with those at the greatest depths, having a temperature of approximately 21.6 C° and a salinity of approximately 40.6 %.

The Problem

In the Red Sea zoogeographical features result in fewer animal and plant species than in the Indian Ocean. There is evidence of a decrease in the number of species as one proceeds from south to north.

The physical, chemical, Hydrographic and topographic features of the Red Sea, the regime of water exchange between the Indian Ocean and the Red Sea through Bab-el Mandab, as well as the effect of the opening of the Suez Canal and the water currents traversing it, played and are playing a role of paramount importance in the present constitution of the fauna and flora. In point of fact, the opening of the Suez Canal, not only has had a strong influence on the fauna of the Red Sea, but also has had an even more pronounced effect on the fauna of the Mediterranean.

Migration of organisms is greatly influenced by water salinity and temperature, direction and strength of currents, and the nature of the bottom of the Suez Canal and its lakes, the Bitter Lakes and Lake Timsah. Salt beds in the Bitter Lakes have created a layer of a very high salinity near the Canal bottom. The current system in the Suez Canal has been greatly affected by the construction of the Aswan High Dam and the decreased amounts of fresh water that consequently reach the Mediterranean basin. For these reasons, a programme for a thorough study of the Suez Canal will be rewarding, not only for those interested in the Suez Canal and the Red Sea, but also for those interested in the eastern Mediterranean.

For the Mediterranean the impact of the Suez Canal and other man made projects, particularly the construction of the Aswan High Dam and the increased transport of oil by sea, has been very great; it will extend to the Red Sea with the re-opening of the Suez Canal. Migration through the Canal, changes in chemistry of the eastern Mediterranean Basin, and increased pollution, have stimulated discussions in various regional and international meetings that have led to the establishment of several marine programmes and marine parks in the region. One idea has been that an ecological model should be created for it in the same way as done for the Baltic Sea. The case of the eastern Mediterranean is, however, much more complex owing to the three major factors mentioned above, and because of a lack of sufficiently detailed oceanographic studies. The establishment of marine parks and reserves in the eastern Mediterranean will contribute much to our knowledge of the area, and will provide ideal sites for the monitoring of different oceanographic and biological parameters necessary for the construction of an ecological model from which we will hopefully be able to predict the future of marine life in the eastern Mediterranean basin.

Marine Parks and Reserves

(1) Areas

- 1a) We commend the measures taken towards establishing marine parks to facilitate tourism and science in the vicinities of Al-Ghardoqa, Port Sudan and the Dahlak islands. We recommend that similar small areas might be protected close to Aqaba, Jeddah and Hodeida, and to the marine science laboratories elsewhere. Also two small areas in Egypt, at Desha el Daba and at Ras Abu Hagar have been suggested as worthy of close protection. In addition during a survey of the Red Sea, care should be taken to identify any other notable areas of non-coral-reef biotopes, e.g. mangroves and mud flats, which require strict preservation. Finally, information should be gathered and if necessary a survey made of the Gulf of Aden area to identify any areas suitable for the establishment of marine parks.

- 1b) We suggest that close consideration be given to delineating a series of larger areas, each of the order of 40 km of coast line and reaching from some distance inland to the outermost shallow waters, as biosphere reserves or national parks. Within these areas every consideration should be given before permitting any development and all natural resources should be carefully conserved. However the welfare of the present inhabitants of these areas should be protected. Thus traditional fishing need not be restricted except in very limited areas or under very special circumstances. But the intrusion of modern commercial fishing activity should be curtailed, thus protecting the means of livelihood of local fishermen. Such areas would serve as replenishment zones from which natural restocking of commercially fished zones will occur. We particularly recommend a system whereby a central core area, including if necessary some fully protected sites, should be surrounded by a buffer zone; the latter should be subdivided into several areas, and controlled exploitation should be permitted within just one subdivision at any one time, on a rotational basis. We recommend that at least one such area should be established in the remoter parts of each country in the Red Sea - Gulf of Aden region, based on surveys to identify the most appropriate sites and the extent of natural resources, and on full consultation with all Government departments and other organisations concerned.

We are also anxious that similar marine biosphere reserves should be established in the adjacent Mediterranean, in view of the interactions between the two water bodies through the Suez Canal, modifications resulting from the effects of the Aswan High Dam and other relevant factors.

(2) Impact of Man:

It is emphasised that there is the immediate possibility of an increase in sea pollution following the reopening of the Suez Canal and we recommend that IUCN and UNEP cooperate with UNESCO and ALECSO in establishing the protection programme proposed by the Red Sea Regional Meeting held in Jeddah in November 1974. It should be closely coordinated with monitoring in the eastern Mediterranean. The possibilities of pollution due to industrial development in the area of major ports will increase rapidly in the near future and monitoring should be extended to cover these threats as necessary. In particular, it is suggested that the increasing pollution believed to be occurring in the Gulf of Aqaba should now be closely studied as indicating the likely future threat to the whole Red Sea.

Among other particular future threats which must be watched are oil and gas exploration, and the possible opening of small ports and installations to serve mining operations inland. We strongly encourage the strict enforcement of existing bans against the use of dynamiting or poisoning to take fish.

(3) Socio-Economic Problems

The socio-economic problems of the area largely relate to the pressing need to ensure adequate food supply to populations in extremely arid areas with few available natural resources. The planned development of fisheries in many areas requires urgent coordination with a system of biosphere reserves.

(4) General Policy

We strongly recommend that publicity and information be dispersed to the governmental and inter-governmental authorities and to the local populations concerned, explaining the severe unforeseen effects which may follow from uncontrolled development on land depleting and destroying natural resources, especially in adjoining sea areas. Perhaps a publication may be produced describing examples of such effects in other parts of the world.

We believe the activities permitted in small marine parks should be carefully restricted and closely supervised by trained personnel. In the larger biosphere reserves special attention must be given to identifying special

reserves which should be more closely protected, and to evolving workable restrictions on human activities which will achieve the desired aims of the reserve.

At an international level we believe our region's Governments should cooperate as fully as possible in agreeing on joint legislation to protect the resources of boundary regions and of international waters.

(5) Manpower and Logistics

We support the regional training programme proposed by the Red Sea regional meeting in Jeddah, and urge that training for resource management and reserve management be given importance. The research and training facilities present in the area are outlined in the report of the Jeddah meeting.

(6) Detailed Surveys

Surveys are required of the extent of ecosystem resources in those areas of the region situated at greater distances from main centres of human habitation. As soon as possible, and before the Jeddah II meeting, a preliminary survey should be conducted in relation to the reopening of the Suez Canal. The survey should give first priority to the defining of biosphere reserves in

- a) southern Egypt and northern Sudan;
- b) southern Sudan; and
- c) southern Saudi Arabia, Farsan bank area.

Further surveys should consider defining biosphere reserves in

- a) northern Saudi Arabia;
- b) Yemen Arab Republic;
- c) north coast of Somalia; and the
- d) outer Dahlak Islands and coast south of Massawa.

(7) Action Plan and Recommendations

1. A survey should be undertaken to determine sites for marine parks in regions of touristic and scientific centres mentioned in the above proposals for Marine Parks and Reserves. It should examine the possible siting of large marine biosphere reserves in remote areas. If possible, the survey should be completed by early 1976 for use at the Jeddah II meeting. IUCN, UNEP, UNESCO and ALECSO should ensure the operation.

2. With results of this survey, marine parks and biosphere reserves should be established.
3. Governments should provide supervision of marine parks and management of biosphere reserves through recruitment and training of staff. Educational publicity explaining the need for conservation measures should be considered an integral part of the programme.
4. Biological and oceanographic monitoring should commence immediately in the proposed marine park areas, preferably before the reopening of the Suez Canal. IUCN, UNESCO, UNEP and ALECSO are requested to assist in establishing a fund for this programme.
5. Information on these areas should be exchanged, possibly through newsletters.

c. Report of the North-West Indian Ocean Working Group

Existing Marine Parks, Reserves and Sanctuaries

Sri Lanka

1. Hikkaduwa Sanctuary: south-west coast; fine coral gardens; many reef fish; presently sanctuary status but recommended by Tourist Board for park status; some reef damage; potential coir industry pollution.
2. Mount Lavinia Lobster Reserve: current-bedded sandstone reef between Mount Lavinia Hotel and Galle Buck lighthouse.

India - None

Pakistan - None

Somalia - None

Kenya

1. Malindi and Watamu National Parks
2. Kisiti Reef National Park

Tanzania - None

Seychelles

1. Ste. Anne Marine National Park: includes islands of Ste. Anne, Moyenne, Round, Long and Cerf, together with the adjacent reefs, sea-grass beds and sea; fishing and shell collection prohibited.

2. Port Launay Marine National Park: includes reefs of Port Launay and Baie Tornay, and coastline other than beaches.
3. Curieuse Special Reserve: includes reefs between Curieuse and Praslin; traditional fishing methods permitted.

Amirantes

There are no marine parks or reserves in the Amirantes; however, Desnoeufs and African Banks islands are designated Special Reserves for their nesting terns.

Aldabra Atoll

British Indian Ocean Territories; strictly controlled by The Royal Society.

Mauritius - None

Maldives - None

Potential Marine Parks, Reserves and Sanctuaries

The following is a list of coastal areas considered by the Working Group to be of sufficient ecological, economic and social importance to warrant consideration and promotion as potential National Marine Parks and Reserves.

Sri Lanka

1. Trincomalee Bay: east coast; fine shallow water corals; bird sanctuary at Pigeon Island; large tourist area proposed; destructive reef fishing.
2. Yala Region National Park: south-east coast; important leathery turtle nesting ground endangered by monitor lizard and wild boar; proposal to extend park border to include two adjacent reefs, Little and Big Basses, with very rich corals; five species of turtles.
3. Puttalam Lagoon-Mannar Peninsula: west coast; representative lagoon, mangrove, turtle grass, coral reef, pearl banks, dugong, fish and turtle feeding and breeding area; includes Arippu and Vankalai reefs.
4. Dutch and Portugal Bays dugong area: endangered by overfishing, increased accidental catches of dugong and habitat destruction; proposed dugong sanctuary opposite Wilpattu including Portugal Bay and offshore islands.

Human Impacts

On the basis of Mr. Salm's Regional Report (pp. 124 - 126), as follows:

1. Dynamite fishing prevalent and has led to habitat destruction and indiscriminate kills; illegal practice, but little enforcement.
2. Intensive collection of reef fish for export with poor regulation of handling procedures has led to an estimated average mortality of 50%.
3. Habitat destruction through coral mining, coir industry, and mangrove cutting.
4. Collection and sale of corals and shells to tourists.

Socio-Economic Problems

The entire population is dependent on fisheries which are inadequate for their needs. Approximately 50% of the fish consumed is imported. This leads to intensification of fishing effort with little control on mesh sizes and fishing practices. Laws governing fishing practices presently exist but are difficult to enforce.

Prosecution of sea turtle fishing violations have been suspended since a significant number of fishing families are dependent on this food source.

India

1. Krusadai Island Region: south-east coast, includes Tuticorin and Rameswaran Island chain; proposed as Marine Park area by Indian Tourist Board; extensive rich intertidal life; marine station; Balanoglossus sp. habitat; coral reefs and sea-turtle breeding sites; coral mining for industry and construction; intense turtle fishing; coastal erosion; collection of specimens prohibited on Krusadai itself.
2. Kerala Region: south-west coast; important fishery area; mangrove-estuarine nursery grounds; turtle nesting beaches; habitat destruction.
3. Gulf of Kutch: north-west coast; unique coral reefs; rich intertidal life at Okha; best representative mangrove on west coast; extensive birdlife, estuarine crocodile Crocodylus porosus, dolphin, otter, turtles and dugong; mangrove cutting, coral dredging.
4. Anjadiv Island: unique area of undisturbed vegetation;

historical site. Palk Bay-Gulf of Mannar: dugong area; possible dugong farming area; turtle feeding area; coral reefs; tourism and habitat destruction.

5. Lakshadweep (Laccadives): extensive coral reefs; tern colonies on Pitti and Baliapanni; proposed airstrip and tourist development.

Human Impacts

In this region the following practices are considered to be detrimental to the marine habitats:

1. Reef destruction through coral mining for the lime and calcium carbide industries and for use in road and housing construction. This practice is heaviest in the Gulf of Mannar and Palk Bay.
2. Reef and mangrove destruction due to dredging and cutting operations in the Gulf of Kutch area.
3. Industrial pollutant inputs threatening the mangrove regions along the west coast.
4. No legislation or controls on widespread egg-collecting and capture of sea-turtles.

Socio-Economic Problems

Increasing coastal populations are exerting pressure on present fishery resources.

Pakistan

1. Karachi - Manora to Cape Manz: excellent sea-turtle breeding beach; no commercial sea-turtle fishery; tidal marsh behind beach for potential sea-turtle farms; encroachment into turtle nesting area due to strip development.
2. Sind Coast: south-east Karachi region; extensive inshore, shallow water shrimp fishery adjacent to extensive estuarine mangrove region.

Human Impacts

At the present time no serious threats to the habitats in this region are evident. Some sea-turtle nesting beaches are being disturbed by beach cottage construction.

Socio-Economic Problems

Pressure is being exerted on the Sind Wildlife Department by

fishing interests to utilize the presently unexploited sea-turtle fishery. Turtle-farming appears to be a feasible alternative.

Somalia

1. Indian Ocean Coast: 1,800 km long; very little information; sand and rocky beaches; presently emphasis on fishery development.
2. Kisimayo Region: terrestrial National Park bordering coast; proposed tourist development (port, airport, hotel). Brava and Marka regions: possible site for frontier park/reserve.
3. Lac Badane Region: site for proposed National Terrestrial and Marine Park; 50 km of coast, offshore islands and surrounding reefs.

Human Impacts

Offshore habitats are being destroyed by dynamite fishing. Shell collecting for export is severe in some areas. At present there is no legislation governing fisheries or coastal zone development. Bottom trawling has disturbed some offshore reef areas.

Socio-Economic Problems

Coastal populations are dependent on fishing and much effort is being directed toward increased exploitation and export. At the present time there is a lack of qualified fisheries or marine sciences personnel.

Kenya

1. Kiunga-Lamu Region: north Kenya coast; presently a fishery Reserve; soon to be declared a National Marine Park; surveys presently being conducted; rich mangrove-coral reef area; probably a small dugong population; possible site for frontier park/reserve.
2. Diani Beach Region: south Kenya coast; rocky intertidal area; rich intertidal life; proposed site of National Marine Park.
3. Shimoni Region: south Kenya coast; possible site for frontier park/reserve.

Tanzania

1. Tanga Region: north coast; outer reefs very rich; numerous reef fish; siltation; intensive fishing;

some local pollution; possible site for frontier park/reserve.

2. Maziwi Island: Green Turtle breeding ground; coral gardens; turtle fishery; egg destruction.
3. Dar es Salaam: coral reefs; habitat destruction; intensive fishery; turbid water.
4. Latham Island: uninhabited; nesting sea turtles and birds, coral reefs; unique flora.
5. Mafia Island-Rufiji Delta: diverse habitats; inshore and offshore reefs; historical sites; dugong and crocodiles; rich fishery; sea-turtle feeding ground; increased tourism; siltation.
6. Kilwa Reserve: formerly dugongs abundant in region but now little known; increasing hunting pressure.

Human Impacts

1. Intensive localized fishing has led to habitat destruction in areas where dynamite is used.
2. Sewage input in some areas could lead to localized destruction of reef and mangrove habitats and the loss of sensitive species of marine life.
3. Spear-fishing is unregulated and has led to depletion of some reef fish species.

Socio-Economic Problems

Coastal populations depend on inshore fisheries which are unregulated. Unrestricted coastal development is being promoted to encourage foreign exchange.

Mauritius

Three areas proposed as Marine Parks:

1. Baie de l'Arsenal: variety of marine habitats; superb intact reefs; geological, historical and aesthetic interest.
2. Le Chaland/Blue Bay: coral reefs; fringing mangroves; recreational interest.
3. Flat Island/Gabriel: extensive shallow corals; few maintenance personnel; no other inhabitants.

Maldives

Numerous atolls with fine coral reefs and sea-turtle nesting beaches. Corals are mined for construction and sale to tourists. Hawksbill Sea Turtle scutes (tortoise-shell) exported to Sri Lanka. Tourist spear-fishing. No reserves, parks or legislation controlling shell, coral or fish collection.

Personnel and Training Facilities

Marine sciences training facilities exist in Sri Lanka, India, Pakistan, Kenya and Tanzania. At the present time no fishery or marine science training is available in Somalia.

There are qualified scientists able to conduct baseline surveys in most of the areas recommended as potential marine parks and reserves. However, specific expertise in some fields may be lacking in this region.

Action Plan and Recommendations

1. That initial steps be taken to establish a survey group of experts familiar with the coastal regions of the north-west Indian Ocean. They should be familiar with the faunal and floral associations of this region, and the results of their survey should form the basis for recommending those areas of highest priority for National or International Marine Parks and Reserves;
2. That these survey groups consult surveys previously conducted in these areas. The experts in the group should include local workers and researchers familiar with coral reef, mariculture and pollution ecology;
3. That the specific sites mentioned in this report should receive priority for survey and planning, as being representative ecologically intact units.
4. That areas previously surveyed for marine park and reserve sites in Somalia, Kenya and Tanzania be given full support by the international organizations represented at this Conference. The areas include: Kisimayo and Lac Badane in Somalia; Kiunga-Lamu region in Kenya; and the Mafia Island-Rufiji Delta in Tanzania.
5. That existing biological laboratories in the countries of the north-west Indian Ocean be utilized in developing local centres for the training of biological, managerial and stewardship personnel for proposed National Marine Parks and Reserves. Financial and scientific support should be provided by national Governments and international conservation organizations.

d. Report of the Working Group on Regional and Park Planning1. National Planning

The planning for marine parks and reserves should be considered an integral part of national and regional land use planning. National land use planning teams should utilize the research findings and recommendations of experts in marine and wildlife affairs.

2. Regional Planning

Master planning for marine parks and reserves should consider regional implications and be implemented in various stages: a) site selection, b) site (resource) inventory, c) site planning, d) site design and e) site use. It should be recognized, however, that planning is a continuing process and related to changing conditions in the environment, human use and technological developments.

It is recommended that the following be considered as an outline for marine parks planning:

- A. Site selection: Depending upon available data, site selection may be based on three elements:
 - (a) physical character
 - (b) oceanographic phenomena
 - (c) ecosystems and their components
- B. Site (resource) inventory: Resource inventory provides data for rational development of those facilities necessary for park operation, including park management and recreation requirements.
- C. Site planning: Site planning answers the questions of what, where, and how to build (develop), and considers the capability of the resource for various types and intensities of use, as well as its carrying capacity in relation to management objectives. The site planning process must also consider human impact on the site, measuring the site's attractiveness, accessibility and need for supervision, and the visitors' environmental awareness.
- D. Site design: Site design ensures quality in design of facilities, spatial relationships, functions, and adherence to the natural character of the park.
- E. Site use: Knowledge of users' attitudes, preferences and behaviour will help in establishing controls on

number of visitors, length of stay, type of activities and services provided. Decisions made regarding administrative facilities, utilities, services and operations depend on the establishment of priorities.

Appendix 2

Resolutions and Recommendations of International Conferences
in recent years relating to Marine Parks and Reserves

1. First World Conference on National Parks,
Seattle, Washington
30 June - 7 July 1962

Recommendation No. 15

Whereas it is recognized that the oceans and their teeming life are subject to the same dangers of human interference and destruction as the land, that the sea and land are ecologically interdependent and indivisible, that population pressures will cause man to turn increasingly to the sea, and especially to the underwater scene, for recreation and spiritual refreshment, and that the preservation of unspoiled marine habitat is urgently needed for ethical and esthetic reasons, for the protection of rare species, for the replenishment of stocks of valuable food species, and for the provision of undisturbed areas for scientific research

THE FIRST WORLD CONFERENCE ON NATIONAL PARKS invites the Governments of all those countries having marine frontiers, and other appropriate agencies, to examine as a matter of urgency the possibility of creating marine parks or reserves to defend underwater areas of special significance from all forms of human interference, and further recommends the extension of existing national parks and equivalent reserves with shorelines, into the water to the 10 fathom depth or the territorial limit or some other appropriate off-shore boundary.

2. Regional Symposium on Conservation of Nature
- Reefs and Lagoons
5 - 13 August 1971
Nouméa, New Caledonia

Resolution No 8 - Marine Parks and Reserves

The Symposium:

Being concerned that representative examples of marine environments should be conserved for the benefit of the island peoples and the world at large because of their scientific and educational value and to ensure the survival of species

Recommends to all governments concerned that action be taken to create a range of underwater reserves and marine parks suitably and effectively protected under appropriate legislation.

3. 11th General Assembly of IUCN
Banff, Alberta, Canada
16 September 1972

Resolution No 11 Marine Parks and Reserves

Welcoming the active interest in many parts of the world, notably the Caribbean, the Mediterranean, the Tanzanian and Kenyan sectors of the East African coast, the Indian Ocean islands, Australia and South Africa, in the establishment and effective management of marine and national parks;

Noting that despite the prominence given to this issue at the Symposium on Conservation in the South Pacific Region held at Noumea in August 1971, the progress hitherto made in this matter in parts of the Pacific region is not yet in keeping with their high scientific interest;

The 11th General Assembly of IUCN meeting at Banff, Canada, in September 1972:

Urges governments concerned to promote the establishment of marine parks and reserves;

And in particular urges the Government of Fiji to take action in its archipelago of exceptional interest, where some of the reefs are under increasingly destructive pressure, and to give support to the efforts of the National Trust of Fiji in arousing public interest in this matter.

4. Second World Conference on National Parks
Grand Teton National Park, Wyoming, USA
22 - 27 September 1972

Recommendation No 4 - Marine Parks and Reserves

Recalling Recommendation 15 of the First World Conference on National Parks urging that governments extend national parks and equivalent reserves with shorelines to appropriate off-shore boundaries;

Expressing satisfaction at the action already taken by some countries to establish marine national parks and other protected areas to conserve underwater habitats of special significance, and sites where the remains of past cultures are to be found under the sea;

Being informed of action taken by IUCN to prepare guidelines for the establishment of marine national parks and other protected areas;

The Second World Conference on National Parks, meeting at Grand Teton National Park, USA, in September 1972:

Urges all governments concerned to set aside appropriate marine areas as national parks and reserves and to take action to extend the boundaries of existing terrestrial national parks and reserves to include representative marine ecosystems.

5. South Pacific Conference on National Parks and Reserves, Wellington, New Zealand, 19 - 27 February 1975

Recommendation No 6

Recalling Recommendation 4 of the Second World Conference on National Parks (Grand Teton National Park, USA, September 1972) concerning the establishment of marine national parks and reserves;

Recognizing that marine ecosystems are not easily protected by national parks and reserves covering limited areas, but that such protection requires a broad programme of conservation measures;

Being concerned at the irreparable damage to coral reefs, lagoons, mangrove forests and other marine sites through pollution, dredging, mining, land reclamation, dumping, dynamiting and other deleterious methods of fishing, shell collecting and other activities;

The South Pacific Conference on National Parks and Reserves meeting in Wellington, New Zealand, on 27 February 1975:

Urges the Governments of the region to take immediate action to control these damaging factors;

Recommends that action to conserve marine areas should include planning of coastal areas and control of destructive and disturbing activities both on shore and off shore;

Recommends also that the Governments of the region set aside appropriate marine areas as national parks and reserves and take action to extend the boundaries of appropriate existing terrestrial national parks and reserves to include representative marine ecosystems;

And recommends further, that the executive administration and control of such marine parks and reserves be vested in the same authority that administers and controls terrestrial national parks and reserves.

Appendix 3

LIST OF PARTICIPANTS

National RepresentativesBahrain

Mr. M.D. Nurun Nabi, Physical Planning Unit, Ministry of Municipalities and Agriculture, P.O. Box 53, Bahrain.

Egypt

Dr. Ali Ibrahim Beltagy, Institute of Oceanography and Fisheries, 101 Kasr El-Eini Street, Cairo, Egypt.

Ethiopia

Mr. Tadesse G. Michael, Wildlife Conservation Organization, P.O. Box 386A, Addis Abeba, Ethiopia.

Iran

Dr. Mohammad Reza Amini, Department of the Environment, P.O. Box 1430, Tehran, Iran.

Dr. Antoon de Vos (UNDP)
 Mr. B. Dolatshahi
 Mr. Cyrus Eilian
 Dr. F.A. Harrington Jr.
 Mrs. B. Khoshnevisan
 Mr. Ali Adhami Mirhosseyni
 Dr. Derek A. Scott
 Mr. Jack Wiles

Address of all the above-named is:

Department of the Environment, P.O. Box 1430, Tehran.

Kenya

Mr. Wilfred W. Asava, Kenya National Parks, P.O. Box 42076, Nairobi, Kenya.

Kuwait

Mr. Mohammad H. Al-Attar, Kuwait Institute for Scientific Research, P.O. Box 12009, Kuwait.

Mr. Abdullatif Al-Zaidan, Department of Agriculture, Ministry of Public Works, Kuwait.

Mr. Nassar A. Husain, Kuwait Institute for Scientific Research, P.O. Box 12009, Kuwait.

Pakistan

Mr. Syed Qadir Mohiuddin, Assistant Director, Marine Fisheries Department, Fish Harbour, West Wharf, Karachi, Pakistan.

Saudi Arabia

Mr. A.R. Nawwab, Marine Research Centre, Jeddah, Saudi Arabia.

Somalia

Mr. Muridi Ali Salah, Director, Technical Department, Ministry of Fisheries and Marine Transport, Mogadiscio, Somalia.

Sudan

Mr. A.M. Salih, Assistant Director, Fisheries Administration, P.O. Box 336, Khartoum, Sudan.

Representatives of International Organizations

International Union for Conservation of Nature and Natural Resources (IUCN)

Dr. Gerardo Budowski, IUCN, 1110 Morges, Switzerland.

United Nations Educational, Scientific and Cultural Organization (UNESCO)

Dr. Selim Morcos, Division of Marine Sciences, UNESCO, Paris 75700, France.

United Nations Environment Programme (UNEP)

Dr. Kai Curry-Lindahl, UNEP, P.O. Box 30552, Nairobi, Kenya.

IUCN Regional Consultants

African Coast

Dr. G. Carleton Ray (Chief Consultant on Critical Marine Habitats), The Johns Hopkins University, 615 North Wolfe Street, Baltimore, MD, 21205, U.S.A.

Mediterranean

Dr. Hedia Bacchar, 52 bis Avenue Jean Jaures, Tunis,
Tunisia.

Persian Gulf

Mr. Erik Carp, c/o Station biologique de la Tour du Valat,
le Sambuc, 13200 Aries, France.

Red Sea

Dr. R.F.G. Ormond, Department of Biology, University
of York, York YO1 5DD, England.

Sri Lanka, India, Pakistan and Islands of the North West
Indian Ocean

Mr. Rodney Salm, Vista do Mar, Glacis, Mahé, Seychelles.

Invited observers

Mr. Victor C. Anderlini, Department of Energy and
Environment, Lawrence Berkeley Laboratory,
University of California, Berkeley, California 94520,
U.S.A.

Mr. Saaïd Sheibani, National Iranian Oil Company Research
Centre, Tehran, Iran.