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SEALS

Proceedings of a Working Meeting of Seal Specialists on Threatened and Depleted Seals of the World;, held under the auspices of the Survival Service Commission of IUCN

18-19 August 1972 at the University of Guelph, Ontario, Canada

international Union for Conservation of Nature and Natural Resources
1110 Morges, Switzerland
April 1973

S E A L S

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The International Union for Conservation of Nature and Natural Resources (IUCN) was founded in 1948 and has its headquarters in Morges, Switzerland; it is an independent international body whose membership comprises states, irrespective of their political and social systems, government departments and private institutions as well as international organizations. It represents those who are concerned at man's modification of the natural environment through the rapidity of urban and industrial development and the excessive exploitation of the earth's natural resources, upon which rest the foundations of his survival. IUCN's main purpose is to promote or support action which will ensure the perpetuation of wild nature and natural resources on a worldwide basis, 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 foundation for saving the world's wildlife and wild places. It was established in 1961 under Swiss law and has headquarters near those of the International Union for Conservation of Nature and Natural Resources (IUCN). Its aim is to support the conservation of nature in all its forms (landscape, soil, water, flora and fauna) by raising funds and allocating them to projects, by publicity and by education of the general public and young people in particular. For all these activities it takes scientific and technical advice from IUCN.

Although WWF may occasionally conduct its own field operations, it tries as much as possible to work through competent specialists or local organizations.

Among WWF projects financial support for IUCN and for the International Council for Bird Preservation (ICBP) have highest priority, in order to enable these bodies to build up the vital scientific and technical basis for world conservation and specific projects. Other 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.

WWF's 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.

WORKING MEETING ON THREATENED AND DEPLETED SEALS

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PARTICIPANTS IN THE WORKING MEETING ON THREATENED AND DEPLETED SEALS

Professor K. Ronald (Chairman of the Meeting)
College of Biological Sciences
Department of Zoology
University of Guelph
Guelph, Ontario, Canada

* * * * * * * * *

Mr. K. W. Kenyon (Chairman, SSC Seal Group)
Bureau of Sport Fisheries and Wildlife
Building 192, NSA Sand Point
Seattle, Washington 90115, USA

Dr. H. D. Fisher (Member, SSC Seal Group)
Department of Zoology
University of British Columbia
Vancouver 8, British Columbia, Canada

Dr. A. W. Mansfield (Member, SSC Seal Group)
Fisheries Research Board of Canada
P.O. Box 450
Ste. Anne de Bellevue, Quebec, Canada

Professor M. Nishiwaki (Member, SSC Seal Group)
Marine Biology Division, Ocean Research Institute
University of Tokyo
Nakano, Tokyo 164, Japan

Dr. D. S. Sergeant (Member, SSC Seal Group)
Fisheries Research Board of Canada
Arctic Biological Station
P.O. Box 400
Ste. Anne de Bellevue, Quebec, Canada

* * * * * * * * *

By invitation

Dr. T. Benjaminsen
Fiskeridirektoratets
Havforskningsinstitutt
Nordnesparken 2
Postboks 2906
5011 Bergen, Norway

Mr. W. N. Bonner
Institute for Marine Environmental Research
Seals Research Division
c/o Fisheries Laboratory
Lowestoft, Suffolk, UK

Dr. A. W. Erikson
University of Minnesota
Minneapolis, Minnesota 55455, USA

Dr. R. J. Hofman
University of Minnesota
Minneapolis, Minnesota 55455, USA

Mr. F. O. Kapel
Greenland Fisheries Investigation
Jaegersborg Alle 1B
2920 Charlottenlund, Denmark

Dr. J. K. Ling
South Australian Museum
Adelaide 5000, South Australia

Dr. E. D. Mitchell
Fisheries Research Board of Canada
P.O. Box 450
Ste. Anne de Bellevue, Quebec
Canada

Dr. Y. Naito
Ocean Research Institute
University of Tokyo
Nakano, Tokyo 164, Japan

Mr. C. A. Repenning
US Department of Interior,
Geological Survey
Branch of Palcontology and Stratigraphy
345 Middlefield Road
Menlo Park, California 94025, USA

Mr. J. C. Walsh
(representing I.S.P.A.)
I.S.P.A.
655 Boyston Street
Boston, Massachusetts 02116, USA

Dr. C. W. Holloway (Ecologist, IUCN, Rapporteur)
IUCN
1110 Morges, Switzerland

* * * * * * * * *

Others who submitted Papers, but were unable to attend

Dr. A. Aguayo
Departamento de Oceanologia
Universidad de Chile
Casilla 13-D
Vina del Mar, Chile

Dr. V. A. Bychkov
Central Laboratory on Nature Conservation
Kravtchenko Street 12
Moscow V-331, USSR

Dr. R. M. Laws
British Antarctic Survey
Monks Wood Experimental Station
Abbots Ripton, Huntingdon, UK

Dr. T. Øritsland
Fiskeridirectoratets Havforskning Institutt
P.O. Box 2906
Bergen, Norway

Dr. R. T. Orr
California Academy of Sciences
San Francisco, California 94118, USA

Mr. D. W. Rice
National Marine Fisheries Service
Southwest Fisheries Center
P.O. Box 271
La Jolla, California 92037, USA

Dr. D. B. Siniff
University of Minnesota
Minneapolis, Minnesota 55455, USA

INTRODUCTION

The Survival Service Commission of the International Union for Conservation of Nature and Natural Resources has two principal functions: first, to collect and disseminate data on threatened species and, secondly, to initiate action to prevent their extinction.

The Commission has established a number of advisory groups of scientists to advise it on the formulation and execution of its programmes. Priority has been accorded to threatened species that require international cooperation for their effective conservation, and one of the earliest advisory groups to be formed was concerned with the study and conservation of seals. The Seal Group's business was conducted entirely by correspondence until mid-1972, when an opportunity arose to hold the first meeting of the Group.

On August 14th-17th 1972, a Symposium on the Biology of the Seal was held at the University of Guelph, Ontario, under the sponsorship of the International Council for the Exploration of the Sea (ICES), the International Commission for the Northwest Atlantic Fisheries (ICNAF), the International Biological Programme (IBP) and the University of Guelph. Seal biologists from all parts of the world attended this meeting and the sponsors very kindly agreed to IUCN organizing a small working meeting of members of the Seal Group and other invited scientists at the end of the Symposium.

The Working meeting was concerned with threatened and depleted seals of the world, and took place at the University of Guelph on August 18th-19th 1972. Working papers were presented on those seals currently listed in IUCN's Red Data Book as being under some threat of extinction, and on brief reviews of the status of all other seal species, with particular reference to populations that appeared to be in need of better management. Discussion of these topics was followed by a review of international research and conservation requirements, on which a number of recommendations were approved, the determination of priorities for action, and an examination of sources of funding and technical cooperation. In conclusion, proposals were made on the future functions and structure of the Seal Group.

This publication comprises a report on the meeting together with copies of the working papers that were presented. It is regarded as the first phase in the formulation of a series of projects designed to improve the status and management of seals whose world populations are threatened with extinction or have seriously declined.

IUCN wishes to record its thanks to the sponsors of the Symposium of the Biology of the Seal for permission to hold the meeting in conjunction with the symposium. The University of Guelph was particularly helpful, and provided numerous facilities and supporting staff that contributed greatly to the meeting's success. Appreciation is also due to the Union's sister organization, the World Wildlife Fund, which financed the attendance of certain participants and has provided funds for the publication of these proceedings.

C.W.H.

Working Meeting on Threatened and Depleted Seals of the World

REPORT ON THE MEETING

1. Introduction:

Professor Ronald welcomed delegates to the meeting on behalf of the Survival Service Commission of the International Union for Conservation of Nature and Natural Resources, which had organized the meeting, and the World Wildlife Fund, which had provided financial support.

There were two principal objectives. First, to examine the current status of those seals presently included in the IUCN's Red Data Book of threatened species and to make specific recommendations to improve their management. Secondly, to review the status of all seal species, to determine if there were others in need of special attention, and to identify existing or potential threats to the world's seal populations that required international measures to safeguard the resource.

It was proposed that a summary report on the discussions and recommendations arising from the meeting, together with the working papers, would be published in the IUCN Supplementary Paper series. The document would be endorsed to the effect that statements in the working papers were necessarily tentative and should not be quoted without reference to the respective authors. It was agreed that the proceedings and supporting papers should be published as outlined.

2. Election of Rapporteur:

Dr. Holloway was elected rapporteur.

3. Status and Conservation Requirements of Threatened and Depleted Seals:

(a) Northern Hemisphere:

Professor Ronald summarized his paper on the Mediterranean monk seal, Monachus monachus (Paper 1).

Dr. Sergeant provided a résumé of his discussions with Mr. Scott (UFAW), who had undertaken a recent survey of the species in Sardinia, and with Dr. Valverde, who was planning a conservation programme for the species in Spain and the Spanish Sahara (see Paper 13, p. 156).

Dr. Valverde hoped to have a post-graduate student working on the seal within a year. Mr. Kenyon agreed to send Dr. Valverde a summary of comparative biological data on the Hawaiian species.

The Mediterranean monk seal appeared to be nocturnal. It was not known if it inhabited caves by choice or as a result of human disturbance on beaches. Scott found that all the seals left a cave immediately humans entered and it seemed reasonable to assume that the seal was intolerant of human disturbance. If areas frequented by the seal were to be accorded reserve status, which was highly desirable, some caves must be prohibited to human visitors.

Mr. Kenyon and other speakers did not favour the proposal to introduce the Hawaiian monk seal into selected areas of the Mediterranean. The Hawaiian species migrated over long distances and, in any case, the U.S. Government would not permit translocation of the species at the present time. He was also dubious about keeping monk seals in captivity; captive specimens of the Hawaiian monk seals had rarely been successful.

Surveys to establish the present range of the species and thus where attention should be concentrated were considered to be of considerable importance. Professor Ronald named four tentative selections for early attention: The Spanish Sahara, Sardinia, the Greek Dodecanese and adjacent Turkish coast, and Caliacra on the Bulgarian coast.

It was agreed that early and decisive action was required if the species was to survive, that the IUCN should approach all governments of countries bordering the Mediterranean, Black Sea and African coast from Tangier to Dakar, to alert them to the problem and to seek legislative and other protection for the seal, that WWF should be requested to provide publicity, high level intervention where required and, ultimately, financial support for suitable projects, and that the University of Guelph should coordinate an expanded programme of distribution surveys and biological investigations. The proposal to capture one or two live specimens for studies on their physiology, behaviour and genetics was approved. It was considered that no large scale captive breeding programme should be undertaken until further experience in maintenance of the animals was available, and adequately protected areas had been established. The proposal to establish the Hawaiian species in the Mediterranean whilst the indigenous species was still extant was considered to be unacceptable.

Information on the status of the Saimaa seal Phoca hispida saimensis was summarized from the Red Data sheet by Dr. Holloway. It was hoped that Dr. Koivisto would submit a paper on this subject, but in the event he has been unable to do so.

It was felt that no specific recommendations could be made on the management of this very localized sub-species without up-to-date information. The meeting recorded its regret that Dr. Koivisto could not be present and agreed to recommend that IUCN, in consultation with its Seal Group, should take appropriate action when data became available.

Dr. Naito presented the working paper by Naito and Nishiwaki on the Kurile seal, Phoca kurilensis (Paper 3), and Dr. Mitchell summarized Dr. Bychkov's paper on the same subject (Paper 4).

The geographic range of this species needed to be determined before its status could be assessed accurately. There was no disagreement over its western limits but, whilst Dr. Naito and Prof. Nishiwaki believed that its eastern range extended only as far as the Aleutian Islands and west Alaska, the Soviet scientists, who regarded the animal as a sub-species of the harbour seal Phoca vitulina richardi, included the Pribilov Islands, Kamchatka and the north west coast of America within its range. It was agreed that Japanese taxonomic investigations should continue and that scientists in Canada, USA and USSR should be requested to re-examine the geographic variation of the animal within their territories. An examination of the skull and hyoid was considered sufficient to distinguish it from other species, although it was suggested that electrophoretic examination might also be desirable. In the meantime, it was agreed to regard the Japanese description of the geographic range as definitive until further information became available.

It was recommended that Karaginski, Commander, Fox, Shikotan, Demin, Panfilyev, Makanrushi, Simushir, and Iturup Islands in the USSR be considered as seal reserves. In Hokkaido, the Daikoku and Moyururi islands were already protected and no other areas within this region appeared to merit special consideration at the present time.

Dr. Mitchell summarized Dr. Bychkov's papers on the Laptev walrus Odobenus rosmarus laptevi (Paper 5) and the Atlantic walrus Odobenus ro3marus rosmarus (Paper 6). Mr. Benjaminsen summarized Dr. Oritsland's paper on the Atlantic walrus in the Svalbard (Spitzbergen) region (Paper 7) and Dr. Mansfield presented his paper on the Atlantic walrus in Canada and Greenland (Paper 8). Mr. Kapel provided additional information on the Greenland populations. Catches in the Molsteinsborg area of western Greenland were low and had decreased over the

past twenty years, but in other areas (eg. Thule and Scoresby Sound) where hunting was heavier, there was no regular or reliable information. Walrus populations on the east coast were believed to be fairly low.

As a basis for discussion, a table of rough estimates was compiled of the original and present population sizes of the species as a whole. In the north Pacific the species had declined from about 200,000 to 125,000, in the north-west Atlantic from about 40-50,000 to 10-20,000, in the north-east Atlantic and Kara Sea from about 50-100,000 to 1-5,000, and in the Lapter Sea from about 10,000 to 4,000.

It was agreed that the Pacific sub-species was under no threat and need not be considered further by the meeting. It was recommended that the Laptev walrus be considered as a separate sub-species. The north-east and north-west populations of the Atlantic walrus appeared to be distinct, although there was little evidence at the present time of precise taxonomic distinctions. The geographic range, discreteness of populations and taxonomy of the sub-species was recommended for further study.

It was agreed to recommend to the Government of the USSR that the main hauling-out areas of the Laptev walrus (listed in the first paragraph of Dr. Bychkov's paper in Paper 5) be considered for reserve status, and that losses due to native hunters and to scientific or exploratory expeditions be assessed and that all possible measures be taken to reduce this drain on the populations.

In regard to the North Atlantic walrus, it was recognized that the Canadian populations were currently under no threat. The introduction of "snowmobiles" had greatly reduced the taking of walruses for dog meat but, on the other hand, the very rapid increases in Eskimo populations and the increasing use of walrus tusks for carving could reverse current trends. The consensus of opinion was that no change was required in the present quotasystem for walrus kills, but it was felt that, ultimately, maximum catch limits for all stocks would probably be required and that the matter should be kept under review.

It was recommended that the Danish Government be urged to speed the establishment of the proposed national park in north-east Greenland (which would benefit numerous other species besides the walrus) and to increase study effort on the status, range and taxonomy of the walrus in Greenland waters.

It was agreed that the Government of Norway should be commended for its efforts to restore the Atlantic walrus in the Svalbard and neigh-

bouring regions. It was suggested that population surveys of walruses and polar bears might be combined in these areas.

It was recommended that the Government of the USSR be asked to consider establishing reserves for this species in its major hauling out areas in the Novaya Zemlya region (listed in the first paragraph of Dr. Bychkov's paper in Paper 6) and to take appropriate measures to improve its conservation.

It was recommended that IUCN include a separate sheet in its Red Data Book for the Laptev walrus. Although Canadian populations of the Atlantic walrus were currently regarded as safe, its populations in the north-east Atlantic were precarious, utilization of arctic resources was still subject to rapid change, and it was felt that a Red Data sheet for this sub-species should be retained for the present.

Professor Nishiwaki summarized his paper on the Japanese sea lion Zalophus californianus japonicus (Paper 9). He expressed grave doubts as to whether the sea lion was still extant. It was possible that it still occurred in some of the secluded bays along the east coast of the Korean Peninsula but he had been unable to establish contact with marine biologists in the countries concerned.

It was recommended that IUCN request the Governments of the Republic of Korea and the Democratic People's Republic of Korea to initiate surveys of their east coasts to determine if the sea lion were still extant. Professor Nishiwaki agreed to provide IUCN with background data on the identification, habits and general biology of the animal, as far as they were known, for transmission with these appeals.

Mr. Kenyon presented his paper on the Guadalupe fur seal Arctocephalus townsendi (Paper 10).

Although the species populations were increasing quite rapidly, they still numbered less than a thousand, and there were disturbing rumors of plans to develop the island as a tourist resort or even as a sheep ranch. Human disturbance could still pose a threat to the survival of the species. Mr. Kenyon referred to two documented cases of rookeries of fur seals that disappeared from St. Paul's Island around 1900 and 1914, as a result of disturbance from nearby villages.

It was agreed that the Mexican Government should be congratulated on the restoration of the species and for its foresight in declaring the island a wildlife sanctuary as early as 1922. Attention should be drawn to the problem of human disturbance, however, and the Government requested either to declare the entire island a strict nature reserve

or, alternatively, to declare the island a National Park and to accord strict nature reserve status to the seals' whelping grounds, including buffer zones around these areas of at least a quarter of a mile in width.

Mr. Kenyon summarized his data on the status of the Hawaiian monk seal Monachus schauinslandi (Paper 11).

In spite of adequate protection from hunting, the population of this species, in total, appeared to be in decline. The principal cause of this trend was almost certainly human disturbance of nursing females and their young by tourists, and military and coastguard personnel, although the possibility that tags on the flippers of marked animals were encouraging predation by sharks could not be excluded.

It was agreed to recommend to the United States Government that appropriate action be taken to ensure that monk seal nursing females and their pups should not be approached or disturbed in any way, that human disturbance of all seals on presently uninhabited islands be minimized, and that military personnel be prohibited from Eastern island and the Seal, Rocky and Dynamite islets at Midway Atoll, in the hope that their beaches might be recolonized by the monk seal. Dogs on Kure Atoll were considered to be a significant factor in the monk seal's decline and the Government should be requested to eliminate dogs from the island. In addition, it should be proposed that tagging of monk seals be restricted to one atoll only and that studies be initiated to determine if tags encouraged shark predation on seals.

Information on the Caribbean monk seal, Monachus tropicalis, was summarized from the Red Data sheet by Dr. Holloway. It was noted that Mr. Rice hoped to submit a paper on this subject for inclusion in the proceedings (see Paper 12).

Mr. Kenyon was not optimistic about the survival of the species. It occurred off islands that had high human populations but was intolerant of disturbance; in the past, the seal had been persecuted relentlessly by fishermen. Mr. Walsh confirmed this view. The ISPA had issued a circular, in English and Spanish, throughout the Caribbean, offering a $500 reward for information on recent sightings of the species, but there had been no response.

In view of the re-discovery of other seal species that had once been considered extinct, however, the meeting decided that the problem merited a concerted effort to determine the precise status of the species and to provide a basis for its effective conservation. Although cooperation of all research and conservation agencies operating

in the Caribbean was considered most desirable, the main thrust should consist of the fulltime employment of a research student to compile all available data on the species' biology and former occurrance and to initiate and coordinate inquiries into its present whereabouts.

Dr. Sergeant presented his review paper on the current status of seals in the Northern Hemisphere (Paper 13). The paper raised a number of fundamental issues of concern to the conservation of the world's seal resources as a whole, and it was agreed that consideration of these items should be deferred until international conservation requirements were discussed. The present discussion would be concerned with national and international study and management problems in respect of individual species. The status of all species in the northern hemisphere was reviewed, but recommendations were confined to those considered to be in need of specific attention.

The harbour seal Phoca vitulina was in no danger of extermination as a species but the meeting expressed grave concern over the future of certain populations. In Washington State there had been a 50% reduction in harbour seal populations within recent decades, apparently as a result of general human disturbance such as boat traffic. It was recommended that the governments concerned should organize a status survey of harbour seal populations along the west coast of North America from British Colombia to Baja California, with particular reference to regions with rapidly expanding human populations. The survey should make arrangements for continued monitoring of this species in this region. The problems of bounty systems, particularly in the maritime provinces of Canada and the Baltic, and pollution, particularly in the North Sea, were also considered but it was agreed that these problems should provide the basis for formal resolutions (see Recommendations 1.2 and 1.3).

In regard to the bounty system for harbour and grey seals Halichoerus grypus in the Baltic, however, Mr. Bonner agreed to investigate the problem in more detail and to inform IUCN if more specific action was both desirable and feasible (see Appendix 2).

It was agreed that the Government of the USSR should be commended for its work in the restoration of the White Sea stocks of the harp seal Pagophilus groenlandicus. It was noted that the Government of Norway, through special regulation and restriction of sealing in the Barents Sea, had contributed to the restoration of the White Sea - Barents Sea population. There was considerable public interest in the conservation of this species and the meeting considred that there was a need for a factual summary of the current status and management of the

species throughout its range, which could be made readily available to the public. It was agreed that Drs. Sergeant, Øritsland and Popov should be requested to revise and, if necessary, to expand the 1969 IUCN statement on this subject. The revised statement would be reviewed by the Seal Group prior to publication.

Attention was drawn to resolution No. 4 of the third bi-annual meeting of the IUCN/SSC's Polar Bear Group (Morges, February 1972) which identified the ringed seal Phoca hispida as the main food source of the polar bear and recommended Arctic nations to support studies and conservation programmes for the species. The meeting did not accept the implication that little research work had been undertaken on the ringed seal and listed the following persons or institutions that were, or had been, engaged in its study:

USA	J. Burns (University of Alaska) University of Washington, Seattle
Canada	M.M.R. Freeman (Memorial University of Newfoundland) J.R. Geraci (University of Guelph) A. Haller (University of Western Ontario) K. Ronald (University of Guelph) T.G. Smith (Arctic Biological Station, Ste. Anne de Bellevue) I. Stirling (Canadian Wildlife Service, Edmonton)
Greenland	F.O. Kapel (Greenland Fish. Investig. Denmark)
Norway	T. Øritsland (Institute of Marine Research, Bergen)
Sweden	S. Søderberg (Nat. History Museum, Stockholm)
Finland	I. Koivisto (State Game Research Institute, Helsinki)
USSR	E.A. Tikomirov (Pinro, Arkhangelsk)

Some concern was expressed over the possibility that the ribbon seals Histriophoca fasciata and bearded seal Erignathus barbatus might be overexploited by present or future harvesting by Soviet vessels operating in the Bering and Okhotsk Seas. US scientists had been un-

able to obtain any recent information on this subject from the USSR. Dr. Mansfield stated, however, that there had been regular exchange of data for these areas between Soviet and American scientists at the time of the 1970 and 1972 Fur Seal Commission meetings and he agreed to examine the relevant reports and to inform IUCN if any intervention appeared to be necessary.

The hooded seal Cystophora cristata appeared to be under no threat, but more information was required on this species. It was agreed to recommend to the Governments of Canada, Denmark and Norway that intensive investigation into the population dynamics and biology of the species should be continued and expanded throughout its geographical range.

A discussion on the approved status of the northern elephant seal Mirounga angustirostris included reference to San Miguel Island, which is unique in that six species of pinnipeds occur on its beaches. In order of abundance they are the California sea lion Zalophus californianus, the northern elephant seal Mirounga angustirostris, the harbour seal Phoca vitulina, the northern fur seal Callorhinus ursinus, the Stellar sea lion Eumetopias jubata, and the Guadalupe fur seal Arctocephalus townsendi. The last species is quite rare but its visits as a wanderer are increasing in number each year; five sightings were recorded last year. With increase in the Guadalupe Island population, they will certainly become more common on San Miguel Island, where they were once very abundant.

It was agreed to recommend that the island should be accorded reserve status and used as a study area for investigations into general seal biology and particularly re-colonization by fur seals. The present jurisdiction of the island was complicated, however, and the US Naval Department, the California State Legislature, and the North Pacific Fur Commission would all need to be consulted over such a proposal, Mr. Kenyon agreed to investigate the matter and to provide IUCN with the elements for the correspondence that was likely to be required.

Finally there was a discussion on the status of seals that occurred in inland waters. There were no recent data readily available on certain of these species and it was recommended that IUCN should propose to the Government of Canada that an investigation into the taxonomic and conservation status of the freshwater harbour seal in Quebec Province should be undertaken. It should also request information on the current status of seal species in the Caspian Sea and Baikal and Ladoga Lakes from the Government of the USSR.

(b) Southern Hemisphere:

It had not proved possible to find an author for the paper on the status of the Galapagos fur seal Arctocephalus galapagoensis in time for the meeting, but, shortly afterwards, Dr. Robert Orr agreed to prepare a paper on this subject (see Paper 14). For the purposes of the meeting, Dr. Holloway summarized the information from the Red Data sheet.

Tourist use of the Galapagos Islands was already established and was very likely to increase. Mr. Kenyon referred to an experiment with Northern fur seals in which pups subjected to human disturbance weighed significantly less than undisturbed animals. He considered that tourist disturbance on beaches could pose a serious problem unless steps were taken to restrict it.

It was agreed that relatively little was known of the population status and biology of this sub-species and that contact should be made with the Charles Darwin Foundation concerning the preparation of a research project. Attention should be drawn to the problem of tourist disturbance of seals and the need for education of visitors in this regard.

Dr. Hofman summarized the paper by Siniff, Erickson and Hofman on the status of the Ross seal Ommatophoca rossi (Paper 15). Although the authors stressed that very little was known on the ecology, activity patterns, or behaviour of the species, they did not consider it a threatened species. The total population was probably at least 100,000. It was basically a pristine resource that had not been exploited commercially, nor was it likely to be. In any case, the absence of aggregation and its restricted habitat would protect it from commercial harvesting other than from ice-breakers. It was noted that Soviet scientists were active in Ross seal population and biology studies.

It was agreed to recommend the deletion of the Ross Seal from the Red Data Book, but to stress that the species was still little known and that further scientific investigation into the population status, biology and behaviour of the seal should be actively supported.

Mr. Bonner summarized the paper on the Juan Fernandez fur seal Arctocephalus philippii (Paper 16) by Dr. Aguayo and provided additional background information from other publications cited in the paper.

It was noted that although the islands apparently had reserve status, protection for this species was only nominal. Fishermen did shoot a few seals each year but the effect was negligible. Numbers were in-

creasing quite well and there was every possibility of a population explosion in the near future.

It was agreed to commend the Chilean Government on the restoration of the species but to stress the need for improved protection and continued biological study. The necessity of adequate measures to prevent tourist and other forms of human disturbance around hauling out grounds should be stressed.

Dr. Ling presented Dr. Laws' paper on the current status of seals in the Southern Hemisphere (Paper 17). It was again agreed that discussion of conservation issues affecting a variety of species, such as the Antarctic Convention, should be deferred to the aection on international conservation requirements.

The absence of recent data on population sizes and trends of the southern sea lion Otaria flavsecens (= byronia) was noted and it was agreed to recommend to the governments within whose jurisdiction it occurred that further investigation into the current population status of this species should be undertaken. The Falkland Islands were recommended for particular attention.

It was agreed to recommend to the Australian and New Zealand Governments that further study and censusing to provide more precise estimates of stocks should be undertaken in respect of the Australian sea lion, Neophoca cinerea and New Zealand sea lion Phocarctos hookeri. Protection of these species was adequate but current estimates suggest very low populations.

Mr. Walsh had been informed of plans to undertake a substantial annual harvest of sea lions and/or fur seals off the Peruvian Coast. Concern was expressed over this news as there appeared to be relatively little data on sizes and recruitment rates of these stocks. It was recommended that the IUCN should request further information from the Peruvian Government.

4. Discussion of International Research and Conservation Requirements:

It had been agreed that this discussion should be restricted to fundamental needs for the conservation of world seal resources or of regional populations of more than one species. Recommendations arising from the discussion would be covered by formal resolution as far as possible.

Whilst accepting that the scope and efficiency of exploitation of the world's fish resources would inevitably increase, the meeting was concerned that the resulting competition between man and seals for this

food resource could result in a serious depression of seal populations in many regions of the world. A resolution on this subject was approved (see Recommendation 1.1).

Similarly it was recognized that competition between seals and man for fish resources often necessitated control of seals, but it was agreed that such control operations required to be monitored if fear of local extirpation was to be minimized. An appropriate resolution was drafted and subsequently approved (Recommendation 1.2).

The consensus was that bounty systems were not an efficient method of regulating seal populations, but it was felt that the preceding resolution covered the main points of concern and that no formal resolutions on bounties was required at this time.

Recent research had suggested that harbour seal populations in the vicinity of the Rhine estuary had been reduced substanially as a result of pollution. It was noted that other factors such as interference with the water regime in the North Sea/Baltic region may also be involved in decline of seal stocks in this area. A resolution on this problem is contained in Recommendation 1.3.

During the meeting, frequent reference had been made to the adverse effects on certain seal populations of human disturbance to nursing females and young. Many countries were almost certainly unaware of this problem, which was likely to worsen in response to increasing tourist use of presently remote beaches. Visitor education programmes, provision of viewing facilities, and better planning of tourist utilization to this effect was approved (see Recommendation 1.4) in which the SSC/IUCN Seal Group proposed to offer an advisory service to governments through the IUCN.

There were still gaps in the current knowledge of the range, population dynamics and general biology of stocks of certain seal species. A fifth resolution (Recommendation 1.5) was passed drawing attention to the need for research effort by countries that had seal populations within their jurisdiction but no study programmes at present.

A number of participants expressed the view that whilst the IUCN Red Data Book provided a form of early warning against extinction of species or sub-species, it provided no insurance against loss of discrete populations of a species, if it were still reasonably secure in other areas. Dr. Holloway stated that the IUCN was well aware of this problem but that the Red Book was a list of priorities, and to include individual populations of a species would make it unmanageable and would dilute the urgency of situations where an entire species was threatened. It was suggested that, as a matter of policy, IUCN should be opposed to introduction of species into areas where closely

related indigenous taxa already existed. It was pointed out, however, that IUCN already had a policy statement on the introduction and reintroduction of species that had been published in IUCN Bulletin 2 (9) 1958.

Finally, there was discussion on the recent Convention for the Conservation of Antarctic Seals. The general reaction to the Convention was certainly favourable, but Dr. Erickson proposed three amendments to its terms for the meeting's consideration, and, if approved, onward transmission to SCAR.

The six sealing zones proposed for the Antarctic were based on the original whaling areas adopted by the International Whaling Commission. It was agreed that these rather arbitrary boundaries should be replaced by divisions based on ecological considerations. Dr. Erickson agreed to submit a note and a map on alternative ecological zones, which could be used in the submission to SCAR (see Appendix 1).

The present arrangement whereby seal exploitation in the Antarctic would occur in five of the six zones in any one year, with a reserve zone to be rotated annually, was considered to be unsatisfactory. It was agreed to recommend that exploitation should be restricted to one defined area until population sizes and species response to exploitation could be assessed. The data could be used in the formulation of more specific management proposals for other zones, which would probably include a permanent reserve zone for comparative studies. The third proposal, that scientific data collection on the Ross seal would be best served by permitting commercial exploitation of the species, was rejected. It was agreed that the present arrangement whereby a protected species could be taken on scientific permit was preferable.

5. Determination of Priorities for Action including Delineation of Projects:

The principle need for a list of priorities was to ensure that the limited funds available for conservaton work were put to the most effective use. Many of the proposals made at this meeting were, in fact, directed at Governments, which could probably implement them without outside financial support.

Within the immediate field of interest of the meeting, however, it was agreed that there were two main priorities. A conservation programme for the monk seals merited the first priority. It was agreed that an IUCN project should be prepared in draft by Mr. Kenyon (Hawaiian and Caribbean species) and Professor Ronald (Mediterranean

species). The draft would be circulated to the Seal Group for comment and subsequently revised by the IUCN Secretariat.

Second priority was accorded to a programme for the Guadalupe, Galapagos and Juan Fernandez fur seals. Although the numbers of at least two of these taxa were increasing satisfactorily, all three were still low in total population size and regarded as vulnerable to some degree. It was agreed that the immediate aim should be to provide official finance for a permanent research worker in each area whose expenses might ultimately be taken over by the respective governments. The research worker would undertake studies on the seals, including the assessment of human disturbance and means to alleviate it, and ensure that the population would be kept under regular surveillance. IUCN would be requested to raise these proposals with the Governments concerned and projects should be formulated with the aid of the Seal Group, on the basis of their response.

6. Sources of Funding and Technical Cooperation:

Professor Ronald proposed to continue his survey of the status and distribution of the Mediterranean monk seal over the next couple of months for which no outside funding was required.

Mr. Kenyon stated that the US Bureau of Sport Fisheries and Wildlife had an old project on the Caribbean monk seal and that, if approached by IUCN, the Bureau might fund the Caribbean species section of the monk seal section. Alternatively, Dr. Ling proposed to explore the possibility of student participation in this project under an exchange system operating between universities in the Atlantic provinces of Canada and the University of the West Indies.

It was noted that recommendations for research investigations into the Kurile seal and the Atlantic walrus, for example, could probably be financed by Governments or National Research Institutions under existing programmes.

In the field of technical cooperation the meeting recorded its regret that there were no delegates from Finland, Latin America and USSR, although representatives had been invited. It was hoped that these countries would be represented at the next meeting.

It was recommended that the Seal Group establish closer liaison with organizations such as ICNAF, FAO and UFAW (the North Pacific Fur Seal Commission, the Sealing Commission for the North East Atlantic and SCAR were subsequently suggested as additions to this

list) and that consideration should be given to inviting representatives of these organizations to attend the next meeting.

7. Future Structure and Functions of the SSC Seal Group:

The meeting confirmed its approval of the proposal that the Seal Group should act as an advisory body to SSC/IUCN on all species of seals and their conservation. Under these circumstances, it was necessary to revise the Group membership to provide for better geographic representation, including the reduction of present membership from countries or regions that are already well represented. Candidates from Australia, Latin America and South Africa were recommended for the Group. It was agreed that the final compilation of the new Group should be the Group Chairman's responsibility, and Mr, Kenyon agreed to reorganize the Group on the basis of the foregoing advice and to submit the names of its members to the Executive Officer of the SSC in the near future.

It was agreed that one of the immediate services that the Group could provide to IUCN was to keep it informed of developments in the seal research and management field, particularly in regard to conservation matters arising from national or international meetings.

Another function suggested was that the Group could offer editorial comments on manuscripts in the seal/marine mammal field prior to publication. In this connection it was noted that R. Harrison's "Handbook of Marine Mammals" would be sent for publication soon and that the Group would be prepared to comment on it, if the author was agreeable.

8. Any other business

It was agreed that the Group should meet again to review progress and developments in this field either in two years time or at the next International Seal Symposium which was tentatively scheduled to take place at Guelph in 1975. A final decision on this subject would be made by the Group early in 1974.

It was agreed that a press release on the meeting should be prepared by Dr. Holloway, in consultation with Professor Ronald and Mr. Repenning. (See Appendix 3.)

INTERNATIONAL REQUIREMENTS FOR CONSERVATION OF SEAL RESOURCES 1972

Recommendations of the SSC/IUCN Seal Group

First Working Meeting
Guelph, Ontario, Canada: 18-19 August 1972

Recommendation 1 - Effect of Extensive Fisheries on Seal Populations

The SSC/IUCN Seal Group:

Considering the rapid development of intensive fisheries in many ports of the world;

Realizing the dependence of many seal species on the same species of fish that are utilized by man;

Noting, with concern, the possible effects:
of high level catches of Alaska pollack (Theragra chalcogramma) and other fish in the Bering Sea on the fur seal (Callorhinus ursinus),

of rapidly growing fisheries for capelin (Mailotus villosus) and polar cod (Boreogadus saida) in the north Atlantic ocean on the harp seal (Pagophilus groenlandicus),

of intensive fisheries for Notothenia rossi around sub-Antarctic islands on the elephant seal (Mirounga leonina);

Recommends to IUCN that the attention of major fishing nations and international fishery agencies be drawn to the urgent need for research into the effects of commercial fishing operations on seal populations, and the desirability, when setting maximum quotes for fish species, of allowing margins sufficient for maintenance of reasonable population levels of predator seals, whether or not these seals are currently exploited by man.

Recommendation 2 - Surveillance of Seal Populations subjected to Control Measures

The SSC/IUCN Seal Group:

Recognizing that the predatory and other habits of seals may be inimical to fishing interests and that, for this reason, seal populations may be maintained at levels below their natural size;

Recommends to IUCN that it urges all nations concerned to monitor carefully such reduced populations, in order to avoid the risk of local extirpation.

Recommendation 3 - Pollution and Development of the North Sea and Baltic Sea

The SSC/IUCN Seal Group:

Believing that the harbour seal Phoca vitulina around the North Sea and Baltic Sea coasts is under some degree of threat from pollution and the use of estuaries for water storage;

Noting that seals may have value as indicators of the health of estuaries and coastal regions;

Recommends to IUCN that it urge all European Governments on the North and Baltic Sea coasts, or that have rivers which drain into these seas, to take all possible measures to curb pollution, and to assess the effects of water storage schemes and other forms of development that might impair the quality of the coastal environment, with a view to reducing such impairment;

Recommendation 4 - Human Interference and Seal Populations

The SSC/IUCN Seal Group:

Recognizing that human activity on seal hauling out grounds, particulary disturbance of nursing mothers and their young, can cause significant mortality among seal populations;

Realizing that this problem will become more acute as a result of increasing tourist and other human use of presently remote beaches;

Noting that visitor education programmes, provision of viewing facilities, and better planning of beach utilization can alleviate this problem;

Recommends to IUCN that the attention of all nations concerned be drawn to this problem and to the SSC/IUCN Seal Group's proposal to offer an advisory service to nations that arc already involved in, or are contemplating, tourist or other development of seal beaches.

Recommendation 5 - National Programmes for Seal Research

The SSC/IUCN Seal Group:

Recognizing that there are still numerous gaps in current knowledge of the geographical and taxonomic range, population dynamics and general biology of many stocks of seal species;

Noting that certain countries have seal populations within their jurisdictional boundaries but have no seal research programmes;

Recommends to IUCN that it requests all nations concerned to encourage or initiate scientific research on their seal populations.

Paper 1

The Mediterranean Monk Seal, *Monachus monachus*

by

K. Ronald

College of Biological Sciences

University of Guelph

Guelph, Ontario

INTRODUCTION

Although the Mediterranean monk seal was first described by Hermann in 1779 from a male caught off the Dalmation coast (18), it was well known prior to this date by the residents of the area (11, 27). The Greek classicists Plutarch, Pliny, Homer and Aristotle wrote of seals (40, 23, 27), and they were included in Aristotle's famous Historia Animalia. In mythology, seals were put under the protection of Poseidon and Apollo because the animals exhibited a "love" of the sea and the sun. Even then the animal's docility and intelligence were noted.

Prior records of the Mediterranean monk seal have come down to us from bones found in upper Paleolithic levels at Grimaldi (11, 27). Many place names in the Mediterranean are associated with the monk seal, eg. Phocis, an ancient Greek district, Foca in Turkey and Foca in Yugoslavia (22), Fokari in the Dodecanese (Ronald, unpublished). Coins of 500 B.C. have been found bearing the seal's head indicating its place in history (21, 23). The name "phoca" is Greek for a swollen or plump animal and it was first applied, not in the taxonomic sense to the monk seal.

Apart from ancient mythology other superstitions have become associated with this species. Seal hunting appeared to be important in ancient Greece and folklore built up so that some believed boats, tents, and dresses made of seal fur gave protection against lightning (23). A skin drawn around a field and then hung on a door would save that field from hail storms (27). On a more personal basis, a man sleeping with the right flipper under the head would be cured of insomnia (23, 27). It is of interest that today a different belief exists in Lebanon, where the fishermen admit to the belief that a monk seal killer will die suffering horribly in a matter of a few days (Le Cavelier, personal communication).

Historically, a fourteenth century map shows an island in the Canary group named Ya de Vegi marini, island of seal wolves, today called Lobos Island. In 1341 seals were included in an inventory of the Canary Islands, and in 1434 industrial exploitation commenced in the bay of Rio de Oro (30).

At the time of Admiral W. H. Smyth's travels in the early nineteenth century, it was reported that seals were abundant around Alexandria and Benghazi (35).

The monk seal may well have been one of the first phocids to be displayed publicly as it was exhibited in France and Germany in 1760, Nimes in 1777 (10, 27), London in 1082, 1894, 1910 (27) and much more recently in France, and from 1958-1969 in Rodos*. The seal holding tank of the Rodos Aquarium was rebuilt in 1971 but still remains empty (Ronald and Tsimenidis, unpublished).

Distribution

Apart from the classical references the distribution is vague but cosmopolitan in the warn; seas of Europe and North Africa. The records are not enhanced either by the seal's secretive habits, or its predisposition to breed in caves, often with underwater entrances. The monk seal is usually reported at night at sea or by day on shore, but the latter sightings are usually on inaccessible ledges and/or inhospitable coasts.

Records of sightings both historical (Fig. 1) and recent (Fig. 2) come from the Almeria, Spain, Cabrera, Balearic Islands (42, 4), Toulon, Corsica, Gulf of Cagliari, Sardinia, Is. of Pelagosa in the Adriatic (25), Gulf of Quarnero and Fort Opus in Yugoslavia (28), Chilia and St. George Arms of Danube (39), Sable Ecrene, Gulf of Salonika, Greece (28), Rodos, Karpathos, Kasos, Simi, Kalymnos, Kos, Nixi, Zafinos and Kastellrizo (Ronald and Tsimenidis, unpublished), Cape Caliacra, Black Sea, Bosphorus, Tantoura, El Arish (6), Fethiye and Simbalou in Turkey (Manus, personal communication), Islands off Turkey, Port Said (19, 42), Marmorica coast of Cyrenaica, Libya (35), Oran, Madeira (19, 42) and Deserta Grande Islands, Canary Islands (19, 38, 29, 29, 32, 30), African coast including Cap Barbas, Baie d'Etoile, Baie du Levrier to Cap Blanc, Cape Verde Islands (31, 36, 16, 1, 13, 42, 23, 33, 29, 19).

The above distribution may now be historical and it would be better summed up as Caliacra on the coast of Bulgaria; remote islands of the Greek Dodecanese, the adjacent Turkish coast (Ronald unpublished); Sardinia; islands between Canaries and African coast, and Cap Blanc (40). In physical terms the southern limit of the monk seal is approximately 20° 49' N with a temperature limitation corresponding to the 20 C winter isotherm (9, 29).

* Live specimen in Lisboa Aquarium

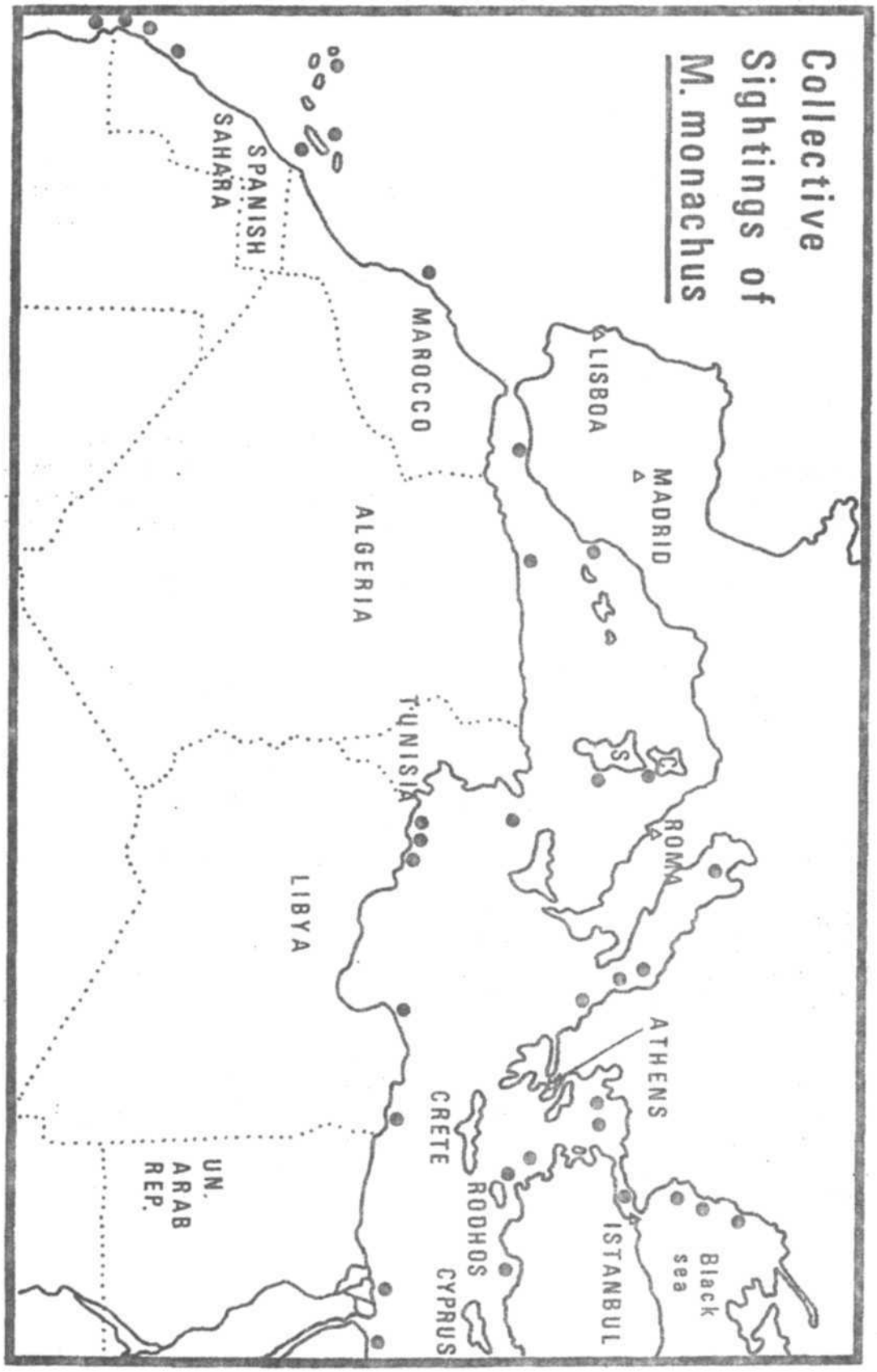
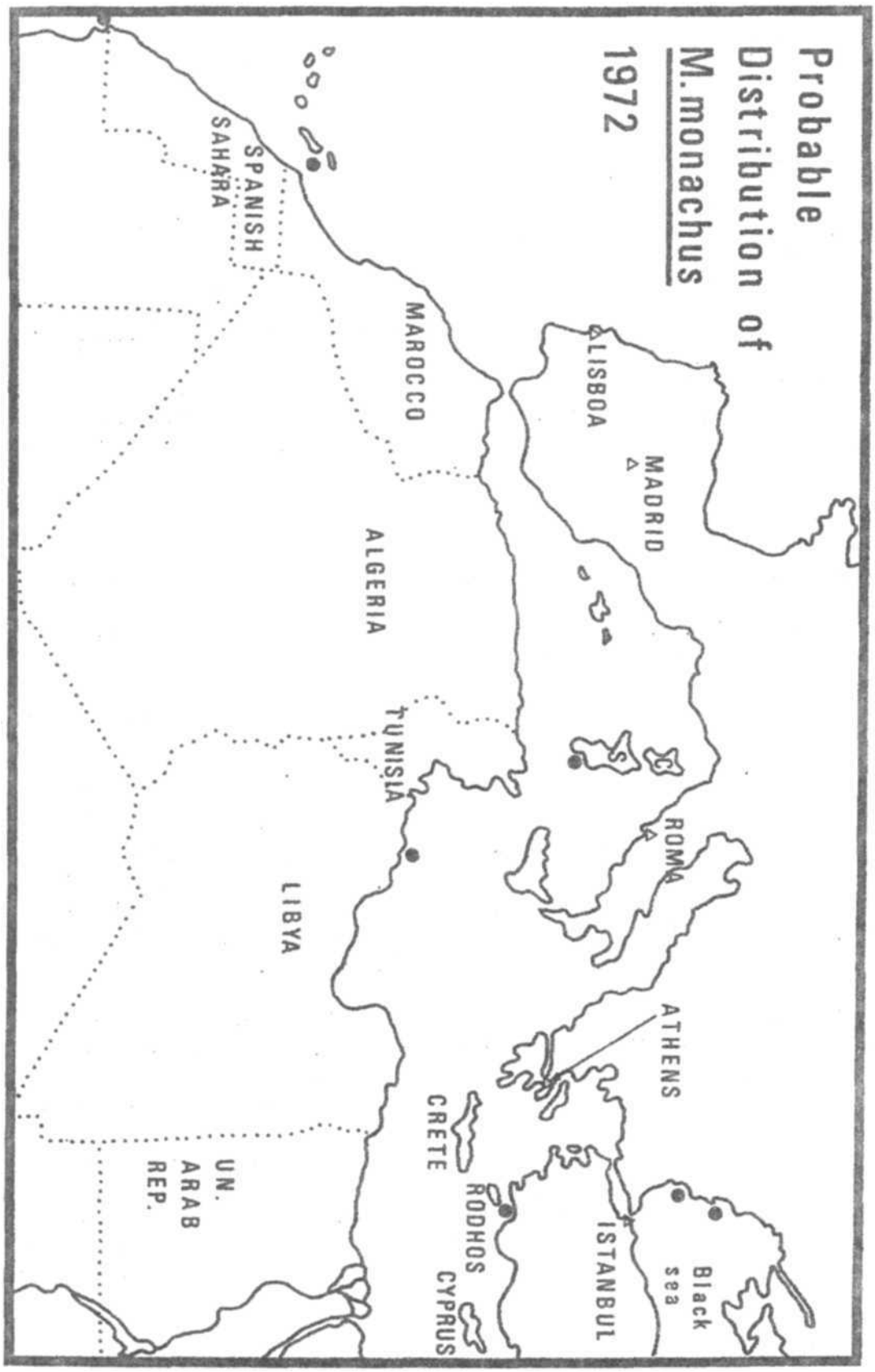

Collective
Sightings of
M. monachus
SPANISH
SAHARA
MAROCCO
ALGERIA
TUNISIA
LIBYA
UN.
ARAB
REP.
LISBOA
MADRID
ROMA
ATHENS
CRETE
RODHOS
CYPRUS
ISTANBUL
Black
sea

Figure 1


Probable
Distribution of
M.monachus
1972
SPANISH
SAHARA
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CYPRUS
ISTANBUL
Black
sea

Figure 2

Description

Taxonomy

The published descriptions of the monk seal are as varied as its distribution. The original scientific description by Hermann (18) was the first for any of the three monk seals (M. monachus, M. tropicalis and M. schauinslandi) and was made from a specimen stored in Strasbourg. He named it P. monachus. Later Buffon (1782) described the same animal without realizing that Hermann had already done so. In 1785 Boddaert (7) using Buffon's description renamed the seal Phoca albiventer. The generic name Monachus was first suggested by Flemming in 1822 (15). Synonomy exists in the names Phoca bicolor, Phoca leucogaster, Phoca hermanni, Phoca crinita, Monachus mediterraneus, Leptonyx monachus, Leptorhynchus monachus, Pelagios monachus, Pelagius sp., Pelagus sp., Pelagias sp. and Rigorn sp. (22).

Morphology

Seal pups, at birth, are approximately 1 m in length and weigh - 20 kg. Their coats vary in colour from dark brown to black and the fur is soft and woolly, 1.0 - 1.5 cm in length, and does not lie close to the animal's body (17, 23, 34).

Female seals are more like the pups than adult males in their colouring; the fur being dark brown with yellow tips and with no light ventral patch (19). The mature females weigh from 62.5 to 302 kg and measure approximately 280 cm (22, Ronald unpublished), although there is one reference to a 380 cm long animal (39). There is variation in colour in adult males from dark brown to black with slight yellowish patches along the centre of the back and belly. The hair of adult seals is short 0.5 cm in length, bristly, lying close to the animal's body (34, 27). The animal's whiskers are light yellow to brown and smooth; in cross section they are oval shaped (34, 27, 39).

Seals from the Black Sea are described as being grey and showing a brownish hue dorsally, and ventrally they are yellowish-white. There is a definite dark dorsal stripe, varying from 30-18 cm from the sternum to the caudal region (1). This same group of seals has broad heavy teeth with the normal 2 incisors in each side of the jaw. Their recorded lengths and weights have shown considerable variation due not only to individual differences but also due to the age of the animal concerned. The tail is darker with yellowish edges. On ventral parts in the anal region there is a small area of dark brown fur. Front limbs are darkish brown in inner parts and light brown on outer parts (39).

Internal Anatomy

In an 62.5 kg. 1.54 m long seal the liver was voluminous, up to 2.25 kg., the brain weighed 365 g, the nine lobed kidneys weighed 280 g for the right and the left 258 g, the structure similar to that of the bear. The intestines and partially filled stomach (988 g) weighed 3.6 kg. The total length of the intestines was 8.74 m. The large intestine however was typically short, measuring only 0.4 m in length (39).

There are some morphological differences in the skull conformations of the young and old seals, mainly in the conformation of the nasal bones and the development of the occipital crest and zygomatic arch.

The dental formula is i $\frac{2}{2}$, c $\frac{1}{1}$, m $\frac{5}{5}$ (2) in the adult M. monachus, whereas the milk dentition is $\frac{2}{2}\frac{1}{1}\frac{3}{3}$. There is a profound difference in the dentition of the three species of Monachus (22).

The monk seals are closely allied to the Antarctic seals and have similar structural characteristics. They have unusual skulls with the brain case approximately equal in length and breadth, and an elongated parallel sided orbital region (22) .

The oesophagus is situated mainly to the left of the trachea. The heart is oval shaped. The larger blood vessels are dilatable. The venous sinus is a dilation of the inferior vena cava and is comparatively large. The left renal vein is almost as large as the large vena cava and is formed by the union of 3 large vessles and the superficial plexus of the kidney. The gall bladder is multinucleate. The left lung is larger than the right. The bladder wall is very thick, the prostate reduced, the penis measures 8 cm in length, with a baculum 7.8 cm long (27, 114, 22).

Breeding

Little is known of the breeding habits of the monk seal. It is believed to have a gestation period of 11 months (41). The pups being born on land in September and October and not entering the water until they are weaned from their tetra mammate mother, at 6 - 7 weeks. The seals remain with their mother for three years, breeding at 4 years of age (27, 19). As the complete breeding cycle takes 13 months, breeding probably occurs every second year (22, 19).

The breeding colonies are believed to exist along the coast of Rio de Oro on the Tropic of Cancer, the Spanish Sahara (42, 12, 33, 22, 24), the Turkish coast between Izmir and Antalya and the nearby Greek Islands, and possibly within the Black Sea, near the mouth of the Danube and Cape Caliacra, Bulgaria (39). It appears that the breeding population of the

Cape Verde Islands may no longer exist (J. Preto, Junta de Investigacoes do Ultramar, personal communication).

Food

The nutritional sources vary from the green algae (39) to eels, carp, whiting, sardines, bonito, octopus (J. Preto, personal communication), lobsters (6, 17), herring (3), Dentex, Labra (8, 22), mackeral (39, anchovy, plaice, flounder (23), other flat fish (27), and other fish species. There are records of seals eviscerating fish (17), eating fish head first, and feeding only while in water (22).

Behaviour and Physiology

The very few references to the behaviour of the monk seal mostly refer to its phonations. When annoyed or wounded it makes a noise similar to a wounded dog, yelping, barking and howling (27, 33, 39).

The only other references are to the monk seals secretive habits and its utilization of inaccessible or difficult to reach areas making it hard to census (27). The seal apparently does not migrate for any distance (27, 39) and nothing is known about its physiology. In oaptivity in Greece a specimen was reported as being somewhat aggressive and this may well have been why it survived for eleven years (Y. Ionnis, personal communication).

Parasites and Disease

The helminth fauna of the gastrointestinal tract is fairly diverse, with records of the nematodes Contracaecum sp. in great quantity (39); C. osculatum (20, 5, 26), Terranova (synonym of Porrocaecum and Phocanema) decipiens in lesser numbers (39), and Anisakis pegroffi (22). The Cestoda are represented by Diphyllobothrium sp. (39), specifically coniceps, elegans, lanceolatum, hians, latum, and Diplogenophorus tetrapteus; Bothriocephalus sp., and an immature form under the name 'Cysticerus cellulosae' (22). In a Black Sea monk seal, swellings were found, containing cestodes which completely occluded the intestinal lumen. These swellings were repeated down the intestinal tract becoming fewer near the junction of the small with the large intestine (39).

In some skeletons examined there has been evidence of ankylosing spondylitis, and osteoarthritis of the lumbar-sacral joint (23).

Population Estimates

There are no accurate data for the ratio between the sexes of M. monachus. For a related species (M. schauinslandi), the ratio was 51% male to 49% (37). The capture records of M. monachus show a predominance of females. This may be due to the female's habit of searching further afield for food than the male, hence it is more likely to be captured (39).

Population estimates for a sensitive, secretive, amphibious marine mammal are always tentative but there would seem to be agreement as all data indicate a decreasing population. Estimates made in the last two decades range from a maximum of 5000 (27, 23), through a more cautious 1000 to 5000 (38), to less than 500 (19, 13). More recent local estimates for Lebanon were 60 in 1952, and 20 in 1972 (Le Cavelier, personal communication), for Cyrenaica 20-30 individuals (35), Port Etienne-Cap Blanc 200 plus, Dodecanese 200 plus with numerous (60) sightings of young and old animals in 1972 (Ronald and Tsimenidis, unpublished), and a Black Sea group of 100 (39).

An estimate of 500 - 1000 Mediterranean monk seals would be enticing, and perhaps just as justifiable as any other at present.

If the feelings of Greek fishermen are any indication of the universal attitude towards the monk seal there may be little possibility of mairitaining the species at any level. They are, with few exceptions, considered as pests, confused with the small whales and blamed for any failure of the fishery. In fact, many sightings are most likely of dolphins, as fishermen do not, in many cases, discriminate between the two marine mammals. In 1971 the dolphin was still bountied. The use of nylon nets and the expanding fishing industry have already had some effect on the population (39). The expanding popularity to humans of insular areas of the Mediterranean and African coasts may drive the secretive monk seal to its physiological limits. The increasing pollution of beaches by human and agricultural wastes, the effluents of increasing industrial expansion and housing developments, the advent of new methods of travel over, on and under water, may well force the monk seal outside its present geographical limits. As it now represents one of the two relic species of seals in the world, it may have little chance to escape its climatological limits.

RECOMMENDATION

1. The population is now estimated at between 500 - 1000 this may well be the last time any recommendations can be of value, hence there should be immediate and decisive action if this species is to survive.

2. The World Wildlife Fund be approached to support such an operation both, through its good offices in the procedures of internal and external affairs of those countries concerned, and through financial support.

3. The study of the distribution and incidence of the monk seal be continued and expanded under the auspices of the governments concerned. The University of Guelph is ready to coordinate this research.

4. That all governments holding territorial limits bounding the Mediterranean Sea (in its total sense), Black Sea, and the coast of Africa from Tangier to Dakar be requested to include the Mediterranean monk seal, M. monachus, in their protective legislation.

5. Immediate measures be made to live capture a select group of M. monachus for study of their physiology and behaviour.

REFERENCES

1. Allen, G.M. 1939. Order Pinnipedia. In: A checklist of African mammals. Harvard Univ., Mus. Comp. Zool., Bull. 83. pp. 247-249.

2. Allen, J.A. 1887. The West Indian seal (Monachus tropicalis (Gray)). Amer. Mus. Natur. Hist., Bull., 2:1-39.

3. Bacescu, M. 1948. Foca un animal pe cale de disperitie in Marea Neagra. Rev. Stiint "V. Adamachi", 34(1).

4. Barcelo y Combis, F. 1875. A puntes para la fauna Balear. Soc. Espan. Hist. Natur., An., 4:53-68.

5. Baylis, H.A. 1937. On the ascarids parasitic in seals, with special reference to the genus Contracaecum. Parasitology, 29:121-130.

6. Bertram, G.C.L. 1943. Notes on the present status of the monk seal in Palestine. Soc. Preserv. Faun. Emp. (now FPS) J., 47:20-21.

7. Boddaert, P. 1785. Elenchus Animatium. 1. Quadrupedia. Rotterdam.

8. Boettger, C.R. 1951. Notizen zur Verbreitung and ueber die Verwandtsehaftsbeziehungen der Moenchsrobbe (Monachus albiventer Boddaert). Zool. Anz., 147:303-310.

9. Budker, P. 1945. Pinnipedes et sireniens d'Afrique. Notes Afr., 27:4-6.

10. Buffon, G.L. de, 1782. Histoire naturelle. Supplement 6. Paris.

11. Clark, J.G.D. 1952. Prehistoric Europe. The Economic Basis. London.

12. Cousteau, J.Y. & Dumas, F. 1953. The silent world. London.

13. Curry-Lindahl, K. 1970. Large mammals in Europe. New Sci., (May): 372-375.

14. Dieuzeide, R. 1927. Sur quelques points d'anatomie du phoque moine de la Méditeranée (Monachus albiventer Bodd.). Sta. Agr. Pêche, Castiglione, Bull, 2:215-249.

15. Flemming, J. 1822. The philosophy of zoology. 2. Edinburgh: Archibold Constable.

16. Flower, S.S. 1922. Notes on the recent mammals of Egypt, with a list of the species recorded from that kingdom. J. Zool. (1932): 369-450.

17. Gavard, 1927. Observations sur le phoque moine Monachus albiventer Bodd. faites au laboratoire de Castiglione. St. Agr. Pêche, Castiglione, Bull., 2:175-211.

18. Hermann, J. 1779. Beschreibung der Moenchs-Robbe. Beschaef. Berlin Ges. Naturforsch. Fr., 4B:456-509.

19. International Union for Conservation of Nature and Natural Resources, 1966. Red Data Book, 1. Mammalia. I.U.C.N., Morges.

20. Joyeux, C. & Baer, J.G. 1936. Cestodes, . Faune de France. 30.

21. Keller, D. 1887. Thiere des Claosischer Alterthums. Innsbruck.

22. King. J.E. 1956. The monk seals (genus Monachus). Brit. Mus. (Natur. Hist.), Bull., Zool., 3:201-256.

23. King. J.E. 1964. Seals of the world. London: Brit. Mus. (Natur. Hist.).

24. King, J.E. 1965. The monk seal of the Pacific. Z. Säugetierk., 29.:37-42.

25. Kuhn, O. von. 1930. Die Robben der Adria. Zool. Gart., n.f., 2:194-197.

26. Markowski, S. 1952. The cestodes of pinnipeds in the Arctic, and other regions. J. Helminthol, 26:171-214.

27. Maxwell, G. 1967. Seals of the world. London: Constable & Co. Ltd.

28. Mohr, E. 1952. Die robben der Europaischen Gewasser. In: Monographien der Wildsäugetiere, 12. Frankfurt am Main: Verlag Schoeps.

29. Monod, T. 1923. Note sur la presence du Monachus albiventer Bodd. sur la côte Saharienne. Mus. Nat. Hist. Natur., Bull., 29:555-557.

30. Monod, T. 1932. Phoques Sahariens. Terre & Vie, 12:257-261.

31. Monod, T. 1945. Un ordre nouveau de mammifères pour la faune d'A.O.F. Motes Afr., 25:14-15.

32. Monod, T. 1948. Le phoque moine dans l'Atlantique. Inst. Zool. Porto, Publ, 34:1-19.

33. Morales-Agacino, E. 1950. Notes sur les phoques moines (Monachus monachus Herm.) du littoral saharien Espagnol. Mammalia, 14:1-16.

34. Mursaloglu, B. 1964. Occurence of the monk seal on the Turkish coasts. J. Mammal., 45:316—317.

35. Norris, W.J.T. 1972. Monk seals in Libya. Oryx, 11:328-330.

36. Postel, E. 1950. Un phoque tropical: le phoque moine. Nature (Paris), 3187:341-342.

37. Rice, D.W. 1960. Population dynamics of the Hawaiian monk seal. J. Mammal., 41:376-385.

38. Scheffer, V.B. 1958. Seals, sea lions and walruses. A review of Pinnipedia. Stanford, Calif., Stanford Univ. Press.

39. Schnapps, B., Hellwing, S., Chizelea, G. 1962. Contributions to the knowledge of the Black Sea Seal (Monachus monachus Herm.). Bucharest. Muz. Nat. Ist. Natur. "G. Antipa", 3:383-400.

40. Scott, W.N. 1971. Monk seals in Sardinia. Univ. Fed. Anim. Welf., Res. & Field Invest., Rep. Acc. 1970-1971: 31-33.

41. Troitzsky, A. 1953. Contributions à l'étude des pinnipèdes à propos de deux phoques de la Méditerranée ramenés de croisière par S.A.S. le Prince Rainier III de Monaco. Inst. Oceanogr. Bull., (Monaco), 1032.

42. Wijgnarden, A. van. 1962. The Mediterranean monk seal. Oryx. 6:270-273.

Paper 2

Extract from the IUCN's Red Data Book:-

SAIMAA SEAL

Phoca hispida saimensis (Nordquist, 1099)

Order PINNIPEDIA Family PHOCIDAE

STATUS Rare. Confined to the Saimaa Lake system, Finland. Numbers reduced to 40 in 1958 by persecution; populations have now increased as a result of legal protection, and control of certain populations is necessary. Parts of Saimaa Lake are avoided by the seals because of pollution. A management plan for the maintenance and regulation of populations is needed, and pollution must be controlled.

DISTRIBUTION A relict that existed in the early post-glacial period between the Baltic and White Sea. Confined to the Lake Saimaa system for some 8,000 years. Probably three separate herds exist at present in Saimaa Lake and a series of connected lakes to the north-east. The town of Savonlinna, which is located on s, narrow strait separates the southern and central herds, and the long, narrow Hanhivirta Sound probably isolates the eastern herd from: the remainder. (1; A. Haapanen 1966, pers. comm,; H. Luther 1966, pers. comm.)

POPULATION In 1958, total population estimated at 40; in 1966, sample counts by the State Game Research Institute suggested an increase in the total population to approximately 200-250 animals. (A. Haapanen 1966, pers. comm.) The increase occurred apparently as a result of legal protection. The earlier decline probably resulted from persecution by local people, particularly fishermen. Following complaints from fishermen in the early 1960's, the Ministry of Agriculture issued licences (16 in 1965/67) to shoot seals in the area of denset population. (A. Haapanen 1966, pers. comm.)

HABITAT Freshwater lakes. Saimaa lake occurs at an altitude of 76 m and is cut off from the sea. (1) The southern part of Lake Saimaa has become badly polluted in recent years and is now avoided by the seals. (A. Haapanen 1966, pers. comm.)

CONSERVATION MEASURES TAKEN Totally protected by law since 1958. The State Game Research Institute has been undertaking ecological studies on the seal since the mid-1960's.

CONSERVATION MEASURES PROPOSED Pollution of the lake system must be curbed and a management programme developed for the maintenance and regulation of seal populations.

REFERENCE 1. Scheffer, V.B. (1958): Seals, sea lions and walruses. Stanford: Stanford University Press.

Paper 3

Kurile Harbour seal (Phoca kurilensis)

by

Yasuhiko Naito and Masaharu Nishiwaki

Ocean Research Institute,
University of Tokyo,
Nakano, Tokyo, Japan

INTRODUCTION

In recent years, concern about the Kurile seal Phoca kurilensis (= Phoca insularis) is increasing; however, information on this seal is quite inadequate and it is difficult to review its status. In this paper, information on this seal in Hokkaido is based on the investigations performed by us from 1969 to 1971.

Concerning the scientific name, McLaren (1966) used Phoca kurilensis instead of Phoca insularis, recognizing the priority of Inukai (1942). In this paper we also employ the name Phoca kurilensis.

History

Discussions on the Kurile seal seem to be originated from the report by Inukai (1942). He reported the new harbour seal Phoca ochotensis var. kurilensis (Phoca ochotensis is a synonym of Phoca vitulina largha) from the southern Kurile Islands and Hokkaido. However, unfortunately his morphological key was only pelage, and he had not referred to the clear keys such as skull. Afterwards Scheffer (1956, 1958) introduced Inukai's paper, and did not recognize the new seal reported by Inukai, but suggested it to be one of many synonyms of P. v. largha. However, in the southern Kurile Islands, Belkin (1964) and Belkin et al. (1969) studied the same seal as Inukai reported, and gave a new species name Phoca insularis to this seal showing clear morphological and ecological differences.

Concerning the origin of this seal, we may trace it to Allen's report (1902). He reported phoca stejnegeri basing on the specimens collected by Stejneger from Commander Islands in 1083. Since the skulls and dentitions of P. stejnegeri are quite similar to those of P. kurilensis collected by us in Hokkaido, we suppose that this seal seems to be a

synonym of P. kurilensis. However, pelage colouring seems to resemble to that of P.v. largha rather than P. kurilensis.

Morphology

Pelage colouring of P. kurilensis differs in our data from that of P.v. largha collected from the southern Sea of Okhotsk. Its general landscape is much darker than P.v. largha both in the back and ventral, and this characteristic colouring gives rise to the common name of "Kurofu or black-pattern seal". Concerning the patterning on the back, there are several clear white rings ranging 9 x 3.5 cm to 3 x 2.6 cm (Belkin et al, 1969) . There are also a few specimens which do not show such clear white rings. On the ventral side, there are not so clear patternings but brownish irregular and unclear patternings are shown. New born pups bear no white coat; however, we exceptionally collected one new born pup from Nemuro Peninsula which bears creamy white coat (Naito and Nishiwaki, 1972).

Concerning the body length, this seal is larger than P.v. largha. The finally attained mean body length, is suggested to be about 186 cm in male and 169 cm in female, whereas the finally attained mean body length of P.v. largha is 170 cm in male and 159 cm in female (Naito and Nishiwaki, 1972). In our study the maximum body length of this seal is 191 cm in male and 186 cm in female, but Belkin et al. (1969) reported the maximum body length to be 181 cm in male.

Birth length is also larger in this seal. The mean body length of 20 new born pups with umbilical cord is 980 mm, whereas birth length of P.v. largha is estimated to be about 850 mm (Naito and Nishiwaki, 1972) and 76-81 cm (Tikhomirov, 1971).

Concerning the skull osteology, description was already made by Belkin (1964) and Belkin et al. (1969). We also examined the skulls of 32 males and 62 females in P.v. largha, and 21 males and 32 females in P. kurilensis. General view of skulls of two seals resembles each other, but clear differences between two seals were observed in following points. The skull of P. kurilensis is larger than that of P.v. largha in zygomatic breadth, mastoid breadth, height of brain case, rostral breadth, breadth and height of lower jaws, and well-developed sagittal crests were observed only in P. kurilensis (Naito, in preparation). Furthermore, we found the difference of hyoid bone as a clear key to distinguish the two seals. In P.v. largha well-developed basihyoid bone, thylohyoid, keratohyoid, epihyoid, stylohyoid and tympanohyoid bones are observed. However, in P. kurilensis no tympanohyoid bone is observed and the stylohyoid bone is very much smaller than that of P.v. largha (Naito, in preparation).

Geographical range

Information on the distribution of P. kurilensis is very scanty inspite of increasing interest in this seal in recent years. Inukai (1942) suggested that this seal is distributed along the Pacific coast from Hokkaido to the northern Kurile Islands. Belkin (1964) collected many samples and made observations in the southern Kurile Islands, and he stated that this seal stays on the coastal area throughout year. The southern limit of the distribution is suggested to be Point Erimo (Inukai, 1942), and our studies support him. On the other hand, the north-east limit of its distribution is still unknowm. Inukai (1942) first suggested that the north-east limit of the distribution is the northern Kurile Islands; however, Allen (1902) reported P. stejnegeri from Commander Islands of which skulls resembled the skulls of P. kurilensis. Belkin et al. (1S69) also collected P. kurilensis from the same islands and east coast of Kamchatka, and moreover they suggested that the Pribilov Islands may be included in the extended distribution area. We suppose there should be some discussions whether their distribution area extends to Pribilov Islands; however, recently Fay and Burns found seals from western Alaska which have the incomplete hyoid bones like P. kurilensis, and they also found that P. richardi has complete hyoid bones like P. v. largha (personal communication, 1972). Therefore, the seals found by them seem to be P. kurilensis rather than P. richardi. From these findings, the distribution cf P. kurilensis seems to extend far east along the Aleutian Islands to western Alaska. But we are still not sure where the eastern limits of the distribution are and how they relate with P. v. richardi.

Hauling ground in Hokkaido

P. kurilensis does not migrate offshore but stays in coastal areas throughout year: the hauling grounds are formed on the coast of small islands or rocky reefs which are well protected from outer threats or waves in the southern Kurile Islands (Belkin, 1964; Belkin et al., 1969). In Hokkaido, such hauling grounds were also observed. According to the fishermen and hunters in Hokkaido, there are several hauling grounds where pupping takes place. Such hauling grounds are distributed along the Pacific coast from Point Erimo, the southern limit, to Nemuro Peninsula (Fig. 1). All of the hauling grounds in Hokkaido are formed not in sand coast but in narrow rocky shores under cliffs of small islands or rocky reefs which seemed to be well protected from outer threats, and they usually sank under water in the time of high tide, so that seals cannot haul out every time.

On these hauling grounds pupping takes place in May, except Point Erimo where pupping season is from late May to the end of June or, rarely, to the beginning of July, According to the hunters, the new born pups go

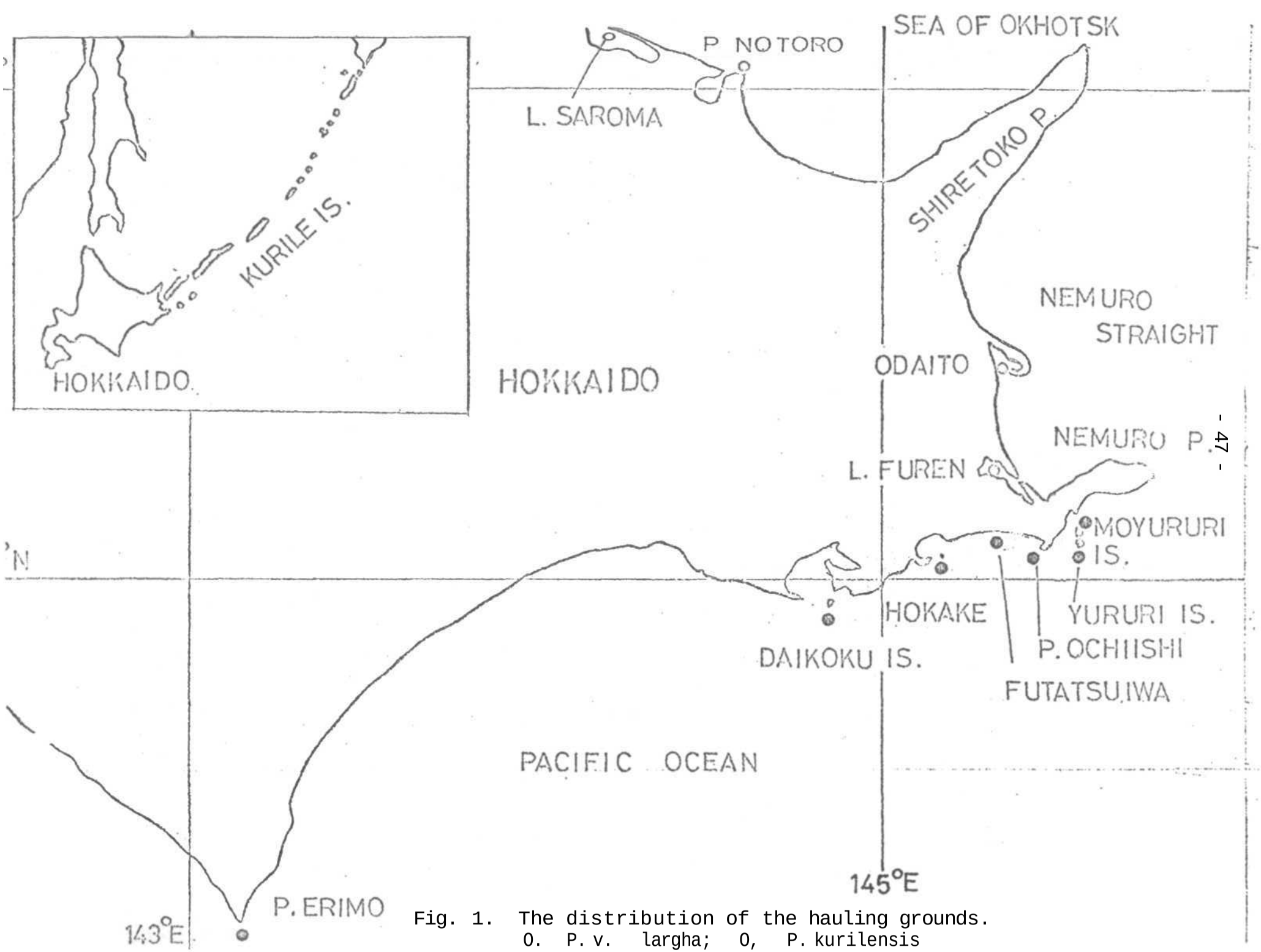

Fig. 1. The distribution of the hauling grounds.
O. P. v. largha; O, P. kurilensis

into the water with their mothers soon after birth. Weaning occurs at about the end of June, 1.5 months after birth (Naito and Nishiwaki, 1972). Before weaning pups were observed with mother and seemed not to move from one hauling ground to another.

Population size

In this paper, most of the information on the population numbers in hauling grounds comes from fishermen and hunters, as follows:

Point Erimo: seals appear from the end of April and disappear at the end of October. The maximum population number is supposed to be about 150 in August.

Daikoku island: seals appear around this island and Akkeshi Bay throughout year. Population numbers became maximum in breeding season (May). The number on the hauling ground is about 50-100 individuals.

Hokake reefs: seals appear throughout year and population number is about 50-100 individuals in spring and autumn.

Futatsuiwa island and reefs: seals appear throughout year except January and February when the sea begins to freeze along the coast and drifting ice floes corns through Nemuro Strait. Numbers increase in May when pupping begins to take place. Maximum populations seemed to be about 50-100 individuals.

Moyururi island: we made the observation on this island from the 9th to the 13th of June 1969, from the 2nd to the 6th of April 1970, and from the 22nd to the 26th of June 1971. In the first observation the maximum of 75 individuals, including 4 pups, were observed. In the second and third observations, we found 92 and 85 (including 7 pups), respectively.

Other places: there are some other places where these seals haul out. Shiranuka coast, Ochiishi coast and Yururi island are known as hauling grounds; however, population numbers are not so large.

It is quite difficult to estimate the population size by counting the number of seals on hauling grounds. We do not know their minor movements from one hauling ground to another, or seasonal migrations along the coast between Hokkaido and Kurile Islands. We do not know the widely dispersed population along the coast, and besides their landing behaviours are also unknown. We are very much lacking in such information; however, very rough population sice can be given as mentioned above.

Russian biologists made an investigation of the southern Kurile Islands in August 1963 and found this seal in all of 28 southern Kurile Islands (Belkin, 1964; Belkin et al., 1969). In these investigations the largest population was observed in Maloi island (676 individuals); also, 286 seals in Schikotan island, 238 in Iturup island, 148 in Makanruski island, 100 in Demina island, 80 in Lisink island and 92 in Simushir island were observed. About 1700 seals in total (except pups) were found in the 28 southern Kurile Islands, and the total population was estimated to be 2000-2500 (Belkin, 1964). However, we suppose this number is a low estimation. In recent years the distribution of this seal seems to extend as far east as the Aleutian Islands or. western Alaska, Therefore, the population could be more than double Belkin's estimation. But we suppose its population would not be large as P.v. largha, for its habitat is limited to the narrow islands.

REFERENCES

1. Allen J. 1902. The hair seals (Family Phocidae) of the North Pacific Ccean. Bull. Amer. Mus. Nat. Hist. 16:459-499.

2. Belkin, A.N. 1964. A new kind of seal from the Kurile Islands. Doklady Abaci. Nauk. S.S.S.R. 158 (2): 1217-1220 (in Russian).

3. Belkin, A.N., G.M. Kosygin & K.I. Panin. 1969. Marine mammals. Academy of Sciences of U.S.S.R. and Ministry of Fisheries of U.S.S.R., Moscow. 157-175.

4. Inukai, T. 1942. Hair seal in our northern waters (1). Shokubutsu Dobutsu 10 (10): 927-932 (in Japanese)

5. McLaren, I.A. 1966. Taxonomy of harbour seals of the western North Pacific and evolution of certain other hair seals. J. Mamm., 47 (3): 466-473.

6. Naito, Y. & M. Nishiwaki. 1972. The growth of the harbour seals in the adjacent waters of Hokkaido. Sci. Rep. Whale Res. Inst, 24 (in press).

7. Scheffer, V.B. 1956. Little known reference to name of a harbour seal. J. Wash. Acad. Sci., 46: 352.

8. _____, 1958. Seals, sea lion and walruses. A review of the Finnipedia. Stanford Univ. Press. 173.

9. Tikhomirov, E.A. 1971. Body growth and development of reproductive organs of the North Pacific Phocids. Pinnipeds of the North Pacific. Israel programme for scientific translations, Keter Press, Jerusalem. 213-241.

Paper 4

The Kurile Harbour Seal = Pagophobic Harbour Seal

by

V. A. Bychkov

Pacific Research Institute of Marine Fisheries and Oceanography

U.S.S.R.

Phoca vitulina richardi Gray, 1864; Phoca stenegeri D. Allen, 1902; Phoca ochotensis kurilensis Inukai, 1942; Phoca insularis Belkin, 1964.

The specific status of pagophobic form of the spotted seal is well substantiated (14, 15, 16).

Distribution

This seal has been knov7n from the 18th to the 19th centuries from the northern part of the Pacific Ocean, as well as from the Bering and Okhotsk Seas (9, 13, 17). At present it is known from Point Barrow (10) to Mexico (3, 0, 18); in Asia its range includes coastal regions from Karaginski Island to Hokkaido (1, 2, 5).

Biological Features

The adult animal is 160-179 cm in length (2) and weighs 59-73 kg (19); newborn pups 87-91 cm and 10-12 kg (19). Most males mature in the 5th to 6th year (4), females at 3 years (3,4,8). The gestation period is 10.5 months (3). The pups are born from the end of April to July (2), or from the end of May to June (8), or from June to September (3). Lactation continues for 4-6 weeks (3, 8, 19), or 2 weeks (2). Mating occurs two weeks after lactation (3). Ovulation was observed in September (3, 8, 19). Delayed implantation (latent time) occurs for 1.5 to 2 month,", 97% of the females remain productive for 28 years. The maximum longevity is 30 years (3).

Moulting is slow and has two peaks of activity, one April-May the other August-September (21). The main food is fish and invertebrates, namely Theragra ehalcogramma, Hexagrammus superciliosus, Thaleichthys pacificus, Clupea pallasi, Pleuronectidae, Gadidae, Salmonidae, Brachyura sp. Paroctopus apollyon (11, 12).

Population status

The total population along the coast of America is estimated at 50,000 to 200,000 (18). Recently, the numbers in British Columbia have been estimated both at 17,000 - 20,000 (20) and 35,000 (3, 8); near Tudjidak Island as 12,000 - 17,000 (4), and along the Alaska coast as 6,000 (11). In Asia, there are only estimates for the Kurile population, they are believed to number 2,000 (2).

Habitat

The habitat condition has not been studied to any great extent.

Research and conservation

The distribution, biology, numbers, and taxonomy of local stocks are being studied on the Kurile and Commander Islands by the Pacific Research Institute of Marine Fisheries and Oceanography (PINRO). Since 1970, the commercial harvesting (2, 13), as well as sport and amateur hunting (5) of pagophobic spotted seals in the waters of the Soviet far east have been prohibited. The relative scarcity of this form along the Asiatic coasts has caused it to be included in the List of Rare Animals by the USSR (5).

Conclusion

Considering the increasing possibility of a sealing industry as well as an intensive development of the coastal zones, it is time to consider in various regions, the creation of natural reserves. In the USSR, Karaginski, Commander, Fox, Shikotan, Demin, Panfilye, Makanrushi, Simushir and Iturup Islands are recommended as reserves (5).

REFERENCES

1. Belkin, A.N. 1964. A new species of seal - Phoca insularis sp. n. from the Kurile Islands. Akad. Nauk. S.S.S.R., Dokl., 158:1217-1219.

2. Belkin, A.N., Kosygin, G.M.,& Panin, K.I. 1969. Data on the biology of the island seal (Phoca insularis sp. n.) pp. 157-175. In: Morskie Mlekopitayushchie, Nauka, Moskva, (All-Union Symp. Study Mar. Mammal., 3rd, Vladivostok, 1966).

3. Bigg, M.A. 1969. The harbour seal in British Columbia. Fish. Res. Bd. Can., Bull., 172.

4. Bishop, R.H. 1962. Reproduction, age determination and behaviour of the harbour seal, Phoca vitulina, in the Gulf of Alaska. Univ. Alaska, College, Alaska, M.Sc. Thesis.

5. Burns, J.J. 1970. Remarks on the distribution and natural history of pagophilic pinnipeds in the Bering and Chukchi seas. J. Mantmmal., 51:445-454.

6. Bychkov, V.A. 1971. Review of the status of U.S.S.R. Pinnipedia fauna conservation. In: Scientific element of nature conservation, Min. Agr. U.S.S.R. Centr. Lab. Nat. Conserv. Pp. 59-74.

7. Chapskii, K.K. 1969, Taxonomy of seals of the genus Phoca sensu stricto in the light of present craniological data. In: Morskie Mlekopitayushchie, Nauka, Moskva (3rd All-Union Symp. Study Mar. Mammal, Vladivostok, 1966). Pp. 294-304.

8. Fisher, H.D. 1952. The status of the harbour seal in British Columbia, with particular reference to the Skeena River. Fish. Res. Bd. Can., Bull, 93.

9. Gray, J.E. 1864. Notes on the seals (Phocidae) including the description of a new seal (Halicyon richardi) from the west coast of North America. J. Zool., (1864): 27-34.

10. Hall, E.R. & Bee, J. W. 1954. Occurrence of the harbour porpoise at Point Barrow, Alaska, J. Mammal., 35:122-123.

11. Imler, R.H. & Sarbcr, H.R. 1947. Harbour seals and sea lions in Alaska, U.S. Fish Wildl. Serv., Spec. Sci. Rep., 28.

12. Inukai, T. 1942. Hari seal (azarashi) in our northern waters. Shvkub . Oyob. Dubut., 10:927-932, 1025-1030.

13. Krasheninnikov, S.N. 1949. Description of the land of Kamchatka. Glabsevmorputi, Moskva.

14. Mohr, E. 1965. Ueber Phoca vitulina largha Pallas, 1811 und weiszgeborene Seehunde. Z. säugetier., 30:273-287.

15. Nasitnovich, A. 1970. Rare and endangered species of mammals on the territory of the U.S.S.R. and their conservation. Geogr. Sb., 4, VINITI (All-Union Inst. Sci. and Tech. Info., Moscow), 168.

16. Nishiwaki, H. & Nagasaki, F. 1960. Seals of the Japanese coastal waters. Mammalia, 24:459-467.

17. Polonskii, A. 1871. Kurile Islands. Zap. Imp. Geogr. Obshchest. Otd. Etorg., Tomsk.

18. Scheffer, V.B. 1958. Seals, sea lions and walruses. A review of Pinnipedia. Stanford, Calif.: Stanford Univ. Press.

19. Scheffer, V.B. & Slipp, J.W. 1944. The harbour seal in Washington State. Amer. Midl. Natur., 32:373-416.

20. Spalding, D.J. 1964. Comparative feeding habits of the fur seal, sea lion and harbour seal on the British Columbia coast. Fish. Res. Bd. Can. Bull. 146.

21. Stuts, S.S. 1967. Moult in the Pacific harbour seal Phoca vitulina richardi. J. Fish. Res. Bd. Can., 24:451-455.

22. Wilke, F, 1957. Food of sea otters and harbour seals at Amchitka Island. J. Wildl. Manage., 21:241-242.

Paper 5

The Laptev Walrus, Odobenus rosmarus laptevi Chapskii 1940

by

V.A. Bychkov

Pacific Research Institute of Marine Fisheries and Oceanography

U.S.S.R.

Distribution

Formerly, central and western parts of the Laptev Sea, as well as eastern parts of the Kara Sea and western areas of the East-Siberian Sea (1, 8). Until the 1950's, there were landing places on the islands: Preobrajeniya, Pestchanyi, Begitchev, Kotelny, Belkovski, Bennett, Faddey, Novaya Sibir, Zhokhov, Henriette, Andrey, Retter, Dunay, Yerkogor, Kuba, Komsomolskoi Pravdy (2, 5, 7, 8). There is no apparent change in the present distribution.

Biological features

Seasonal movements are rather restricted. In the spring and summer, walruses appear near the shores from northern and central parts of the Laptev Sea, and in autumn, they move northwards for wintering (5, 8). Walruses live in the high sea, near leads and polynias; they lie on flat sea shores and on the ice (1, 3, 5). Animals occur mainly within water areas 20-30 m deep (3, 7, 8). Males mature at the beginning of the 5th year: mating and pupping occur in a short period. The majority of females mate first in the 3rd year, parturition occuring in the 4th. Marc pupping occurs at the end of April and first half of May (4).

Population status

This subspecies is stable and not numerous. In 1907, there were many walruses on the shores of Begitchev Island (1). In 1924, large herds of walruses were seen on the Novosibirski Islands (6). In 1920-1935, the number of walruses on the coastal landing places in the Prontchistcheva Bay was estimated as several hundreds, on the Andrey Island - 200, Belkovski Island - 300, Vstretchny Island - 1,000 (5). In 1953, there were 2,500 - 2,800 walruses on the Pestchanyi Island, and in 1954 approximately 3,000 (4). In the 1930's, total numbers of the subspecies were estimated as 6,000 - 10,000 (1).

Habitat condition

Was not studied.

Conservation

According to the Decree of the Council of Ministers of the RSFSR "On the measures to protect Arctic animals" of November 21, 1956, state walrus harvesting was prohibited from 1957. As an exception, participants of some Arctic expeditions and native people can take walruses for subsistence.

Conclusion

It is necessary to declare the main landing places of Laptev walruses as reserves (5).

REFERENCES

1. Chapskii, K. 1941. Marine mammals of the Soviet Arctic. Moskva, Leningrad: Izdatelstvo Glavseumorputi, Biblioteka Polianika.

2. Chapskii, K.K. 1963. Walruses. In: I.I. Sokolov, ed., Mammalian fauna of the U.S.S.R., 2. Moskva, Leningrad: Izd. Akad. Nauk. S.S.S.R. Pp. 915-920.

3. Koshkin, V.N. 1940. On the wintering of the walrus in the western part of the Laptev Sea. Probl. Sev., 7-8: 90.

4. Popov, L.A. 1958. Walrus hauling ground on Pestchanyi Island. Priroda, 9: 102-103.

5. Shereshevskii, E.I. 1960. The walrus (Odobaenus rosmarus L.): its distribution and migrations in the Laptev Sea. In: Animal migrations, 2. Moskva: Izd. Akad. Nauk. S.S.S.R. Pp. 27-37.

6. Sverdrup, G.U. 1930. The voyage of "Maud" in the waters of the Laptev and East-Siberian Seas. In: Materials of the Commission for the study of the Yakutian A.S.S.R. Leningrad: Izd. Akad. Nauk. S.S.S.R.

7. Uspenskii, S.M. 1958. The distribution of walrus in the Laptev Sea and western part of the Kara Sea in winter and spring. Probl. Sev., 2: 219-221.

8. Vinogradov, M.P. 1949. Marine mammals of the Arctic. Moskva, Leningrad: Izdatelstvo Glavseumorputi.

Paper 6

Atlantic Walrus, Odobenus rosmarus rosmarus L., 1758 Novaya Zemlya Population

by

V.A. Bychkov

Pacific Research Institute of Marine Fisheries and Oceanography
U.S.S.R.

Distribution

In the IX - XVI centuries, the range of the Novaya Zemlya population included the White, Barents and Kara Seas (4). In the first half of XXth century, walruses occurred in the waters between Kola Peninsula, Yamal Peninsula and 81°N (4, 11). In 1956-1959, walruses were seen near Franz Josef Land, western coasts of Novaya Zemlya, Vaigach, Kildin and Kolgner Islands, as well as near the coasts of Yamal, Karin and Kola Peninsulas (1). In recent years, the walrus range has not been studied in detail.

Biological features

It is supposed that walruses of this population move by the following ways: in winter and spring, they occur in the south-east of the Barents Sea; in spring, they migrate northwards and through the Karskye Vorota Straits into the Kara Sea; in autumn, they move to the wintering grounds using the sane route (5, 11). There is also evidence that in summer some walruses migrate from Novaya Zemlya to the Franz Josef Land (10). At any season, walruses are often on the sea ice, and in summer and autumn on the shore as well (6, 10, 11). It is believed that the reproduction rate is very low. Birth and mating occur in April-June, Females are mature at the age of 3-4 years, and males at 5 years. A female usually has one pup every second year. Lactation continues for 2 or more years (6, 10).

Population status

In the XVII century, walruses were abundant on the Sharapoy Koshki (vestern shores of Yemal Peninsula), (8). In the XVIII - XIX centuries, walruses continued to be rather common near Novaya Zemlya and Franz Josef Land (2, 9). In the 1930s, the total number in the Kara Sea did not exceed 3-4 thousand (5). In 1956-1959, they were only observed near Kola Peninsula, Novaya Zemlya, Vaigach Inland and Dickson Island (1). A decrease in

walrus stocks in the Novaya Zemlya area was linked with the intensive harvests in the XVIII and XIX centuries (4, 5, 7). On the other hand, N.A. Smiznov supposed that the decrease of walrus range was a result of natural degradation (4).

Habitat condition

Not studied.

Research and conservation

In the U.S.S.R., harvesting of Atlantic walrus was first limited in 1921. In 1935, the state harvest from sealing vessels ceased; in 1949 killing walruses by any fishing and sealing industry was prohibited. From 1957, hunting for walrus was banned for all Soviet citizens (3), excluding a limited harvest for subsistance needs of native people and expeditions (3). In 1971, the Novaya Zemlya population of Atlantic walrus was included in the list of Rare Animals of the U.S.S.R. (3).

Conclusion

It is necessary to bring to public attention and local game management organizations the need to strictly control the regulations concerning the protection of walrus, as well as to carry out education programmes (1). At first, it is necessary to completely prohibit the harvesting of walruses for any expedition; to carefully protect from the various disturbances the coastal landing places and haul out places on the sea ice (3).

REFERENCES

1. Belkovich, V.M. & Khuzin, R.S. 1960. (The Atlantic Walrus) Priroda, 2: 67-69.

2. Belomozski, O. 1858. Sea mammals breeding on the northern shores of European Russia. Arkhangelskiye guberuskiye vedomviti, Arkhangelsk.

3. Bychkov, V.A. 1971. (Review of the status of U.S.S.R. Pinnipedia fauna conservation.) In: Scientific elements of nature conservation. Min. Agr. U.S.S.R. Centr. Lab. Nat. Conserv. pp. 59-74.

4. Chapskii, K.K. 1939. A brief historical analysis of the walrus resources in the Barents and Kara Seas. Probl. Arkt. 3: 62-69.

5. Chapskii, K.K. 1941. Marine mammals of the Soviet Arctic. Moskva, Leningrad: Izdatelstvo.

6. Chapskii, K.K. 1963. Walruses. In: I.I. Sokolov, ed., Mammalian fauna of the U.S.S.R., 2. Moskva, Leningrad: Izd. Akad. Nauk. S.S.S.R. Pp. 915-920.

7. Kleinenberg, S.E. 1957. On the protection of the walrus. Priroda, 7: 103-163.

8. Maximov, S. 1858. Travelling to the Petchora. 4. Sea hunting on the Novaya Zemlya. Morski Sb., 2: 235-266.

9. Nansen, F. 1898. In Nacht und Bis. I.

10. Tsalkin, V.I. 1937. On the biology of the walrus on the Franz Josef Archipelago. Moskovsk. Obshchest. Ispyt. Prir. Otd. Biol., Bull., 46: 43-51.

11. Vinogradov, M.P. 1949. Marine mammals of the Arctic. Moskva. Leningrad: Izdatelstvo Glavseumorputi.

Walrus in the Svalbard Area

by

Torger Øritsland

Institute of Marine Research
Directorate of Fisheries
5011 Bergen-Nordnes, Norway

Introduction

The natural history and general distribution of the Atlantic walrus (Odobenus rosmarus) is reviewed in the next Paper by A.W. Mansfield. According to him a small geographically isolated walrus population exists in the north-east Atlantic, confined to the east coast of Greenland, Spitzbergen (Svalbard), Franz Josef Land, and the Barents and Kara Seas.

In this report an attempt is made to discuss the present status of the north-east Atlantic population. A summary, if fragmentary, of the history of walrus hunting in the north-east Atlantic serves to indicate the former range and abundance of the population. Existing regulations are outlined and recently reported sightings at Svalbard, which may be used as an indication of present distribution and abundance of the walrus in that area, are summarized. Finally reports of southward stragglers are summarised in order to make available all supporting evidence from Norwegian sources.

In preparing the report I have had to lean heavily on work done by others. In particular I would like to mention the efforts made by Cand. real. Magnar Norderhaug, Norsk Polarinstitutt, to collect new information on the walrus in the Svalbard area.

Hunting

Statistics on catches of walrus in the Svalbard area were compiled by Lønø (1972). In his review of available data he shows how the walrus was abundant on Bjørnøya during the first years after its discovery in 1596. Several expeditions took substantial catches on the island during the first few years of the seventeeth century. As an example it may be mentioned that one ship caught more than 900 walruses on Bjørnøya in 1608. Walrus Hunting at Bjørnøya seems to have stopped with the development of bowhead whaling at Vestspitsbergen from 1611 on.

However, a Norwegian wintering party caught some 750 walruses on Bjørnøya in 1823-1824, and in 1824-1825, 677 were taken. Later expeditions were less successful and the last record shows that only one walrus was caught on Bjørnøya in 1865-1866.

It may be assumed that during the years of inshore whaling at Spitzbergen from 1611 to about 1650, quite a number of walrus were taken as a by-catch. The walrus lost its attraction and catches must have decreased as the whalers moved out into the pack ice and offshore waters to find the remaining whales. However, there were occasional catches of walrus, even after the cessation of shorebased whaling around 1710, when the ships came close enough to land to discover the animals.

Russian hunters came to Svalbard before 1720, and shorebased wintering expeditions as well as ships during summer certainly caught many walruses through the years, though very little information is available on their catches. Six to eight Russian ships visited Svalbard every year up to 1808, but the Russian hunt stopped during the Anglo-Russian war of 1808-1812. After the war only one or two Russian ships visited Svalbard every year. A few records are available, and it may be mentioned that two groups - about 40 people all told - caught 1200 walruses at Sørkapp, Vestspitsbergen, in the winter of 1818-1819 or the next winter, and a party of 20 caught 1100 walruses in Bellsund, Vestspitsbergen, in 1822-23. The Russian hunters stopped their activity at Svalbard in 1853.

Norwegian hunting at Svalbard and in other Arctic areas developed quickly from 1821 on, and occasional expeditions from other countries, e.g. from Copenhagen and Hamburg, hunted walrus in the Svalbard area during the 1830s.

Norwegian walrus catches increased from about 300 in 1821 to about 1600 per year in the early 1830s. For the period 1836-1873, only fragmentary records are available, but annual catches between about 100 and 1300 are indicated and the average annual catch for the years 1841-1845 was 222. From 1874 to the year 1900, annual catches varied between the less than 100 in 1895 to the all-time record Norwegian catch of 2261 walruses in 1887. Catches from 1901 up to the First World War were small, appreciably less than 300 walruses in any one year. Data are incomplete for the very intensive hunt at Svalbard during the war and a few years thereafter, but fairly good catches were taken for nearly ten years from 1924 on, with annual catches between some 200 in 1926 and 1929 and more than 1000 in 1925.

With a few exceptional years, Norwegian catches in the north-east Atlantic have been insignificant from 1932 on. However, in 1949 and 1951 one Norwegian ship caught 623 and 1175 walruses off the northern coast of west Greenland.

When Norwegians started hunting in the 1820's there were still a considerable number of walruses at Bjørnøya in the south, but the animals quickly disappeared from this island after 1830.

Walrus hunting continued, mainly on the west coast of Vestspitsbergen up to the 1860's. Hunters then moved to the less accessible northeastern and eastern areas of Svalbard. Nordaustlandet was circumnavigated in 1863 and large numbers of walrus were found and caught. The walrus was abundant east of Nordaustlandet as late as 1887.

In 1886 walrus hunters visited the waters around Franz Josef Land for the first time, and from 1896 these islands and the pack-ice around them were regular hunting grounds for Norwegian sealers. Thus most of the good walrus catches from 1924 to 1931 were taken by engine-powered ships in this area, and it is unofficially known that one Norwegian ship caught about 50 walruses in the pack-ice near Franz Josef Land as late as 1953,

In 1886, Norwegians also started hunting for walrus at Novaya Zemlya and in the Kara Sea, and catches in this area account for a significant part, more than half of the total Norwegian catch in some years, during the period up to about 1910. Also a total of 77 walruses are said to have been taken by Norwegian expeditions to north-east Greenland in the years from 1903 to 1908.

Regulations

Concern in Greenland and Denmark caused by the Norwegian walrus catches off west Greenland led to consultations between Danish and Norwegian authorities and a consideration of the status of walrus stocks in the North Atlantic. Somewhat late, it was found that the walrus was depleted to such a degree that the species could no longer sustain any significant Norwegian harvest, and the walrus was given complete protection through a total prohibition of walrus hunting by Royal Decree of 20 June 1952. This Decree which is still in force, was given in accordance with the Sealing Law of 14 December 1951 (Anon. 1966).

The Sealing Law, and consequently also the Walrus Decree, applies to "sealing inside the Norwegian fisheries limit, and to sealing carried out by Norwegian citizens, inhabitants of the country or by Norwegian companies and other organizations outside the Norwegian fisheries limit".

The Norwegian-Soviet Sealing Agreement of 1958 (Anon. 1959) which applies to north-east Atlantic waters east of Kap Farvel, Greenland, also includes a provision that the catching of walrus is forbidden throughout the year. The Agreement thus confirms both the Soviet total prohibition of walrus hunting in the western Soviet Arctic since 1956 and ship-borne hunting since 1934, and the Norwegian total prohibition since 1952.

Recent sightings of walrus at Svalbard

The only known direct evidence of the effect of the walrus protection comes from observations at Svalbard.

Norderhaug (1969) reported 18 observations of walrus in the Svalbard area in 1960-1967, and has included an additional 19 observations from 1966 to 1970 in later reports of animal life at Svalbard (Norderhaug 1970a, 1970b and 1972). One additional observation of three animals - one male, one female and one calf - at Kvadehuken in Kongsfjorden, Vestspitsbergen, in the summer of 1969 was reported by Lønø (1972).

Four unpublished observations are listed in the appended Table I, making a total of 42 reported sightings of walrus in the Svalbard area during the years from 1960 to 1971.

Table I. Unpublished reports of walrus sighted in the Svalbard area 1965-1971.

Date	Locality	No.	Reference
7 May 1965	Ny-Alesund	1	Dr. J. Eggvin
3-10 July 1970	Tusenøyane	10–15	Captain P. Stark
July-Aug. 1971	Basisodden, Hinlopenstredet	1	Cand. real. M. Norderhaug
Summer 1971	Kvitøya	several groups	Captain K. Stokkholm

The geographical distribution of all observations is plotted on the map in Figure 1 and the observations . are plotted on a time-scale in Figure 2.

Walrus on the coast of Norway

A total of 81 sightings relating to 31 individual walruses seen on the coast of Norway and on other coasts around the North Sea during the years from 1900 to 1967, were reviewed by Brun, Lid and Lund (1968). Four more recent observations on the coast of Norway are listed in the appended Table II. Presumably the two latest observations refer to the same animal. The observations in Table II have been brought to my attention without any effort of mine, and no attempt has been made to search through newspapers or to consult other sources for a complete coverage of the years from 1968 to 1972.

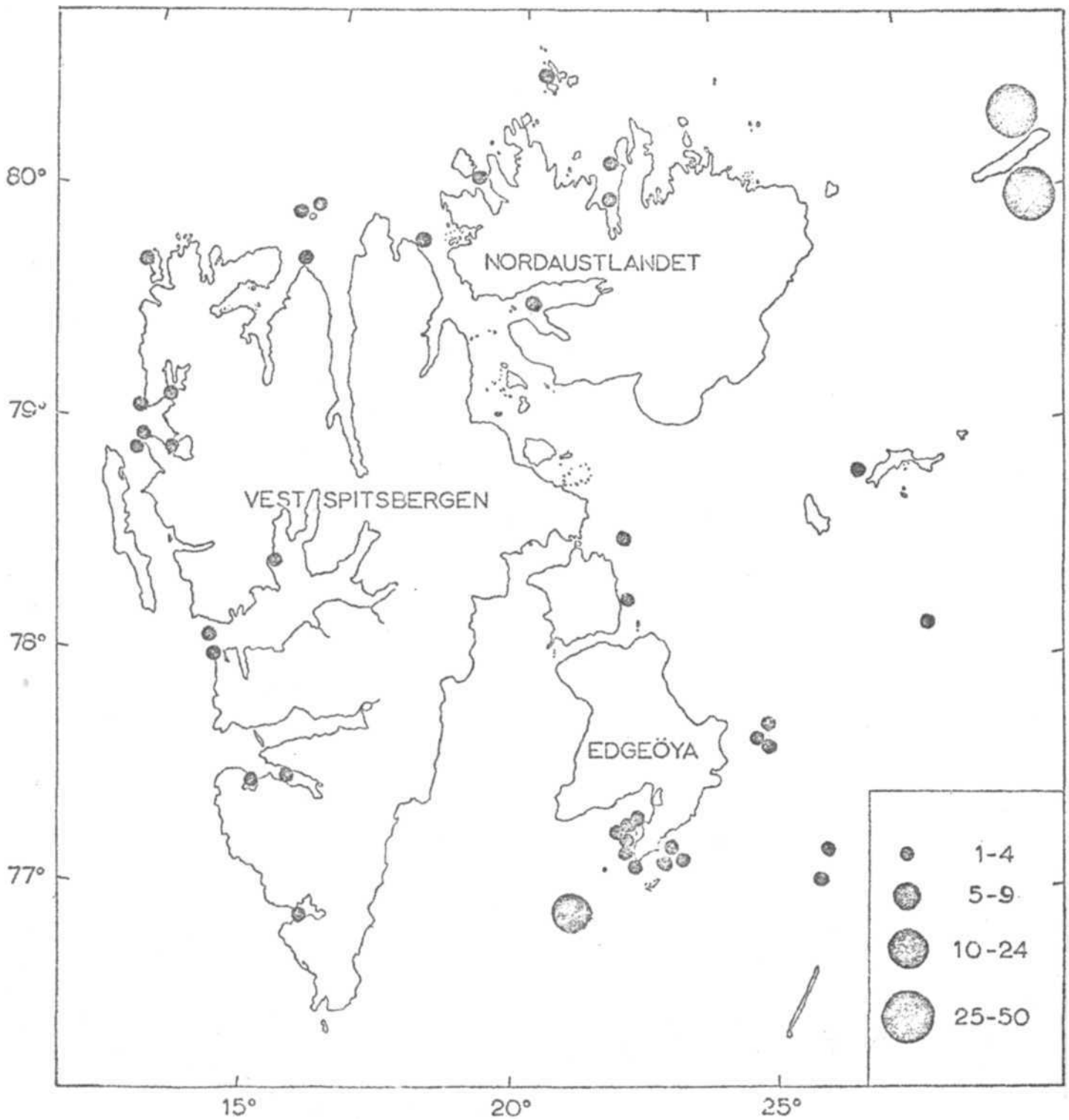

Figure 1. Distribution of reported sightings of walrus at Svalbard 1960-1971. Approximate numbers of animals sighted are indicated by legend.

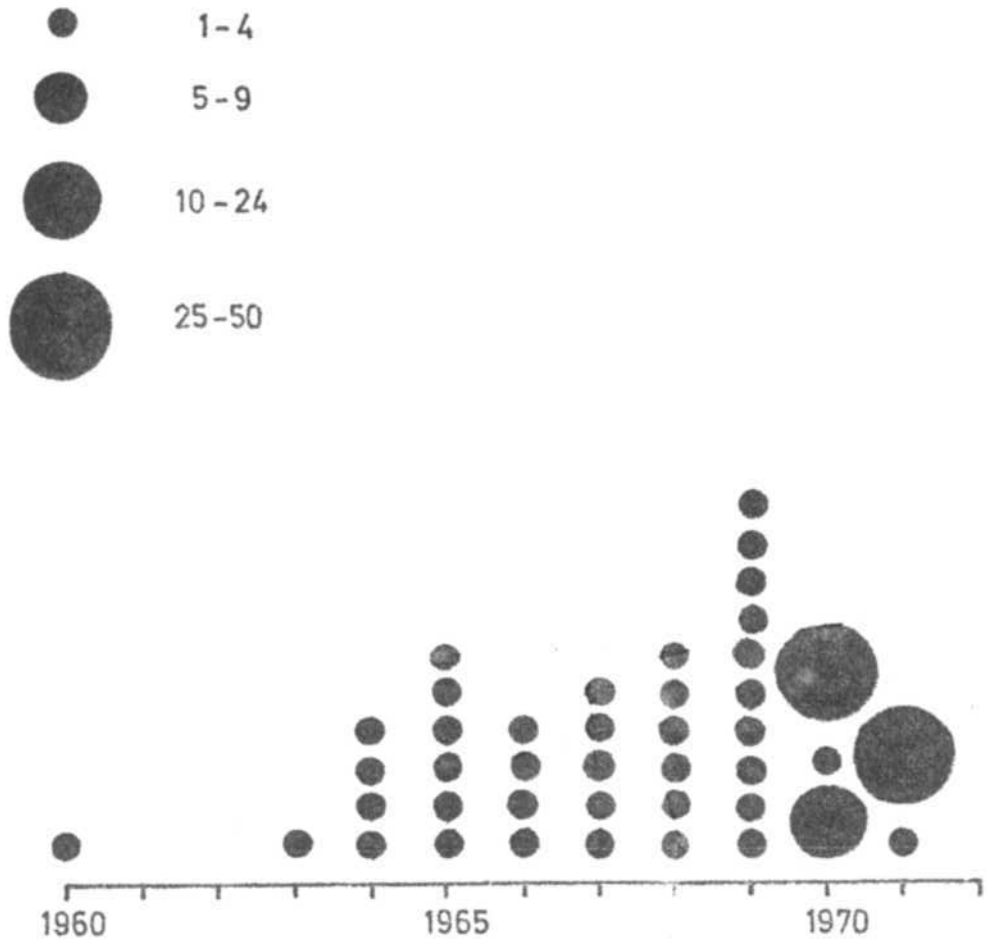

Figure 2. Reported sightings of walrus at Svalbard 1960-1971 plotted against date. Approximate numbers of animals sighted are indicated by legend.

Table II. Occasional reports of walrus sighted on the coast of Norway 1969-1972.

Date	Locality	No.	Reference
Feb. 1969	Krempenes and Ekkcrøy, Varanger-fjord	Ad.	Aftenposten 28. Feb. 1969
Dec. 1971	Gjøsundholmen, Vigra, Sunnmøre	Juv.	Sunnmørsposten 17 Jan. 1972
Jan 1972	Flakkstadvåg, Senja, Troms	Ad.	Aftenposten 1 Feb. 1972
20 Feb. 1972	Valdercøy-Ålesund, Sunnmøre	Ad.	Mr. Skule Vaksvik report to Aftenposten s.d.

A latitude/date plot of all reported vagrant animals is shown in Figure 3. Bearing in mind the incomplete coverage for the last four years, the increasing frequency of sightings in the last 20 years is rather conspicuous. Another distinctive trait is the concentration of sightings at high latitudes. As a matter of fact 14 of the 34 animals were seen only in Finnmark. However, one animal was followed as far south as to Den Helder in Holland in 1926, another to the west coast of Sweden and to the Lübech Bucht, Germany, in 1939, and a third walrus which moved at an average speed of some 30 km per day went south to Sylt, northern Germany, in 1960.

Discussion and conclusions

Historical data on walrus hunting in the north-east Atlantic gives evidence of a stepwise depletion of stocks, each step followed by a transfer of hunting effort to new grounds, through the period from the early part of the 17th Century up to about 1950.

It should be remembered that since the middle of the 19th Century industrial sealing for harp and hooded seals at Jan Mayen, in the Denmark Strait and in the Barents and White Seas developed in Norway, more or less independently of the development of the walrus hunt, although sealing for harp seals in the Barents Sea-White Sea area was often combined with walrus hunting at Novaya Zemlya and in the Kara Sea. During the years of the First World War a large fleet of sealing vessels diverted its efforts to the Svalbard area, and it is believed that the walrus stock at Svalbard received its final blow then. Unfortunately statistical data are not available for these most critical years (Lønø 1972).

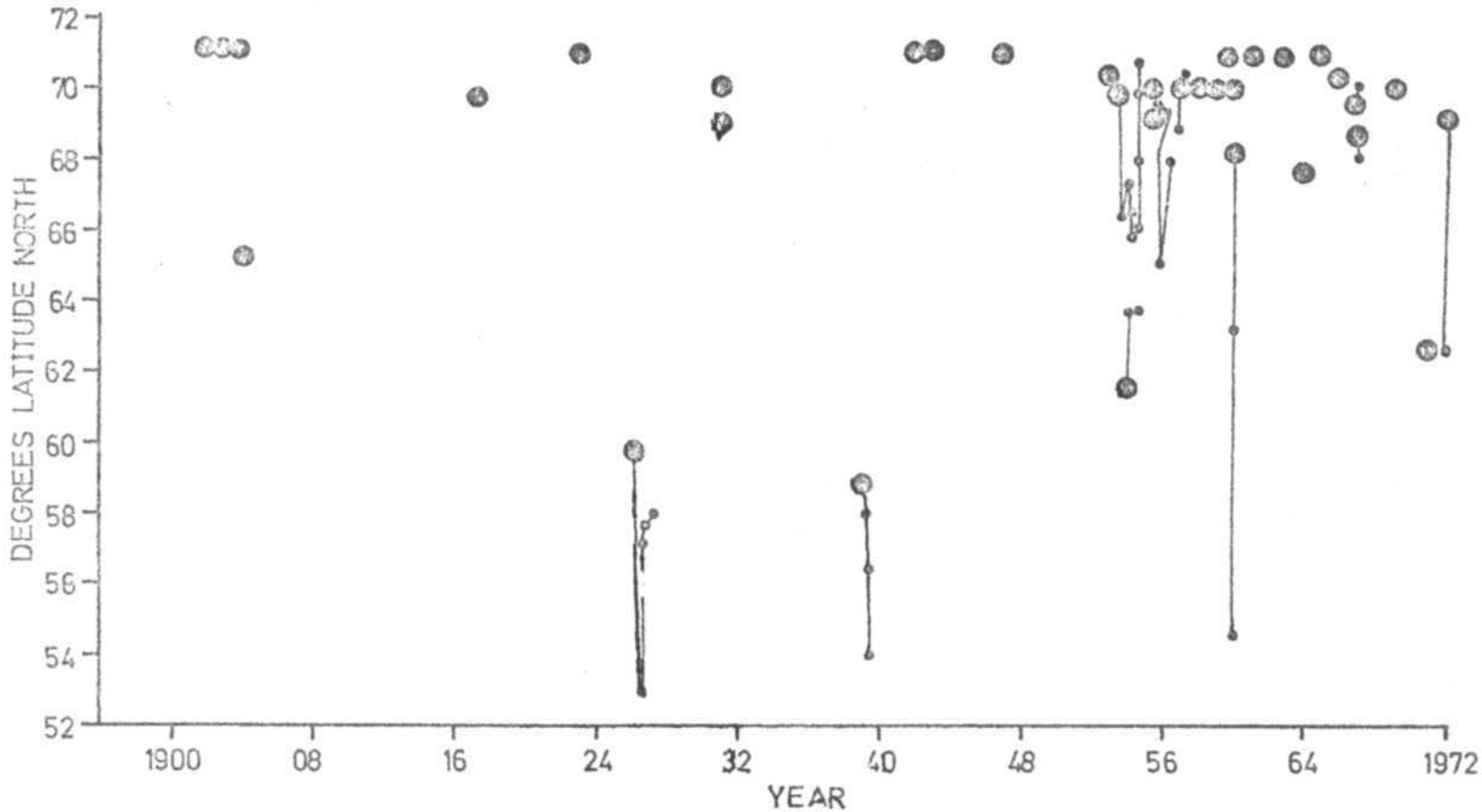

Figure 3. Walrus sighted on the coast of Norway and in other countries around the North Sea 1900-1972 plotted against date and latitude of the observations. Secondary sightings are indicated by smaller symbols connected by a line to the first sighting.

The current Norwegian regulations which have prohibited the catching of walrus since 1952 have not been completely observed through the years. Mention has already been made of a catch of about 50 walruses south of Franz Josef Land in 1953, and one allegedly sick walrus was shot at Svalbard as late as in 1970. However, protection has become more effective with the years. Both an increasing public awareness and a gradual loss of tradition may have contributed to this,

Recent observations of walrus at Svalbard indicate that walrus abundance in the area is now increasing again, even though development is still slow. Observations since 1960, summarized in this report, cannot be compared directly on an annual basis because an increased interest and publicity may very well account for part of the apparently increasing number of reports. However, the most recent reports of groups of walrus in the eastern and north-eastern areas constitute rather definite evidence of an increasing stock.

Supporting evidence comes from sightings on the coast of Norway. Again the apparently increasing number of reports may partly be explained by an increasing publicity and public interest. Even so the observations show that walrus are still living in arctic areas of the north-east Atlantic.

Soviet sources have not been searched for information on the status of walrus stocks in the western Soviet Arctic. However, Norderhaug (1969) referring to a personal communication from S.M. Uspenskii states that a stock of a few hundred walrus remains at Franz Josef Land. Also a Polar Record summary of three Soviet papers on walrus (Anon. 1964), citing Belkovich and Khuzin (1960), states that these authors found evidence in reports from sealers and others of a decline in numbers of walrus in the southwestern part of the Kara Sea and at Novaya Zemlya. No total for this population was given, but the 1941 figure of 2000-3000 walruses at Novaya Zemlya was believed to have been significantly lower in 1960. It was also believed that unauthorized killing must account for the continuing decline.

Concluding this report it may be stated that available evidence from sightings does suggest an increasing number of walrus at Svalbard in recent years, and that the current protection seems to have taken effect. However, some funds could be spent in a useful way buying flight-time to spot walrus in the north-eastern parts of Svalbard.

REFERENCES

1. Anon. 1959. Norwegian-Soviet Sealing Agreement, 1958. Polar Record 9:345-348.

2. Anon. 1954. Walrus in the 3oviet Arctic. Polar Record 12:205-206.

3. Anon. 1966. Rccent Norwegian laws relating to sealing. Polar Record 13:209-211.

4. Belkovich, V.M. & Khuzin, R.Sh. 1960. Atlanticheskii morzh. Sberech' i umnozhit' tsennoe zhivotnoe severa. Priroda 1960 (2):67-69.

5. Brun, E., Lid, G. & Lund, H.M.-K. 1968. Hvalross, Odobenus rosmarus, på norskekysten (Walrus, O.r., on the coast of Norway.) Fauna, Oslo 21:7-20. (Summary in English.)

6. Lønø, O. 1972. The catch of walrus (Odobenus rosmarus) in the areas of Svalbard, Novaya Zemlya, and Franz Josef Land. Årbok norsk Polarinst. 1970:199-212.

7. Norderhaug, M. 1969. Hvalrossens (Odobenus rosmarus) forekomst i Svalbardområdet 1960-1967. (The walrus (O.r.) in Svalbard 1960-1967.) Årbok norsk Polarinst. 1967:146-150. (English Abstr.)

8. Norderhaug, M. 1970a. Iakttagelser over dyrelivet på Svalbard 1968. (Observations of animal life in Svalbard 1968.) Årbok norsk Polarinst. 1968:101-106. (English Abstr.)

9. Norderhaug, M. 1970b. Iakttagelser over dyrelivet på Svalbard 1969. (Observations of animal life in Svalbard 1969). Årbok norsk Polarinst. 1969:139-144. (English Abstr.).

10. Norderhaug, 11. 1972. Iakttagelser over dyrelivet på Svalbard 1970. (Observations of animal life in Svalbard 1970.) Årbok norsk Polarinst. 1970:264-270. (English Abstr.).

Paper 8

The Atlantic walrus Odobenus rosmarus in Canada and Greenland

by

A.W. Mansfield

Arctic Biological Station

Fisheries Research Board of Canada

Fisheries Service, Department of the Environment

Ste. Anne de Bellevue, Que.

Distribution

Walruses are circumpolar in distribution rarely straying further south than the spring limit of pack ice. At the present time they occur in three geographically isolated groups: a small population confined to the east Greenland coast, Spitzbergen, Franz Josef Land, and the Barents and Kara Seas; a larger population occupying the eastern Canadian arctic and western Greenland; and the largest population occurring in the Bering and Chukchi Seas, between Russia and Alaska. A small population in the Laptev Sea, north of Siberia, may form a fourth distinct group.

Canada

Though the walrus is a species typically associated with ice, records indicate that in the 16th century it occurred as far south as Sable Island, off the east coast of Nova Scotia, where it probably remained until as late as the end of the 18th century, though much reduced in numbers. It also inhabited the shallow waters of the Gulf of St, Lawrence and was found in large numbers at Miscou Island, Prince Edward Island and especially at the Magdalen Islands where as many as seven to eight thousand animals were seen at the échouries or hauling-out sites (Allen 1880).

At present the walrus is rarely seen so far south and only a few occur along the Labrador coast. Scattered group3 are found in Ungava Bay and along the south and east coasts of Baffin Island from Hudson Strait to Lancaster Sound. In Hudson Bay a small population inhabits the Belcher Islands but the main population is found about Coats Island and southern Southampton Island. The largest population of all occurs in northern Foxe Basin.

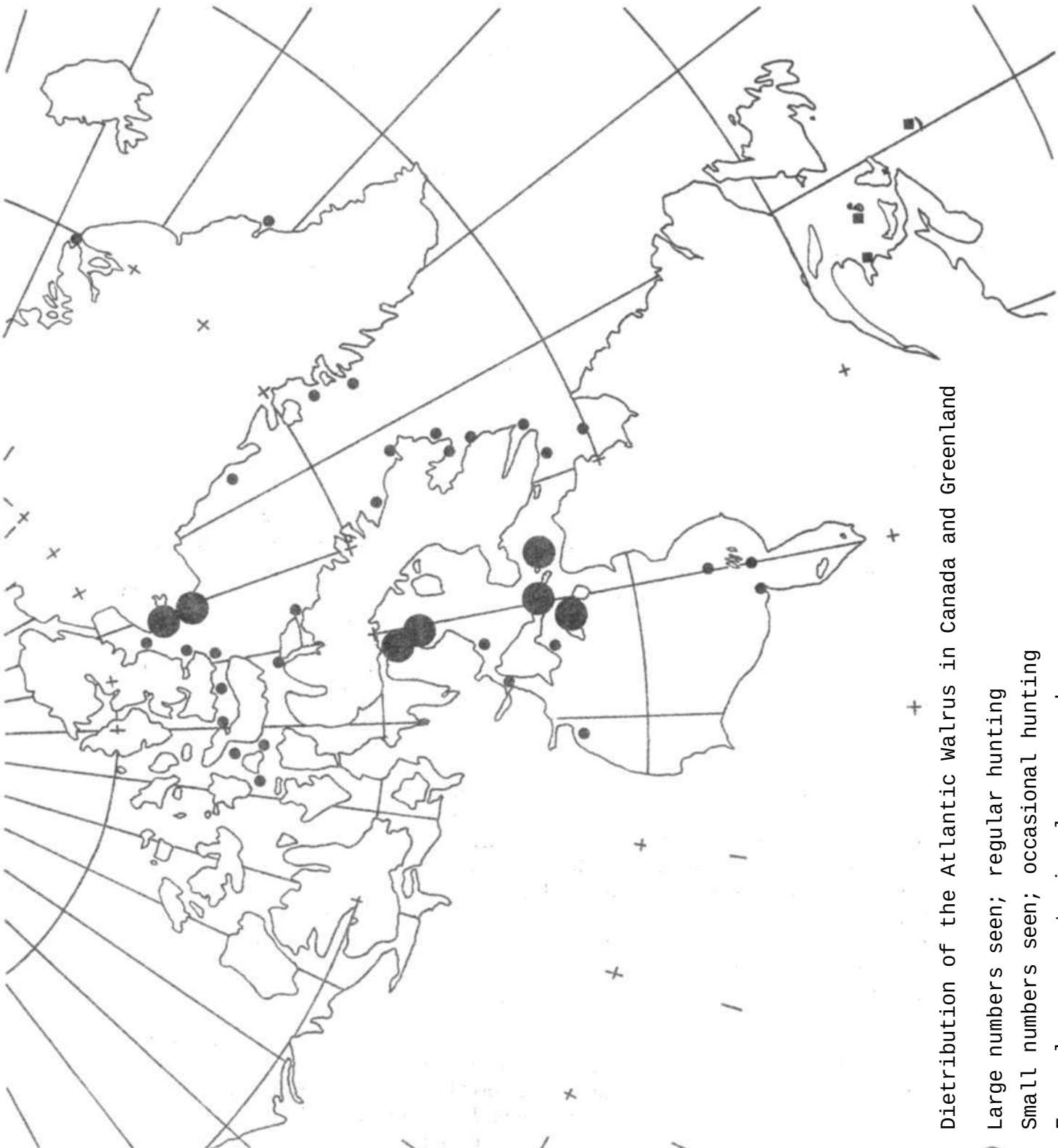

Fig. 1 Dietribution of the Atlantic Walrus in Canada and Greenland

● Large numbers seen; regular hunting

● Small numbers seen; occasional hunting

■ Formerly present in large numbers

North of Baffin Island, walruses generally penetrate into Lancaster Sound as far as Bathurst Island, but occasional stragglers have been reported from as far west as Prince Patrick and Melville Islands (Harington 1966). In the western Canadian arctic walruses are sometimes seen about southern Banks and Victoria islands and along the mainland coast to as far east as Bathurst Inlet, but these are reliably identified as belonging to the Pacific race (Harington, op cit.).

North of Lancaster Sound walruses are found in Jones Sound and the open part of Norwegian Bay, and scattered groups occur along the coast of Ellesmere Island as far north as Kane Basin.

Greenland

The principal population in Baffin Bay is found in the Thule area of northwestern Greenland, from Cape York to Smith Sound.

Further south along the west coast of Greenland walruses are found in small numbers principally near Upernavik and in the area between Egedesminde and Holsteinsborg. They are rarely found further south than Godthaab.

On the east coast of Greenland walruses have been seen from Angmagssalik to as far north as 81°10'N (Jensen 1928). According to Jensen walruses were common in Scoresbysund in 1924, when the colony was established there, but by 1927 only a few were seen. This population appears to be quite small since few animals have been taken by Eskimos from the settlements at Angmagssalik and Scoresbysund in the past 20 years.

Behaviour affecting distribution

In Canada at the present time walruses are rarely found far from floating ice. As long as the ice drifts above suitable feeding shallows, the animals remain crowded together on the ice-floes to rest between feeding excursions. However, where the ice is dispersed by winds and currents in the summer the walrus herds haul out on the land at traditional sites (ugli. pl. uglit in Eskimo). These are usually low prominent headlands and small islands that provide easy access to the sea for feeding and escape. Over two thousand animals were seen at one of these traditional sites on. eastern Coats Island in early August, 1961.

Walruses do not appear to like strong onshore winds and heavy seas and will move to more sheltered sites when necessary. They appear to be sedentary creatures, remaining within a restricted territory throughout the year.

Where the coast is steep, as in eastern Baffin Island and northwestern Greenland, continuous ice may extend out over deep water and prevent access to food on the sea bottom. When this occurs, walruses will move to new feeding grounds.

There is no indication that extensive migrations occur except in the case of the west Greenland herds. In the area between Holsteinsborg and Egedesminde walruses appear at the outlying islands along the coast in September and October and remain there until April or May (Jensen 1928, Freuchen and Salomonsen 1958). Their absence in the summer months suggests that they move northwards with the retreating ice as far as the Thule area, a distance of 700 miles, but this seems unlikely in view of their reappearance in the Egedesminde-Holsteinsborg area in the fall long before the ice has formed. An alternative explanation is that they move across Davis Strait to the eastern shore of Baffin Island, a distance of only 200 miles, but there is no evidence for this as yet.

Feeding

Within the broad limits of its range, the walrus is restricted in distribution by the occurrence of suitably shallow feeding areas. Its diet consists principally of clams which it digs up from the muddy bottom with its quill-like vibrissae. The tusks are nearly always heavily worn along the front and sides, suggesting that the walrus feeds head down, with its body in an almost vertical position. It then stirs up the bottom by rotating its tusks from side to side or ploughs a furrow with its muzzle by swimming slowly forwards. Usually only the siphons (breathing tubes) of the soft-shell clam (Mya truncata) and the feet of the cockle (Serripes groenlandicus) are found in the stomach. In spite of its massive jaws and teeth the walrus is able to nip off or suck out these parts, leaving the shell and remainder of the clam behind.

Since the walrus usually dives for no longer than four or five minutes, there is a critical depth below which feeding is impracticable. This appears to be about 250 feet (Vibe 1950).

Where clams are not found, walruses will eat. a variety of epibenthic invertebrates and fish. Occasionally parts of marine mammals, particularly the ringed seal, are found in walrus stomachs. Most of this food is probably carrion, although walruses will attack and eat small seals.

The occurrence of hypervitaminosis-A and trichinosis in a small proportion of walruses suggests that they derive these pathological conditions from the seal-eating habit, as does the polar bear (Thalarctos maritimus) which feeds primarily on seals (Fay 1960).

Growth

Walruses are large animals even at birth. The newborn calf is just under 48 inches long and weighs about 120 pounds. The skin is dark grey in colour, particularly when wet, and is covered with a coat of short silver-grey hair up to half an inch in length.

Calves grow quickly and reach an average length of 60 inches and a weight of 450 pounds by the end of the first year. Thereafter males grow faster than females. Females attain an average length of about 102 inches and an average weight of 1,250 pounds, while males attain an average length of 120 inches and an average weight of 2,000 pounds. The maximum recorded weights of males and females from arctic Canada are 2,600 and 1,600 pounds respectively (Mansfield 1966).

The tusks begin to protrude through the gums two to three months after birth. At first the tusks grow about an inch a year in both sexes. In males growth declines during adult life until, at about 25 years of age, growth at the root of the tusks is just enough to compensate for wear at the tip. In very old males, which may attain an age of 35 years or more, growth cannot keep up with wear and the tusks decrease in length. Few tusks grow longer than 14 inches.

In immature and adult females tusk growth is slightly less than in males of similar ages. In females the smaller diameter of tusks results in more rapid wear during feeding, and breakages are common in old animals. Few females have tusks longer than 10 inches.

Adult males may also be distinguished from females by the development of fist-sized fibrous tubercles on the skin of the neck and shoulders. This is a secondary sexual character, The muzzle is also broader, and the powerful neck muscles give the male a noticeable heaviness about the neck and shoulders.

Walruses have sparse hair, which rarely exceeds half an inch in length in adults. In summer the hair, which has turned reddish-brown in colour, moults in patches as the new silver-grey hair lengthens.

Reproduction

Walruses are gregarious animals. For most of the year the adult males rest peacefully together, forming compact herds on the ice floes. The adult females, calves and immature animals of both sexes form other

herds which may remain quite separate from the adult males unless floating ice is absent and the land is used as a resting place.

Males mature when six years old and appear to be sexually active thereafter. The peak of reproductive activity appears to be in February and March (Fay, MS 1960). Females may be ready to mate when four years old, though many do not do so until several years later. They can bear young every two years, though most appear to produce a calf only once in three or four years. This low rate of reproduction results in an annual increment of about 11 percent of the population.

The gestation period lasts about 15 months, births occurring over a period of about two months with a peak around the middle of May. The calf is suckled for at least one year, and most probably two years, and appears to begin independent feeding in the third summer. During the critical period before weaning, the calf remains under the constant protection of the cow. When danger threatens, the calf will often cling to its mother's neck, or the cow may clasp the calf in its foreflippers. The strong ties between mother and young probably have great survival value in an animal whose reproductive rate is so low.

Status of populations

The large Gulf of St. Lawrence and Sable Island populations suffered severely from overhunting by early mariners and settlers, who killed the animals for their valuable fat, skins and ivory. Few animals in these southern populations survived beyond the end of the 18th century (Allen 1880).

In more northern waters whalers continued the hunt, especially in the early 20th century after the Greenland right whale or bowhead (Balaena mysticetus) had been nearly exterminated. In Canada, newly opened trading posts of the Hudson's Bay Company created a continuing demand for ivory and skins, and the walrus herds at many localities in northern Hudson Bay, Hudson Strait and along the east coast of Baffin Island were hunted heavily. In 1928 this trade was stopped by a Department of Fisheries Act, which limited the hunting and killing of walruses to Eskimos for their own food and clothing requirements. These regulations and several amendments made in later years appear to have prevented further decline in the walrus herds despite high hunting losses in some areas.

At present only the status of the Southampton Island population is known with any certainty. This was estimated by the Fisheries Research Board to be about 3,000 in 1954, a figure which was confirmed by aerial survey of the uglit carried out by the Canadian Wildlife Service in the same year (Loughrey 1959). Subsequently in 1961 another aerial survey showed

this population to be undiminished in spite of an average annual take of over 17C males and females of all ages.

The walrus population in northern Foxe Basin appears to be larger than the Southampton Island population since the average age of males in the catch is greater. However no real estimate of numbers is available owing to the lack of uglit and the difficulties of surveying large areas of ice.

Little is known about other groups of walruses in the eastern Canadian arctic since adequate samples and catch statistics have not been available. However many occur in relatively inaccessible areas and remain at present immune from predation by man.

In western Greenland no estimate of the population is available. However it seems likely from catch statistics that this population has declined markedly since the early 1940's. In 1932 the introduction of large motor boats at Holsteinsborg provided readier access to the remoter parts of the coast where walruses were to be found from September to May (Vibe 1967). Catches reached a peak of over 600 in 1940 and thereafter showed wide fluctuations until the last major catch of over 400 in 1956, After that year new regulations came into force but catches continued to decline rapidly to an all time low of 19 in 1967, and the last year for which published data are available (Ministeriet for Grønland, no date). Unfortunately no estimate of changes in hunting effort are available, but it would be wise at this point to assume that the eatches are a reasonable reflection of the state of the population.

An added factor which might have aided this decline was the Norwegian catch of walruses. Between 1949 and 1952, 2,082 animals were taken, of which 1,253 were caught by a single vessel in Davis Strait in 1951. Fortunately this hunt was prohibited by law after 1952 (Fiskeridirektøren Bergen 1954).

In the Thule area of northwestern Greenland less complete catch statistics are available. However during the period 1948-1965 an average of 132 walruses was reported taken in the area. Since 1965 no details of catch have been reported by the Ministry for Greenland, but F. Bruemmer (unpublished report) estimates that 100-130 walruses are taken per year, plus 30 to 40 lost during hunting. These catches do not appear to be having an adverse effect on the population.

Utilization

Killing a large walrus has always been a source of pride to Eskimo hunters. Perhaps the most dangerous method of hunting occurs in northern Foxe Basin where Eskimos take their dog teams onto the moving ice in

early winter and seek walruses in the open water between the floes. Changes in wind direction have sometime marooned hunters on the ice, leaving them to die of exposure.

Much hunting is carried out from canoes and whaleboats amongst the loose ice in spring and summer. Losses are estimated to be as high as 30 percent at this time of year since many mortally wounded animals escape their pursuers.

In Canada the most successful hunting is carried out in the autumn when larger, fully-decked "Peterhead" boats visit the areas near the uglit and hunt small groups of walruses in the shallow bays along the coast. Wounded animals rarely escape, and those animals which sink before being harpooned can usually be hooked off the bottom. This type of hunting is particularly advantageous since meat taken at this time of year freezes quickly and can be kept in good condition.

Utilization of carcasses varies from settlement to settlement. About 35 percent of a carcass is meat fit for human consumption. Some of this, as well as the remaining meat, skin, guts, and much of the blubber, is used for dog food. The skin has some commercial value and is used at the present time for the manufacture of billiard-cue tips. The Royal Greenland Trade Department (K.G.H.) buys up to 5,000 kg per year at 1 Kroner per kilogramme (F. Bruemmer, unpublished report), but in Canada walrus hide is used only for feeding to dogs.

A trade in ivory is still maintained with the Hudson's Bay Company in Canada and K.G.H. in Greenland, but much ivory is sold privately. For example, at Thule, good sets of skulls and tusks, particularly from large bulls, are sold to local Danish residents and to service-men from the U.S. Air Base.

In the 1960's the average annual walrus kill for the eastern Canadian arctic was about 500, plus about 200 for western Greenland. To this total must be added another 30 percent for hunting losses.

There is no evidence that exploitation has been too high except in the Holsteinsborg area where the population appears to be at a much reduced level.

Conservation

In 1928 Canada established regulations which limited killing of walruses to Eskimos for their own food and clothing requirements (Canada, Privy Council 1920: Order in Council P.C. 1036). In 1931 more explicit regulations were issued forbidding the export of walrus hides and uncarved tusks, and limiting the catch of walruses to 7 per family (P.C. .1543).

Further Orders in Council issued in 1934 (P.C. 1274), 1947 (P.C. 5361), 1949 (P.C. 4991) and 1959 (P.C. 807) amended the earlier regulations, but did not change their main intent.

In Greenland, new walrus hunting regulations came into force on 1 April 1957 (Ministeriet for Grønland, MS 1956). These limit hunting in Davis Strait and Baffin Bay to Danish citizens resident in Greenland, and allow only boats of up to 40 registered tons to be used. From 1 June to 1 January all hunting of males in the West Ice is forbidden, and from 1 April to 1 January no females and calves may be taken in the same area. Hunting on the land in the Kangatsiaq district near Egedesminde is also forbidden from 15 October to 31 January. In spite of these regulations the walrus population in West Greenland appears to have continued its decline.

Prior to 1953 no regulations prevented Norwegian vessels from hunting in the West Ice in Baffin Bay. Following an excessively large catch in 1949 and again in 1951, a regulation came into force in June 1952 forbidding Norwegian vessels to hunt walruses at any time (Fiskeridirektøren Bergen 1954).

Research

Vibe (1950) provided a detailed account of walrus ecology in the Thule area of Greenland, while Jensen (1928) and Freuchen and Salomonsen (1958) summarized much of the general knowledge of this species, particularly in Greenland.

In Canada Loughrey (1959) carried out detailed studies of the walrus in 1954, and these were continued and amplified by Mansfield in subsequent years (MS 1958, 1966).

At present government research on marine mammals in Canada is carried out by the Fisheries Research Board, now part of the Fisheries Service, Department of the Environment. Headquarters of the marine mammal programme are at the Arctic Biological Station, Fisheries Research Board of Canada, Ste. Anne de Bellevue, Quebec. No field studies of the walrus have been carried out since 1961, when the population in the Southampton Island-Coats Island area was surveyed by boat and aircraft. Since that time the walrus catch in this area has declined somewhat owing to the increasing use of snowmobiles and the resultant decrease in the number of dogs and the need for large amounts of dog food. Since the walrus population in 1961 appeared to be maintaining itself, there has been no urgent need to re-examine its status in the intervening years. However the results of recent exploration for oil and gas indicate that greatly increased activity associated with pipeline development may occur in north-eastern Hudson Bay and will warrant further

study of the walrus in this area.

In spite of the current easing of demand for walrus meat, it will not be many years before the increasing human populations in eastern Keewatin, northern Quebec and southern Baffin Island bring heavier pressure to bear on all marine mammal stocks. The Federal Government is aware of this situation and will revise the regulations when required. One major change already suggested is the adoption of quotas for populations confined to particular areas such as northern Hudson Bay and northern Foxe Basin.

REFERENCES

1. Allen, J.A. 1880. History of North American pinnipeds. A monograph of the walruses, sea lions, sea bears and seals of North America. U.S. Geol. Geog. Surv. Terr. Misc. Pub. 12, Washington, Government Printing Office, 785 p.

2. Canada, Privy Council. 1928. P.O. 1036. Protection of walrus, Canada Gazette, 30 June 1928.

3. Fay, F.H. MS 1960. Investigations of the Pacific walrus. Arctic Inst. North America, Project 26, Terminal Report. MS 72 p.

4. Fay, F.H. 1960. Carnivorous walrus and some arctic zoonoses. Arctic 13(2): 111-122.

5. Freuchen P. & F. Salomonsen. 1956. The arctic year. G.P. Putnam's Sons, New York, 438 p.

6. Harington, C.R. 1966. Extralimital occurrence of walruses in the Canadian arctic. J. Mammalogy 47(3): 506–513.

7. Jensen, A.S. 1928. Grønlands fauna. Festskrift udgivet af Københavns Universitet i anledning af Hans Majestaet Kongens fødselsdag, 26 September 1928. Pp. 51-52.

8. Loughrey, A.G. 1955. Preliminary investigation of the Atlantic walrus Odobenus rosmarus rosmarus (Linnaeus). Canadian Wildlife Service, Wildlife Management Bull. Ser. 1, No. 14: 123 p.

9. Mansfield, A.W. 1958. The biology of the Atlantic walrus Odobenus rosmarus rosmarus (Linnaeus) in the eastern Canadian arctic. Fish. Res. Bd. Canada, MS Rep. 653: 146 p.

10. Mansfield, A.W. 1966. The walrus in Canada's arctic. Canadian Geog. J. 72(3): 80-95.

11. Ministeriet for Grønland, MS 1956. Vedtaegt om regulering af hvalrosfangst i Davisstraedet og Baffins Bugt. MS 3 p.

12. Ministeriet for Grønland, (No date). Sammendrag af Grønlands Fangstlister 1/1-31/12 1967.

13. Vibe, C. 1950. The marine mammals and the marine fauna in the Thule district (Northwest Greenland) with observations on ice conditions in 1939-41. Meddelelser om Grønland 150 (6): 116 p.

14. Vibe, C. 1967. The walrus. Pp. 77-80. In: Arctic animals in relation to climatic fluctuations. Meddelelser om Grønland 170(5): 227 p.

Status of the Japanese Sea Lion

by

Masaharu Nishiwaki

Ocean Research Institute, University of Tokyo

There have been few occurrences of the Japanese sea lion (Zalophus californianus japonicus) in the adjacent waters of Japan for long.

Only we know that a breeding colony of this species had been on Takeshima, a small rocky island. However, since the end of World War II, the Republic of Korea claimed sovereignty of Takeshima. Since then, we have heard only a rumour telling that Korean soldiers on the rocks fired at Japanese sea lions. But we can do nothing to see whether it was true. From Takeshima to Oki Islands we have had no records of Japanese sea lions since long before that.

Dr. Nagamichi Kurod in his book on the mammals of Japan, "Nihon Zyurui Zusetsu", 1953 (in Japanese), wrote that a Japanese sea lion probably appeared in the Yodo River, Osaka in March 1940. It seems, however, that this might not have been a wild one, but an escape from a circus or some facility.

I have asked at every fishing village I have visited in the past 20 years to send reports of occurrences of sea lions and have had three replies as follows:

(1) In May 1962, a marine mammal came up to the beach of Ashizuri Peninsula, Shikoku, and was captured by fishermen and put into the Kohchi Aquarium, It died a few months later. News of the incident reached me after its death and, unfortunately, Kohchi Aquarium had discarded its carcass and I could only inspect part of its pelt and obtain information from the director. As a result I could only identify it as a bull northern fur seal. According to the director, snivel was running at its nose without interruption. Supposedly, this animal was suffering some serious disease and came up to the shore because of this.

(2) On 8 March 1968, I was on board the research vessel "Hakuho-maru" presiding at a meeting; the ship was anchored just in front of Toba City. While I was standing on the bridge I saw an animal coining from the northward swimming like a sea lion. The flippers of the animal were a little wider and its body was coloured a paler yellow than that of the California sea lion.

I thought the animal had escaped from Toba Aquarium and was swimming away. I inquired at the aquarium, but was told that there had been no escape nor was there a Steller's sea lion in captivity. Possibly the animal was a stray Steller's sea lion looking for its way out.

(3) In May 1969, there was a report of an incident in which a sea lion had come to the vicinity of a light-buoy outside Tokuyama City, in the waters of the Seto Inland Sea. The animal was not afraid of boats and the fact enabled local people to take photographs. I saw some of those pictures and identified it a Zalophus sea lion. When I got to the spot an 8 June, the animal had already gone. Fishermen told me that it had eaten mackerel thrown to it. If so, the animal might be an escape. I inquired at every aquarium and found that the Amakusa Aquarium, Kyushu, had lost two individuals of California sea lion (Z. californianus) in August 1968. One of them was recaptured by net two months later, but there had been no report of the other. The Zalophus sea lion at Tokuyama may have been this other one.

These are all the incidents I have collected, and it may be safe to say that the Japanese sea lion does not inhabit the waters adjacent to Japan.

The only possibility of its existence, which we heard from seamen and fishermen is that there were colonies of sea lions under the precipitous cliffs on the east coast of Korea. Those animals are probably Steller's sea lion but it is still possible that Japanese sea lion might exist near colonies of the Steller's sea lion.

I have tried to contact Korean scientists, but have received no reply, and unfortunately it is difficult to investigate the animals because of political difficulties between South and North Korea.

Paper 10

Guadalupe Fur Seal (Arctocephalus townsendi)

by

Karl W. Kenyon

Bureau of Sport Fisheries and Wildlife

Naval Support Activity, Bldg. 192

Seattle, Washington 0115

Introduction

Recently Repenning, Peterson and Hubbs (1971) reviewed the taxonomic status of the Guadalupe fur seal Arctocephalus philippii townsendi and its closest relative the Juan Fernandez fur seal, A. p. philippii. They came to the tentative conclusion that the two forms should probably stand as Arctocephalus townsendi and Arctocephalus philippii.

A comprehensive review of the history, present status, habits, and behaviour of the Guadalupe fur seal was prepared and published by Peterson, Hubbs, Gentry and DeLong (1968). Except for shore counts of seals, little new information has become available since they studied this seal on Guadalupe during two expeditions in 1967.

Distribution

Past.--In the 19th century, thousands of fur seals were killed on the islands off the southern California coast, but specimens were not preserved and the sealers failed to recognize specific differences (Repenning et al. 1971).

It has thus been presumed that this species may have bred on islands of the California coast as far north as the Farallons (38°N) off San Francisco (Starks, 1922). This supposition, however, has been seriously doubted. Hubbs (letter, 1972) stated: "The population there was probably of the northern species. As Dick Peterson and Burney LeBoeuf indicated in their Pacific Discovery articles on 'Fur seals in California' in 1969, I have held to the theory, largely on oceanographic grounds, that the fur seals of the Farallons were of the northern species. In partial confirmation of my somewhat heretic view, Repenning inserted in our 1971 paper that finally, according to a personal communi-

cation from J. Schcnewald, fur seal fragments from a Russian garbage dump on the Farallons have been identified as Callorhinus. In this paper there is no indication that the Guadalupe fur seal may have wandered into such arctic waters as those off San Francisco." It has also been presumed that they may have ranged as far south as Islas Revillagigedo (18°N) (Morrell 1832; Repenning et al. 1971).

At Guadalupe, on the basis of polished rocks (presumed to have been smoothed by centuries of use by seals), it is hypothesized that seals formerly occupied most of the east coast to near Pta del Norte at Pilot Rock. Also, that they formerly occupied about the southern one-third of the west coast and a nearby small volcanic islet, Islote Negro (Peterson et al. 1968).

Present. ——The only known breeding colony today (Peterson et al. 1968) is scattered along about 17.4 km of the east shore of Guadalupe Island (29°N), 140 miles (256 km) west of Baja California, Mexico.

Individual seals occur with some regularity about 315 miles to the north (34°N) on Ft. Dennett, San Miguel Island, California, according to R.L. DeLong (pers. comm.). On 31 August 13/1, in company with DeLong and C.H. Fiscus, I visited the beach. Among the rocks we found an adult male, a subadult male, and a young female. This is the first time that a female has been observed there and also the largest number of animals seen on shore at one time. In order not to disturb these seals and in the hope the species might recolonize San Miguel Island, the place where they habitually haul out is seldom visited.

We saw three individuals in the water near the east coast of Cedros Island, about 170 wiles east of Guadalupe, on 3 February 1965. None could be found on shore (Rice, Kenyon and Lluch, 1965).

It thus appears that these seals range widely; however, because their population is still small, few are seen at distances from the breeding colony.

Summary of Natural History

This seal has been observed in the wild and its behaviour documented primarily by Peterson et al. (1968). No studies have been conducted of growth rates, age structure of the population, or mortality.

Birth and copulation occur in May, June, and July. The harems of the territorial bulls are more scattered and near caves or recesses, more loosely organised, and smaller than those of the northern fur seal (Peterson et al. 1968).

It appears that seals are ashore on Guadalupe throughout much of the year, but additional observations (see Table 1) are needed to document their occurrence in late summer. It would appear that young probably remain at the island throughout the year. We found adult males very scarce and adult females only fairly numerous during our visit in late January 1965.

Status of Population

An adult male Guadalupe fur seal, photographed in 1928 (Repenning et al. 1971:25) was held captive in the San Diego Zoo, California. Efforts by the zoo staff and others to locate the remnant wild population failed (Belle J. Benchley, pers. comm.). It was concluded then that the animal brought to the zoo by professional seal catchers may have been the last survivor or that the remnant population might be too small to be viable.

The discovery that the species still existed was made by Bartholomew (1950) on San Nicolas Island, California, in 1949 where he observed a lone male. The breeding animals eluded observers until 1954, when C.L. Hubbs (1956) discovered a small colony on Guadalupe Island, Mexico. At this time he was able to count only 14 seals. Since then, several counts have been published (Table 1). These indicate that the population is probably in a stage of logarithmic growth. According to Hubbs (pers. comm. 1972), the most recent beach counts are "approaching 400 animals" and the area occupied by the seals along the east shore of Guadalupe is continuing to be extended (as noted by Peterson et al. 1968) toward the southeast point of the island at Morro Sur. The two published estimates of the total population (500 and 600, Table 1) are, today, probably conservative.

It may be realistic to estimate that the total population does not, in 1972, exceed 1,000 animals.

Status of Habitat

The habitat remains essentially undisturbed. The presence of several Mexican families at a weather station, and a garrison of marines at the southwest tip of Guadalupe, probably do not occupy a significant part of potential shore habitat--at least for the immediate future.

"The isolation of Guadalupe is one of the most important factors which permitted the survival of the northern elephant seal and the Guadalupe fur seal. Also, because of the scarcity of water on the island (there is only one small spring on the upper slopes of the north end of the island), no permanent human population has occupied the island. The small detachment of Mexican marines now living at the south end of the

Table 1.——Counts and estimates of Guadalupe fur seals at Guadalupe Island, Mexico[1/]

Date	Count	Estimated total	Authority
1950	0		Bartholomew and Hubbs, 1952
Nov. 1954	14		Hubbs, 1956
Feb. 1964	240		Lluch, Irving and Pilson, 1964
Nov. 1964	252		Hubbs (in litt.)
Jan. 1965	285	600	Rice et. al. 1965
March 1965	211		Hubbs (in litt.)
April 1966	372	500	Peterson et al. 1968
May 1967	198		Peterson et al. 1968

1/ Dr. and Mrs. Carl L. Hubbs kindly assembled their most recent Guadalupe Island field notes (letter, 24 July 1972): "We have observations along the entire east coast from the point where I rediscovered the species and named Discovery Point (at the south end of the main northeastern embayment of the island), down to, and once actually within Galeta (Cove) Melpomene.

"The totals for the given dates are 298, for February 17 and 18, 1969; 365 for January 22-23, 1970; 374 for April 15-16, 1970 (from Summary Report by Michael L. Bonnell and Mark O. Pierson of the UC Santa Cruz group); and 235 for May 21-22, 1971.

"There was some variation in the extent of the shore that was actually covered on foot., which method gives the higher counts, and there certainly is some variation with the season. For instance, the two high counts of 365 and 374 for January and April include very few adult males. Certainly some individuals are also at sea. Considering points like this, has led us to believe that the population must exceed 500 somewhat.

"It is a real pleasure to be able to make these figures available, though we do regard them as approximations and perhaps somewhat preliminary, subject to some modification when the quickly taken notes on the shore traverse have been critically reexamined. I would prefer to have the counts indicated as of this nature."

island may act in some degree as a deterrant to yachtsmen and fishermen who might otherwise visit the island and cause damage to animal populations there. Unfortunately, though, the marine detachment does not have facilities to properly patrol the more than 50 miles of shoreline.

"Guadalupe was declared a wildlife sanctuary by President Obregon of Mexico in 1922. Daniel Lluch told us that a movement is now in progress to make this a Mexican National Park and to increase the facilities for proper control of visitors to the island. An interesting example of what can happen because of inadequate patrol facilities has recently occurred. A group of Americans came to the island in 1964 and brought with them a quantity of equipment. They apparently remained on the island for about 4 months and then hearing that a patrol vessel was en route to evict them they left hurriedly and abandoned what we estimated to be at least $5,000 worth of goods. This included two refrigerators, a motorcycle, a 4-wheel jeep-like vehicle, a large quantity of bedding, mattresses, chairs, food, scuba-diving equipment, skiff and outboard motor. At the raquest of Lt. Vasquez, we assisted the Mexican marines, as an international courtesy, by hauling some of the confiscated American equipment from Barracks Beach to the military post on the south tip of the island. We found expended .306 caliber rifle shells and were told that the Americans had killed some seals." (Kenyon 1965).

Conservation Measures in Effect

"Because this seal has been observed within United States boundaries in recent years, zoologists have been concerned about its legal status. In a memorandum of 23 November 1966, the Bureau of Commercial Fisheries clarified the Fur Seal Act of 1966 (80 Stat. 1091), pointing out that 'fur seal' is not defined by the Act and therefore the Townsend fur seal as well as the Alaska fur seal are protected in American waters and are protected from exploitation anywhere by American citizens," (Scheffer 1967).

Mexican law also gives this seal complete protection.

Conclusions

"Because of its innate tameness, this seal is exceedingly vulnerable to decimation by illegal hunters. At present the Mexican garrison is unable to offer adequate protection to the seals because available boats are too small to visit the area occupied by the seals. Illegal hunters could operate for a number of days at the seals' breeding and hauling grounds without being detected. Although some adults and many young seals remain at the Guadalupe breeding ground, most adult males and many adult females were at sea during the late January and early February season of our visit," (Kenyon 1965).

REFERENCES

1. Bartholomew, G.A. 1950. A male Guadalupe fur seal on San Nicolas Island, California. J. Mammal. 31/175-180.

2. Bartholomew, G.A. & C.L. Hubbs, 1952. Winter population of pinnipeds about Guadalupe, San Benito, and Cedros Islands, Baja California. J. Mammal. 33(2):160-171.

3. Hubbs, C.L. 1956. Back from oblivion. Guadalupe fur seal: still a living species. Pac. Disc. 9:14-21.

4. Kenyon, K. W. 1965. Expedition to Baja California, Mexico, 19 January to 11 February 1965. (Unpublished report in Bureau of Sport Fisheries and Wildlife files, 30 p.)

5. Lluch-B, D., L. Irving & M. Pilson, 1964. Algunas observaciones sobre Mamiferos acuaticos. Inst. Nacional de Inveotigaciones Biologica-pesqueras. Pub. No. 10, p. 1-23. Mexico,

6. Morrell, B. 1832. A narrative of four voyages to the South Seas, North and South Pacific Oceans .... from the year 1822 to 1831 .... 429 p. J. & . J. Harper. New York.

7. Peterson, R.S., C.L. Hubbs, R.L. Gentry & R.L. DeLong, 1968. The Guadalupe fur seal: habitat, behaviour, population siza and field identification. J. Mammal. 49:665-675.

8. Repenning, C.A., R.S. Peterson & C.L. Hubbs, 1971. Contributions to the systematics cf the southern fur seals, with particular reference to the Juan Fernandez and Guadalupe species. In: Vol. 18, Antarctic Research Series: Antarctic Pinnipedia, W.H. Burt, Ed. Am. Geophys. Union, Nat. Acad. Sci., Mat. Res. Council.

9. Rice, D.W., K.W. Kenyon & D. Lluch-B., 1965. Pinniped populations at Islas Guadalupe, San Benito and Cedrcs, Baja California, in 1965. Trans. San Diego Soc. Nat. Hist. 14(7):73-84.

10. Scheffer, V.B. 1967. Arctocephalus philippii townsendi: protection. In: Am. Soc. Mammal. Mar. Mammal. Comm. Hep. for l966-67, unpublished.

11. Starks, E.C. 1922. Records of the capture of fur seals on land in California. Calif. Fish and Game, 8:155-160, figs. 1-3.

Paper 11

Hawaiian Monk Seal (Monachus schauinslandi)

by

Karl W. Kenyon

Bureau of Sport Fisheries and Wildlife
Naval Support Activity, Bldg. 192
Seattle, Washington 93115

INTRODUCTION

Monachns is a relict genus, the future survival of which may depend on the absence of man from its environment. No authentic information exists that in historical times there aver were large flourishing populations of the three species, although locally they were said to be "common" when discovered.

The Hawaiian species probably survived the period of intensive marine mammal exploitation during the 18th and 19th centuries because of the isolation of its oceanic habitat in the Leeward Hawaiian Islands. Also, in all probability, its comparative low abundance and rather solitary habits did not offer sufficient incentive to attract many sealers. Unlike its close relative, the elephant seal, monk seals do not congregate in large groups on breeding grounds. They are scattered loosely along beaches or haul out in apparently non-social groups where the habitat permits easy access to shore and basking areas.

It is commonly presumed that if an animal is "genetically tame" it is not disturbed by the presence of man. This may be true of some species but evidence accumulated since 1957 indicates to me that human presence in the vicinity of mother monk seals with nursing pups is an important factor in reducing survival of young. Perhaps the lactating seal is psychologically and physiologically upset to the extent that she is unable to deliver sufficient nourishment to her pup, decreasing its chances of survival after weaning. Because the monk seal evolved under conditions where escape from land predators including man was unnecessary, it failed to develop the ability to flee. It does not follow, however, that the seal is not frightened and thus physiologically disturbed by the close proximity of men.

Data on the observed decrease of monk seal populations at two atolls, Midway and Kure, occupied by man in recent years was recently assembled and discussed (Kenyon 1972).

In addition to a review of published information on the Hawaiian monk seal, unpublished data gathered on. surveys of the Hawaiian Islands National Refuge since the 1956-58 studies are included in this report. The cooperation of Refuge Manager and Wildlife Administrator Eugene Kridler (1971), Assistant Manager David Olsen, and Biologist John L. Sincock, BSFW, contributed substantially to this effort.

Distribution

Present. ––The Hawaiian monk seal breeds today regularly on five atolls (Kure, Pearl and Hermes Reef, Lisianski, Laysan, and French Frigate Shoals). It travels, apparently with some frequency, long distances from these breeding islands. Seals have been observed along the shores of the main Hawaiian Islands (Kenyon and Rice, 1959) about 1165 km (650 nautical miles) from the nearest breeding island; a seal tagged on Laysan Island was recovered 1013 km (550 nautical miles) away on Johnston Island (Schreiber and Kridler, 1969); between 1964 and 1969 on five visits to Necker Island, 6, 10, 12, 15, and 20 seals were counted and on two visits to Gardner Pinnacles 5 and 6 were seen (field notes, E. Kridler and K.W. Kenyon). These islets are respectively 139 and 213 km (75 and 115 nautical miles) from the nearest breeding atolls. Neither Necker nor Gardner Pinnacles can become breeding islands because their rocky beaches footing cliffs are narrow and are often swept by heavy surf.

Refuge Manager E. Kridler has tagged a relatively large number of seal pups beginning in the mid 1960's. A number of recoveries have been recorded but these data have not yet been completely analyzed. The data, however, show that individual seals move from one breeding island to another.

Past. ––In the 1957-58 period monk seals bred on six atolls, but continuous use of beaches by people at Midway Atoll is assumed to be the cause for this breeding colony to disappear. No pups are known to have been born there in the latter 1960's. In 1970-71 human use of certain beaches was reduced and three pups were born and apparently weaned on a small islet between Sand and Eastern Islands in 1971 (Kenneth C. Balcomb, III, pers. comm.).

It is evident that monk seals may be killed easily and that they abandon areas where human disturbance is frequent. Because monk seals are today observed among the main Hawaiian Islands, we may postulate that before the arrival of Polynesian people some centuries ago this seal bred on favourable beaches on these islands. Being easily approached, they were probably quickly extirpated. No archeological evidence, however, has yet been found to demonstrate that this was true.

Laysan Island is today an important breeding ground. When the island was occupied by men in the late 19th and early 20th centuries the seal was virtually extirpated there (Dill and Bryan, 1912). It is thus apparent that there is a direct correlation between the presence or absence of man and the presence or absence of this seal. It is also apparent that if protected and undisturbed the monk seal is capable of repopulating ancestral breeding grounds from seed populations in undisturbed areas.

Summary of Natural History

Growth and body size. --Pups quadruple their birth weight of about 16 kg (35 pounds) during the approximately 6-weeks nursing period. Their length at birth is about 100 cm. During their first year while learning to fend for themselves, they lose weight. Yearlings were found to average about 45 kg (100 pounds) in weight but had increased in length to about 130 cm (Kenyon and Rice, 1959: 245).

Rice (1960) found that two seals tagged as yearlings doubled their weight in their second year and that one increased in length by 36 percent and the other by 15 percent. He concluded that monk seals probably do not attain full growth until at least 4 years of age.

A normal-appearing adult male, aged approximately 20 years (Kenyon and Fiscus, 1963), weighed 173 kg (380 pounds) and measured 214 cm in length. Adult females, shortly before parturition, are more obese than any male observed. One was estimated to weigh about 272 kg (600 pounds) (Kenyon and Rice, 1959).

Breeding

Copulation has not been observed and is believed to take place in the water.

Birth occurs on sand beaches. The dry sand area in the vicinity of Scaevola shrubs well above the tide line is preferred. However, when human disturbance is frequent on the preferred areas, pupping takes place on isolated shifting sandpits (Kenyon 1972). Here the seals are exposed to strong winds and their inadequate resting areas are inundated by high tides and storm waves.

The pupping season extends over a period of nearly 8 months from late December to mid-August (Kenyon 1966). Host pups, however, are born in the March through May period. Rice (1960) estimated the birth rate of 16.3 percent and postulated biennial breeding of females. Wirtz (1968) conducted a study of 78 tagged females through two consecutive breeding seasons (1964 and 1965). He recorded that 44 (56%) of these bred during the study period. Of the breeding females, 15 (34%) bred

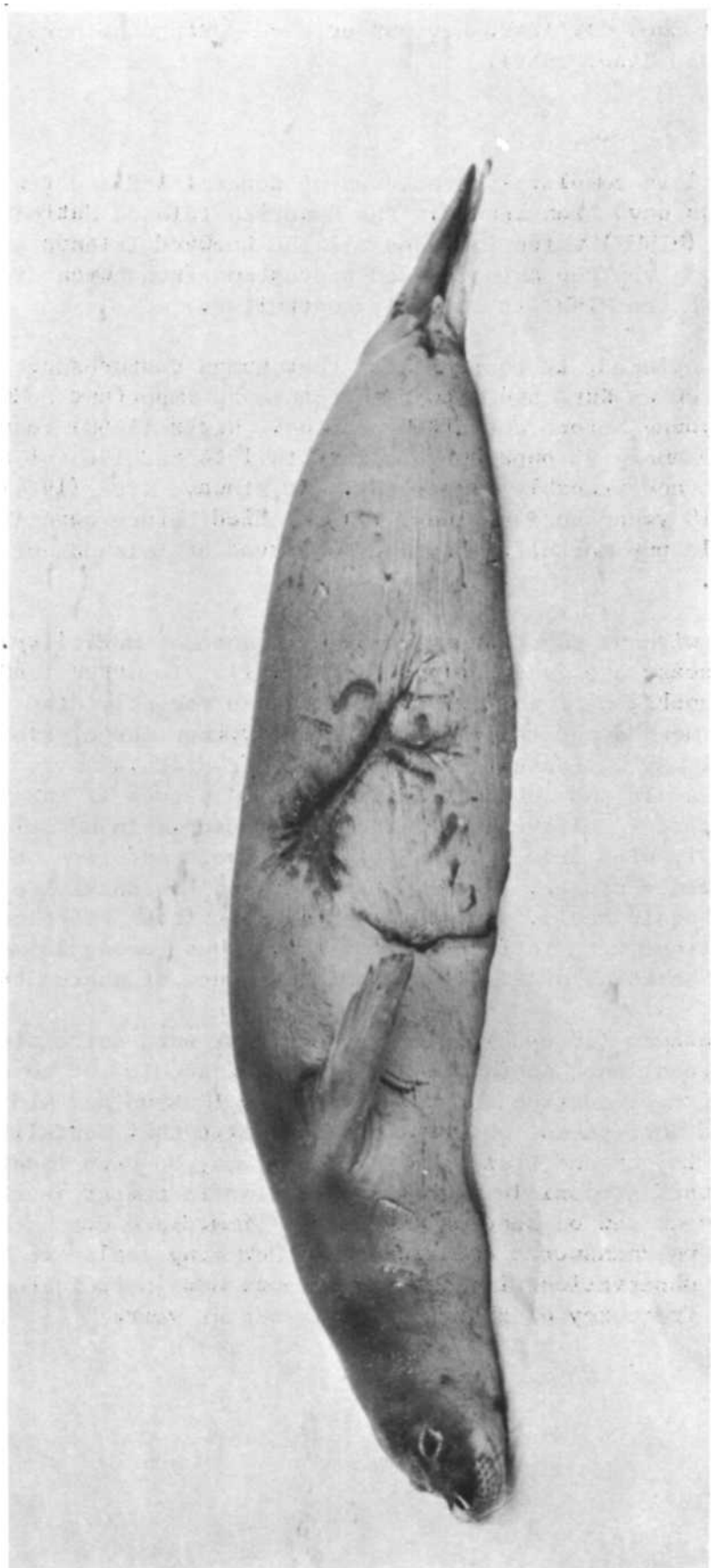

Figure 1. --A pregnant monk seal showing scars of a large healed wound inflicted by a shark. KWK 68-7-19.

in both seasons, 14 (32%) only in 1964 and 15 (34%) only in 1965. The mother monk seal does not leave her pup or feed during the nursing period (Kenyon and Rice, 1959).

Mortality

The monk seal is completely protected by federal law and few permits to take specimens have been issued. The Hawaiian Islands National Wildlife Refuge (HINWR) which includes all the Leeward Islands except Kure and Midway, gives the animal added protection from human disturbance because access to the HINWR is strictly controlled.

As previously mentioned, it is indicated that human disturbance during the nursing period on Kure and Midway may cause an important reduction in survival of young before and after weaning. Hirtz (1968) recorded a mortality rate among 62 pups horn at Kure in 1964 and 1965 of at least 19 percent and probably 27 percent. At Midway, Rice (1964) recorded that of 18 young born at least 7 (39%) died before weaning. Relatively little pup mortality has been observed at islands not occupied by man.

Shark attack is without question an important cause of mortality. Seals bearing healed scars are frequently seen (Fig. 1). In March 1968, on Laysan and Lisianski, we found two seals that had recently died of shark-inflicted wounds and three seals bearing rather large, fresh shark bites that may ultimately have caused their death. On 26 March 1969, among 138 adult and subadult seals that I observed 12 bore fresh wounds or old scars I believed to be shark-inflicted. In addition, one dead seal probably died from a shark-inflicted wound and five others were dead of undetermined causes. On 30 March 1969, on Lisianski I examined 97 adult and subadult seals. Among these, 16 bore fresh bites or old scars that I believe were inflicted by sharks. Thus, among 235 seals examined in 1969 a total of 29 (12%) showed evidence of shark attack.

Previous observations (1956-58) at Midway and Kure were quite different from the more recent ones at Laysan and Lisianski and led us to conclude that mortality from predation was relatively low (Kenyon and Rice, 1959; Rice 1960). The more recent observations indicated that mortality from shark attack at Laysan and Lisianski, at least, may be very important and may have caused a possible population decline in recent years (see Table 1). Seals we saw on beaches had escaped immediate death from shark attack. Two unanswered questions are: How many seals are killed at sea? Do the observations indicate that there has in fact been an increase in the frequency of shark attack in recent years?

Table 1 . -- Counts of monk seals in the Leeward Hawaiian Islands, 1957-68

Island	1957 Sprang[1]	1958 Spring[2]	March[3]	Sept.[3]	1966 Sept.[4]	1967 March	1967 Sept.	1968 March	1969 [6]	1970 [7]
Nihoa	NC	NC	1	1	NC	0	NC	NC	NC	NC
Necker	NC	NC	NC	6	10	12	15	NC	20	NC
French Fr. Shoals	35	43	NC	43	55	66	95	NC	159	166
Gardner Pinnacles	NC	NC	NC	NC	5	NC	NC	NC	6	NC
Laysan	233	326	310	252	202	199	181	167	211	147
Lisianski	256	281	180	121	139	139	108	123	130	109
Pearl and Hermes Reef	290	338	121	88	109	[5]80	107	[5]96	153	122
Midway	71	76	NC	NC	1	NC	NC	1	4	7
Kure	128	142	NC	NC	NC	NC	NC	69	NC	NC
Total	1,013	1,206	612	511	521	496	506	456	683	551

NC= no count.

1/ Highest count; various aerial and surface counts made (Kenyon and Rice, 1959).

2/ Highest count; various aerial and surface counts made (Rice 1960).

3/ Surface counts (Kridler letter, 1966).

4/ Surface counts.

5/ Incomplete count.

6/ Counts (except for Midway) from HINWR unpublished BSFW report by E. Kridler. Counts are selected highest made in February, March, August, and June 1969.

7/ Counts (except for Midway) are from HINWR unpublished BSFW report by E. Kridler. Counts are selected highest made in April, July, and August 1970.

Status of Populations

The basic data are not available to reveal reliably the total population of the Hawaiian monk seal. Those animals on land may be counted but the unknown number that may be far at sea (see Distribution) can only be guessed at.

The most comprehensive counts yet available were gathered in the 1956-57 period (Kenyon and Rice, 1959) and 1957-58 period (Rice 1960) when the total seals recorded were respectively 1,013 and 1,206 (Table 1). On the basis of his studies, Rice (1960) estimated the 1958 population to be about 1,350 seals.

The total number of pups born during the prolonged pupping season (see Breeding) is difficult to ascertain and attempts to count all pups born have not been made since 1958. Also, the frequency of pupping is incompletely known. Thus, current population estimates cannot be based on these parameters.

Rice (1960) postulated on the basis of data then available that the monk seal population was increasing. More recent field counts (Table 1), however, reveal no overall growth trend, but indicate to the contrary that the population may be decreasing at Midway, Kure, Lisianski, Laysan and Pearl and Hermes Reef, for example, (see Fig. 2). Only French Frigate Shoals shows an increase. Field counts must be viewed with caution since, for the same area, they vary due to weather, season, time of day and with the method of counting (aerial, boat or ground) (sec Kenyon and Rice, 1959). Thus, knowing that an unknown number of seals are at sea and that none of the recent counts cover all of the islands where seals are known to haul out, we may postulate that the present population probably numbers at least 700 animals and that it may number about 1,000.

Status of Habitat (Past and Present)

The presence of man in the monk seal habitat is a seriously detrimental factor to population survival. Thus, frequent visits by feather hunters, sealers and the occupation of Laysan Island by a guano works during the late 19th century and early in the present century furnished the first demonstration that a monk seal population, now re-established, could not coexist with men. The presence of a large human population on Midway during and after World War II resulted in the virtual disappearance of seals there during the 1960's. After Kure was occuped by a U.S. Coast Guard loran station in the early 1960's, a decline in the seal population was documented there in the latter 1960's (Kenyon 1972). French Frigate Shoals was occupied by a U.S. Coast Guard loran station during World War II and re-

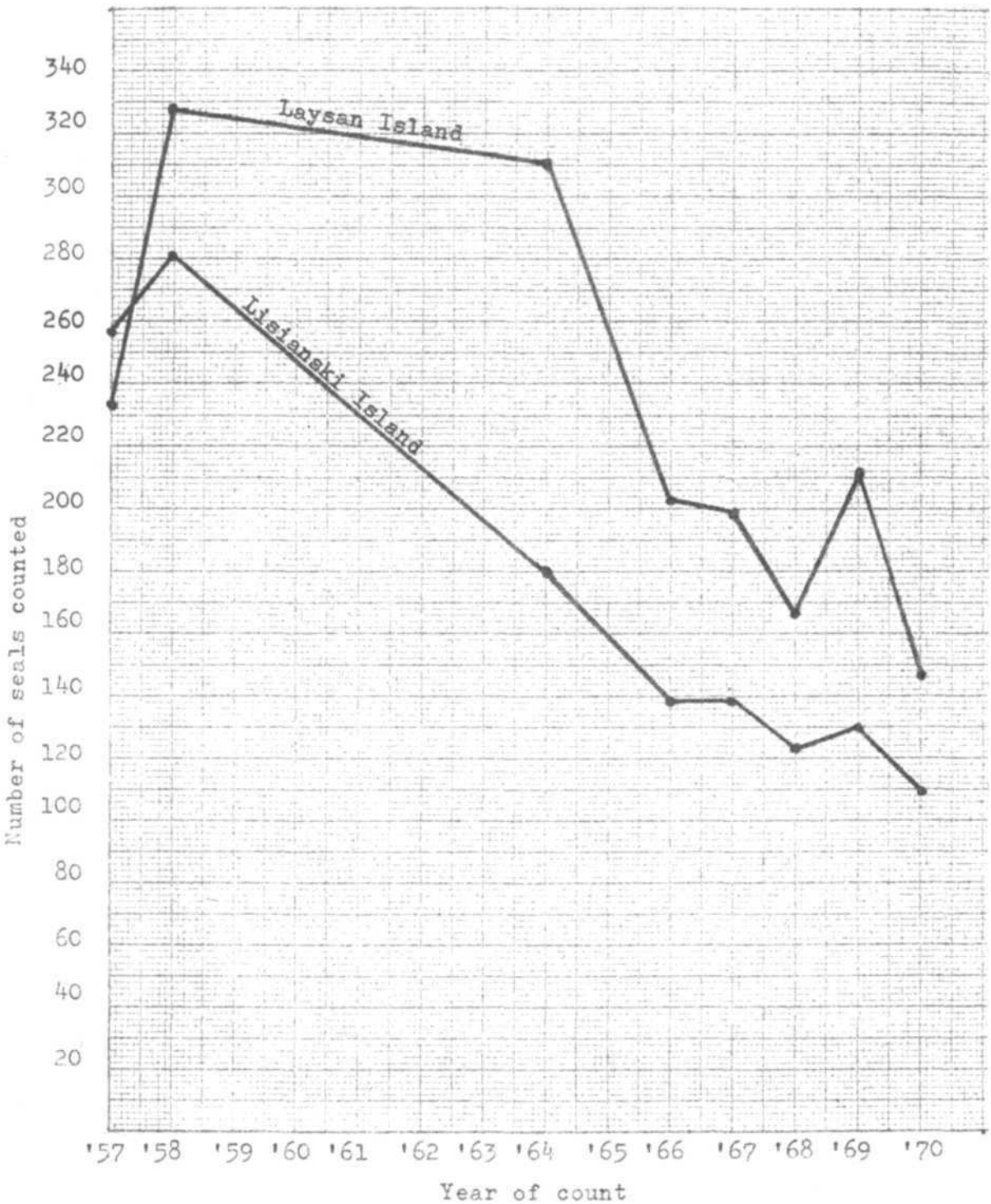

Figure 2.--Best counts of monk seals for each year counted on beaches of Laysan and Lisianski Islands, HINWR, 1957-70. It is not possible to say with certainty that these counts are comparable. If they are they indicate that the populations of these two islands may have decreased during this 13-year period. (Data from Kenyon and Rice, 1959; Sice, 1960; and from field notes and unpublished reports of E. Kridler and KWK for 1964 and 1967-70.)

mains so today, seals do not today come ashore on Tern Island which is occupied by men, but they are seldom disturbed on other isolated islets. Thus this habitat remains relatively intact and the seal population there is large and increasing (E. Kridler, pers. comm. and Table 1).

Research Programmes and Conservation Measures in Effect

The HINWR staff usually conducts two annual surveys of refuge islands, one in the spring and the other in the fall, and may make occasional shorter trips. During these field expeditions, cattle-ear tags and/or numbered plastic tags are placed in the web of the hind flippers on young seals (mostly pups). Also, previously marked seals are recorded. All seals hauled out on beaches are counted. Other than this, the seals are completely unmolested on the HINWR and all other visits to the refuge islands are discouraged or prohibited.

Conclusions and Recommendations

Available evidence indicates that certain Hawaiian monk seal populations have declined in recent years. The declines have been most drastic at atolls (Midway and Kure) where numbers of people have easy access to beaches. At French Frigate Shoals where isolated islets are rarely visited an increase is indicated.

The possibility that tagging of seal pups on breeding islands may be detrimental to survival must be considered. Because the seal populations at Lisianski and Laysan (where there is no human population) appear to show a decline in the past decade, I would recommend that (1) consideration be given to limit the tagging of seals to one atoll only and (2) that mothers accompanied by nursing pups not be approached or disturbed in any way on all other breeding grounds.

The possibility also exists that the shiny monel tag or even the plastic tags in the flipper of a seal flash in such a way as to encourage shark attack. Experiments should be conducted to discover if this is so.

There seems to be little prospect that human activity at the Kure Coast Guard Station and Midway Naval Station can be limited sufficiently in the foreseeable future to allow these seal populations normal use of beaches. It would appear, though, that certain areas at Midway, i.e., the small islets (Seal, Rocky, and Dynamite) and Eastern Island, could be put permanently off limits to military personnel as seal and bird refuges, since evidence exists that seals will reoccupy breeding beaches after they are left undisturbed by man.

It must be emphasized that human disturbance of seals on all presently uninhabited breeding islands should be kept to a minimum.

REFERENCES

1. Dill, H.R., and W.A. Bryan, 1912. Report of an expedition to Laysan Island in 1911. Bull. U.S. Bur. Biol. Surv., 42:9.

2. Kenyon, K.W. 1966. Marine Wildlife Observations, Leeward Hawaiian Islands, 8-27 September 1966. Unpublished report in Bu. Sport Fisheries and Wildlife files, 47 p.

3. Kenyon, K.W. 1972. Man versus the monk seal. J. Mammal. 53: 606-615.

4. Kenyon, K.W., and C H . Fiscus, 1963. Age determination in the Hawaiian monk seal. J. Mammal. 44(2): 280-282.

5. Kenyon, K.W., and D.W. Rice, 1959. Life history of the Hawaiian monk seal. Pac. Sci. 13:215-252.

6. Kridler, E. Unpublished Refuge narrative reports on the Hawaiian Islands National Wildlife Refuge for 1969 and 1970. Bureau of Sport Fisheries and Wildlife, Regional Office files, Portland, Ore.

7. Rice, D.W. 1960. Population dynamics of the Hawaiian monk seal. J. Mammal. 41(3): 376-385.

8. Rice, D.W. 1964. The Hawaiian monk seal. Nat. Hist. 73: 48-55.

9. Schreiber, R.W., and E. Kridler, 1969. Occurrence of an Hawaiian monk seal (Monachus schauinslandi) on Johnston Atoll, Pacific Ocean. J. Mammal. 50: 841-842.

10. Wirtz, W.O., III. 1968. Reproduction, growth, and development and juvenile mortality in the Hawaiian monk seal. J. Mammal, 49: 229-238.

Paper 12

Caribbean Monk Seal (*Monachus tropicalis*)

by

Dale W. Rice

National Marine Fisheries Service, Southwest Fisheries Center
P.O. Box 271, La Jolla, California 92037, U.S.A.

INTRODUCTION

The Caribbean monk seal *Monachus tropicalis* was first encountered by Columbus during his second voyage to the New World in 1494. It was one of the first New World mammals to be made known to Europeans, yet another 350 years elapsed before a specimen reached a museum and the species was formally named and described by Gray (1850). By that time the species was already scarce. As long ago as 1887, J.A. Allen called it an "almost mythical species". To this date, fewer than 50 skulls of this species have reached museums, and very few biologists have ever seen the animal in the wild. Although it is doubtful whether the species even survives, the IUCN and the U.S. Department of the Interior have placed it on their lists of endangered species.

Previous summaries of our knowledge of the Caribbean monk seal were compiled by J.A. Allen (1887), G.M. Allen (1942), and J.E. King (1956).

This report is based upon (1) a review of the literature, (2) an examination of most of the specimens of this species preserved in museums, and (3) the results of correspondence since 1956 with biologists who have worked within the former range of the species.

Distribution

There are three species of monk seals-- *Monachus monachus* in the Mediterranean, *M. tropicalis* in the Caribbean, and *M. schauinslandi* in the Hawaiian Islands. The genus *Monachus* probably originated in the Tethys Sea during the Miocene, close to the region where *M. monachus* still lives. The ancestors of *M. tropicalis* doubtless reached the Caribbean Sea by crossing the North Atlantic from the

Mediterranean area. King (1956) postulated that the ancestors of M. schauinslandi came from the Caribbean by crossing the isthmus of Panama. Unfortunately, she had few specimens of M. tropicalis, and only photographs of one skull of M. schauinslandi, upon which to base this conclusion. In a taxonomic study of this genus (to be published elsewhere), based upon large series of skulls of all three species, I found that M. schauinslandi differs markedly from M. tropicalis. Morphological comparison of the three species, along with geographical and ecological considerations, suggests that monk seals almost certainly reached the Hawaiian Islands from the west, rather than the Caribbean.

The Caribbean monk seal formerly ranged from the Bahamas west to the Yucatan Peninsula, thence south along the east coast of Central America and through the western Caribbean Sea, and eastward in the northern Caribbean as far as the northern Lesser Antilles. Its precise original distribution is difficult to chart, because most locality records are based on secondhand accounts of explorers and fishermen. It doubtless occurred at many unrecorded localities.

Like the Hawaiian species, the Caribbean monk seal probably hauled out and bred regularly only on uninhabited offshore islets and atolls, and occurred only as a straggler on the beaches of the mainland and the larger islands which had permanent aboriginal human populations.

Past Distribution (1494-1952)

Known records of occurrence of the Caribbean monk seal are summarized below. Table 1 (page 100) shows the last recorded date of probable regular occurrence of monk seals at each locality where they have been reported.

Bahamas. --According to Sloane (1707), "The Bahama Islands are filled with seals; sometimes Fishers will catch one hundred in a night." R. W. Kemp, in a letter dated 29 April 1878 to J. A. Allen (1880), said ". . . some few (seals) are to be found in that vicinity (the Bahamas)." Although the Bahamas would appear to offer a vast area of ideal monk seal habitat, and the animals must have been abundant there in the past, I have not been able to find any additional published records of the occurrence of seals there.

Cay Sal Bank. --Count L. F. de Pourtales informed J. A. Allen (1880) that his pilot told him in 1868-69 that he had killed seals among the rocky islets of Cay Sal Bank. According to J. A. Allen (1887) a half-grown seal captured on the "coast of Cuba" in 1883 fell into the hands of Felipé Poey; the U.S. National Museum, however, has two skulls from "Havana, Cuba," a subadult with no date and an adult dated 12 September 1883 (both numbered 20994), that were received from Poey. The subadult specimen was described by Elliott (1884) and True and Lucas (1886). Allen suggested that "capture. . .near Havana. . .seems to indicate that some still exist in the vicinity of Salt Key Bank."

Table 1. --Latest recorded dates of probable regular occurrence of Caribbean monk seals at known localities of occurrence. See text for references.

Locality	Latest date	Remarks
Bahamas	1878	
Cay Sal Bank	1883	
Florida Keys	1908	One killed in 1922.
Arrecifé Triangulos	1915	Four seen in 1948.
Arrecifé Alacran	1890	
Isla de Pinos	1878	Only one report.
Isla Providencia	1948	Only one report.
Serranilla Bank	1952	
Pedro Cays	1846	One killed in 1939.
Hispaniola	1494	Only one report.
Guadeloupe	1667	Only one report.

Florida Keys. --During Ponce de Leon's discovery of the Dry Tortugas on 21 June 1513, a shore party killed 14 seals (Herrera 1601). Fontenada referred to the presence of "sea-wolvos" in the Florida Keys during the mid-1500 s (Smith 1945). R. W. Kemp, in a letter dated 27 April 1878 to J. A. Allen (1880), said "Some two or three years ago there were two (seals) seen near Cape Florida. It was supposed that they had strayed from the Bahama Islands," He referred to their great rarity on the Florida coast, where they occur "only once or twice in a life-time." An army radio operator stationed at Fort Jefferson in the Dry Tortugas from 1903 to 1908 said that several "sea lions" inhabited the nearby islands (Moore 1953). According to Townsend (1906) "On February 25, 1906, a party of fishermen killed a West Indian seal about five miles from Key West where the specimen is now on exhibition. It is a female, nine feet long and apparently quite old." Townsend (1923) also refers to another specimen killed near Ksy West on 15 March 1922, which was identified by Mr. L. L. Mowbray of the aquarium staff.

Arrecifé Triangulos, Campeche. ---In 1856 a Mr. Alexander was on the Arrecifé Triangulos and saw only two live seals, but remains of skeletons and hides indicated a once flourishing scaling business (H. L. Ward 1887). Mr. H. L. Ward of Rochester (son of Professor H. A. Ward) and Mr. Fernando Ferrari-Perez, Naturalist in Chief of the Mexican Geographical and Exploring Commission, visited Arrecifé Triangulos from 1 to 4 December 1886; they found seals in "considerable numbers" and killed 49 of them (J. A. Allen 1887; H. A. Ward 1887; H. L. Ward 1887). In 1897 about 30 seals were seen on Arrecifé Triangulos, and 4 were captured alive (Anon. 190.3; Mann 1930). E. W. Nelson and E. A. Goldman of the U.S. Bureau of Biological Survey spent the period from 18 to 23 June 1900 on Arrecifé Triangulos; they were "very successful" in their quest for seal specimens (Goldman 1951) and obtained a series of 34 skulls for the U.S. National Museum. In June 1909, the New York Aquarium received three live seals from a dealer in Yucatan; their exact origin was unknown, but they were thought to have been taken at Arrecifé Triangulos (Townsend 1909; Anon. 1910; Grant 1911). In January 1911, some fishermen visited the reef and killed about 200 seals, leaving very few alive (Gaumer 1917). In 1915, six seals were captured alive, presumably at Arrecifé Triangulos, by the crew of a fishing vessel and taken alive to Pensacola, Florida (G. M. Allen 1942). In 1936, Francis W. Taylor, President of the Warren Fish Company of Pensacola, wrote to Dr. Francis Harper (in G. M. Allen 1942) that "on numerous occasions in the past fishing vessels had brought these seals in to Pensacola alive. He understands that they are now to be found only on the Eastern Triangle Key. . .the Mexicans have killed a great many, possibly all. . . I know of no seals which have been taken from the island in recent years." In June 1948, the lighthouse keeper reported four seals on the beach of West Triangle Key, and another seal was sighted in 1949 (Gilmore 1959). During an aerial survey of Arracifé Triangulos on 5 March 1950, Gilmore saw no seals (Gilmore 1959). Harvey R. Bullis (in litt, 15 August 1957) of the U.S. Fish and Wildlife Service found the bleached skull of a seal on East Triangle Key in August 1950.

Arrecifé Alacran, Yucatan. --Dampier (1705) reported seals on Arrecifé Alacran in 1675, and mentioned that large numbers were killed commercially for their oil. S. W. Gorman (in J. A. Allen 1880), on the U.S. Coast Survey steamer Blake in the winter of 1877-78, said that seals were "frequently seen and killed by one of the officers of the Blake. . .at the Alacranes. . ." According to Gaumer (1917), seals were found at Alacran up to 1890, but had not been reported in more recent years. Gilmore (1959) found none there during an aerial survey on 5 March 1951.

Isla de Pinos. --S. W. Gorman (in J. A. Allen 1880), who was on the U.S. Coast Survey steamer Blake in the winter of 1877-78, said that seals were "frequently seen and killed by one of the officers of the Blake. . . about the Isle of Pines'."

Isla Providencia. --According to secondhand information received by Gilmore (1959), a Mr. B. W. Winkler of Evansvillc, Indiana, saw some seals on Isla Providencia in 1948. This is the most southerly report of a hauling ground, although Henry Setzer of the U.S. National Museum reported seeing three seals in the channel between Puerto Limon, Costa Rica, and a small near-shore island in April 1949 (Gilmore 1959).

Serranilla Bank. --C. Bernard Lewis, Director of the Institute of Jamaica (in litt., 11 June 1957) said that up until 1952 there was a small colony of seals on Serranilla Bank but that he had received no reports of them since then. In 1948, Stewart Springer of the U.S. Fish and Wildlife Service saw several seals over Rosalind Bank, which lies immediately northwest of Serranilla Bank (Gilmore 1959).

Pedro Cays, Jamaica. ––Hill (1843, 1846) described a small seal captured alive on the Pedro Cays in 1843. In the spring of 1846, a Mr. George Wilkie and party visited Seal Cay, one of the Pedro Cays, and found five seals ashore, two of which they killed (Gosse 1851). One of the latter was sent to the British Museum, and is the type specimen of Monachus tropicalis. According to Lewis (1948) a young seal was killed on Southwest Cay of the Pedro group in 1939, but in 1957, he (in litt., 11 June 1957) was sure that there were no seals remaining on the Pedro Cays.

An alleged sighting of two monk seals on Drunken Man's Cay, near Kingston, Jamaica, in November 1949 (King 1956) is extremely questionable, according to people familiar with the area.

Hispaniola. --0n Columbus' second voyage, near the end of August 1494, on the islet of Alta Vela, off the south coast of Hispaniola, the sailors went ashore and killed eight "sea wolves" which were sleeping on the sand (Kerr 1811).

Guadeloupe. --Du Tertre (1667) was told by Brother Charles Poncet, who had recently been to Guadeloupe, that he had seen at least 20 seals asleep near the shore, and many of them were killed. There are no other published references to seals anywhere in the Lesser Antilles.

Recent Reports (1952-1972)

Since the disappearance of the last knowm colony of Caribbean monk seals from Serranilla Bank in 1952, there have been few sightings--none confirmed.

According to Archie Carr (in litt., 1 December 1964), fishermen and turtle captains say that seals arc once in a great while seen between Belize, British Honduras, and the Yucatan Channel. He said that the son

of the Director of the Natural History Museum in Merida, Yucatan, had recently seen a seal at Isla Mujeres. Charnock-Wilson (1970) said that seals are rumoured to inhabit Chinchorro Reef, Quintana Roo, but he found none there during an aerial survey in 1969.

In 1957 a seal was seen on the beach near Rockport, Texas (Anon. 1957) but it was not identified; escaped California sea lions (Zalophus californianus) have been found in the Gulf of Mexico on several occasions (Gunter 1968). Hearsay reports of "seals" along the Texas., coast in 1926 and 1932 (Gunter 1947) cannot be accepted as evidence of the occurrence of Monachus.

Fossil and Archeological Records

There are six reports of remains of Caribbean monk seals from Quaternary fossil deposits and archaeological sites. These finds indicate that monk seals ranged as far north as South Carolina in prehistoric times.

1. Melbourne, Brevard County, Florida. A proximal phalanx of the right hallux was unearthed from Pleistocene deposits (Ray 1961).

2. Lake Hellen Blazes, Brevard County, Florida. A fragmentary right mandible was recovered from an Indian midden (Ray 1961).

3. St. Petersburg, Pinellas County, Florida. A left maxilla with P2 and P3 in place was found in association with Indian artifacts. This specimen can be dated no more precisely than Quaternary (Ray 1961).

4. Vicinity of Charleston, South Carolina. "Fossil" remains were recovered (age not stated) (Ray 1961).

5. Rancho Diexmero archeological site, Nueces River (20 miles inland from mouth), Nueces County, Texas. One canine tooth was found. It was not possible to determine whether this tooth dated from before or after the Spanish occupation, which began in the early 1800's (Raun 1964).

6. Mission Nuestra Señora del Espiritu Santo de Zuñiga at Goliad, Goliad County, Texas, At least five canine teeth were found. They probably date from the Spanish occupation, which began in 1749 (Raun 1964).

Referring to the specimens from the two Texas sites listed above, Raun (1964) says "These teeth were probably trade items and do not definitely establish the West Indian seal as a former inhabitant of the Texas coast."

Natural History

Very little is known of the life history, ecology, and population dynamics of the Caribbean monk seal. I have summarized the meagre data available, and where relevant have compared them with data on the Hawaiian monk seal, the only species of the genus that has been studied in detail (Kenyon and Rice, 1959; Rice 1960, 1964a, and 1964b).

General behaviour and vocalizations, ––None of the brief published descriptions of the behaviour of Caribbean monk seals suggests that they differ markedly from other phocid seals in terrestrial locomotion, swimming, or other general aspects of behaviour,

According to H.L. Ward (1897), "The whole character of this seal is that of tropical inactivity. . .Upon first approaching them they appeared to have no dread whatever of the human presence, lazily looking at us, perhaps uneasily shifting their position, and then dozing off in restless sleep. Upon advancing to within three or four feet they would somewhat rouse themselves, bark in a hoarse, gurgling, death-rattle tone, and uneasily hitch themselves along a few paces." Obviously the Caribbean monk seal has the inherent tameness characteristic of the Hawaiian monk seal (Kenyon and Rice, 1959) and other species that have evolved on remote oceanic islands where they are not subject to terrestrial predators,

Most published descriptions of the voice of the Caribbean monk seal are. too vague to be of much use in comparing the vocalizations of this species with those of other species of phocids. H.L. Ward's description of their voice, quoted above, sounds like the "bubbling sounds" of the Hawaiian monk seal (Kenyon and Rice, 1959), a vocalization also characteristic of at least some of the other species of the subfamily Monachinae found in the Antarctic, but never reported from any of the northern seals of the subfamily Phocinae.

Reproduction. ––When H.L. Ward (1887) was on Arrecifé Triangulos from 1 to 4 December 1886, he killed five pregnant females, all with near-term fetuses (the only one that was measured was 85 cm long). He also saw one female with a nursing calf whose teeth had not yet erupted. These data suggest that December is the peak of the pupping season. In this respect, the Caribbean monk seal differs from the Mediterranean species, which pups from September to November (King 1956), and the Hawaiian species, which pups from January to June, with a peak in April and May (Kenyon and Rice, 1959).

The female has two pairs of functional mammae (H.L. Ward 1887), as do the other two species of monk seals and the bearded seal Erignathus barbatus; all other phocid seals have only one pair.

Food habits. --According to H. L. Ward (1887) "The contents of the stomachs of several were examined but nothing except fluids was found, which gave no clue to their food. It undoubtedly consists largely of fish; one in captivity was fed this food and appeared to thrive well."

Parasites and epizoites. --H. L. Ward (1887) said "several of those collected has such a growth of minute fungi on their back and flippers, more especially the hinder ones, as to appear quite green," The green colour indicates that the organisms were algae, not fungi. A minute green alga, Pringsheimiella scutata, commonly grows on the pelage of the Hawaiian monk seal (Kenyon and Rice 1959).

Banks,(1899) described the nasal mite Halarachne americana from the Caribbean monk seal. Other species of this genus occur in many species of monk seals.

The only reference to internal parasites is H. L. Ward's (1887) statement that "They are greatly infested with intestinal parasites several inches in length which, shortly after death, swarm out of anus and vagina (!), dying as they reach the air." It is difficult to guess what these parasites might have been. Other species of monk seals are host to diphyllobothriid cestodes (Diphyllobothrium, Diplogonoporus) and polymorphid acanthocephalans (Gorynosoma) in the intestine, and heterocheilid nematodes (Anisakis, Contracaecum, Phocanema) in the stomach.

Predators. --At Arrecifé Triangulos, H. L. Ward (1897) noted "very few scars" on monk seals and postulated that "some of them were not unlikely inflicted by the myriads of sharks surrounding the islands." Some Hawaiian monk seals likewise bear scars or wounds that appear to have been inflicted by sharks, but sharks were not believed to cause significant mortality (Rice 1960). More recent observations, however, suggest that shark attack may be an important mortality factor (see Kenyon's account of the Hawaiian monk seal in Paper 11 of this volume).

Papula tion dynamics. --The birth rate may be estimated from the sample collected by H. L, Ward on Arrecifé Triangulos in December 1886 (H. L. Ward 1887; J. A. Allen 1887). He collected one newborn pup and 48 older seals. Seven of the latter had to be abandoned on the island because of an approaching storm, so presumably only 41 specimens were closely examined. This series included five females carrying near-term fetuses. The one calf and the five fetuses indicate a birth rate of 6/41, or 0.15. This rate is essentially the same as the mean rate of 0.163 found in six populations of the Hawaiian monk seal in 1958 (Rice 1960). These data suggest that the female Caribbean monk seal, like the Hawaiian species. rarely bears a pup two years in succession (Rice 1960: Wirtz 1968).

Data on the sex ratio and age structure are available for only one sample of 34 Caribbean monk seals collected by E. W. Nelson and E. A. Goldman on Arrecifé Triangulos in June 1900. These specimens were collected six months after the pupping season. Since the collectors were professional mammalogists, this series is probably an unbiased sample of the population that was hauled out at that time and place, I have examined these specimens and classified them into two age categories, "subadults" and "adults" (Table 2). Analogy with the Hawaiian monk seal (Rice 1960) suggests that the subadults are 0.5 to 2.5 years old, the adults 3.5 years old and older.

Table 2. --Sex and age composition of a sample of 34 Caribbean monk seals collected on Arrecifé Triangulos, Campeche, Mexico in June 1900

Age group	Male	Female	Total
Subadults	2	5	7 (21%)
Adults	6	21	27 (79%)
Total	8 (24%)	26 (76%)	34 (100%)

Males comprised only 24% of this sample. This is markedly different from the essentially equal sex ratio reported for the Hawaiian monk seal (Kenyon and Rice 1959). In the latter species there is much variation in the sex ratio of groups of animals hauled out at different times and places, so little importance can be attached to the unequal ratio in this one sample of Caribbean monk seals.

Subadults comprised 21% of the sample, the same proportion found in the Hawaiian monk seal (Kenyon and Rice 1959; Rice 1960). In the latter species, yearlings spend much less time hauled out than do older animals (Rice 1960), so the proportion of subadults in the sample is probably less than their proportion in the population.

Maintenance in captivity. --Caribbean monk seals are known to have been kept in captivity on only eight occasions, involving 18 animals. Only seven of these were kept in zoos or aquaria. None bred, and none lived longer than 5½ years.

1. In 1843, a young seal about 4 feet (1.22m) long was captured on the Pedro Cays, Jamaica. It refused to eat, became blind, and died after 4 months in captivity (Hill 1843).

2. On 29 November 1886, a young seal was captured near the city of Campeche, and taken by its owners to Progresso, Yucatan, for public exhibition (Allen 1887).

3. Between 1 and 4 December 1886, a recently born pup was captured on Arrecifé Triangulos by H. L. Ward (1887). It was taken to the city of Campeche, but lived only 1 week.

4. In 1897, two seals were captured at Arrecifé Triangulos and taken to the New York Aquarium. One lived 2 years. The other, a female, lived 5½ years, dying in January 1903. Death was attributed to fatty degeneration of the heart, liver and kidneys, thought to have resulted from too little exercise (Anon. 1903).

5. In the summer of 1897, two seals, also from Arrecifé Triangulos, were received at the National Zoological Park in Washington, D.C., but they survived only 2 months (Mann 1930).

6. Some time between 1903 and 1908, two seals were captured and kept in the moat at Fort Jefferson on the Dry Tortugas (Moore 1953).

7. On 14 June 1909, the New York Aquarium received three seals--an adult male and two young animals--from a dealer in Yucatan who had. presumably obtained them from Arrecifé Triangulos or Arrecifé Alacran (Townsend 1909; Anon 1910). The adult died on 27 December 1910, one young on 16 January 1911; the other young was still alive in March 1911 (Grant 1911).

8. In 1915, six seals were captured by fishermen--probably at Arrecifé Triangulos--and taken to Pensacola, Florida, where they were kept for "some time" before being released (G. M. Allen 1942).

Status of Populations

The Caribbean monk seal, if not already extinct, is certainly nearly so. Even if a few individuals do survive, it is possible that the females are rarely if ever able to find suitable secluded, undisturbed beaches on which to bear and rear their pups. If so, any survivors would be older animals, and the species would be doomed to extinction in the near future.

Status of Habitat

The habitat requirements of the Caribbean monk seal are probably similar to those of the Hawaiian species--shallow lagoons and reefs for feeding areas; sandy beaches for hauling grounds; and permanent islets or beaches above high tide, and adjacent to shallows that are protected from wave

action, for pupping areas (Kenyon and Rice 1959). Within the Caribbean monk seals' historical range, there are doubtless still many areas that satisfy these requirements.

The main factor responsible for the reduction or extinction of the Caribbean monk seal is the large, rapidly growing, and mostly indigent human population within the seals' range. Many of these people make their living from the sea by fishing or catching turtles, and would probably kill any seal that they encountered. In recent years tourists and yachtsmen have increasingly invaded the seals' habitat.

Monk seals are more vulnerable to exploitation by man than are most other pinnipeds because they haul out on low sandy beaches where it is relatively easy to land small boats, and they are tame and allow a close approach. A female with a nursing pup is especially vulnerable because she will stand her ground and defend her pup. Apparently monk seal populations cannot coexist with man for very long (Kenyon 1972).

Research Programmes and Conservation Measures

The only efforts to conduct research on this species were the 1950 aerial survey of islands off the Yucatan Peninsula by Raymond Gilmore (1959) of the U.S, Fish and Wildlife Service, and the 1969 aerial survey of Chinchorro Reef, Quintana Roo, by Charnock-Wilson (1970). Neither investigator found any seals.

No effective conservation measures have ever been applied to this species. It is legally protected in Jamaica (Lewis 1948).

Conclusions

Although the Caribbean monk seal may already be extinct, this is by no means certain. The most urgent need is to determine the location of any survivors. This could best be done by an aerial survey. The most likely places for finding survivors are the islands off the coast of Quintana Roo and British Honduras, and the islands on Serranilla Bank. However, the search should also be extended westward to include the islands off Yucatan and Campeche, and southward as far as Nicaragua, as well as other islands in the western Caribbean Sea.

A twin-engine aircraft with long-range, moderately slow speed, and good visibility, such as a Grumman Albatross, would be needed for a survey; a flight altitude of 50 to 150 m is most suitable (Rice 1960).

My experience with the Hawaiian monk seal indicates that the most propitious time for a survey would be during the winter, since monk seals haul out more frequently during the cooler months. Also, the calving

season of the Caribbean species appears to be in December, and females with pups remain on or within 50 metres of the beach throughout the nursing period. Monk seals spend more time on the beaches during sunny weather and in the afternoon than they do during cloudy weather or in the morning.

Even if no seals are observed, their use of a particular beach may be revealed by tracks and "wallows" in the sand, or trails worn into coral rubble banks at the upper edge of the beach (Kenyon and Rice 1959).

If a viable colony of seals is located, the following steps should be taken immediately: (1) The government concerned should extend complete legal protection to the species, and declare its hauling grounds and adjacent waters an inviolate refuge; (2) a full-time warden should be assigned to the area to ensure that the seals are not molested; and (3) an experienced pinniped biologist should begin an observational study of the colony.

Caribbean monk seals should not be captured and kept in captivity except as a last resort, since no species of monk seal has bred in captivity, and most individuals in zoos and aquaria did not live very long. If it should become necessary to capture animals, they should be kept under as near natural conditions as possible--prcfcrably a portion of natural habitat enclosed by nets and fences. Moore (1952) made a proposal for maintaining a captive colony at Fort Jefferson National Monument on the Dry Tortugas in Florida.

REFERENCES

1. Allen, G.M. 1942. Extinct and vanishing mammals of the western hemisphere with the marine species of all the oceans. Amer. Comm. Internat. Wildl. Prot. Spec. Publ. 11: 1-620.

2. Allen, J.A. 1880. History of North American pinnipeds. U.S. Geol. and Geogr. Surv. Terr. Misc. Publ. 12: i-xvi, 1-785.

3. Allen, J.A. 1887. The West Indian seal (Monachus tropicalis Gray). Bull. Amer. Mus. Nat. Hist. 2(1): 1-34.

4. Anonymous, 1903. The West Indian seal. Bull. New York Zool. Soc. 9: 83.

5. Anonymous, 1910. Rare tropical seals. Bull. New York Zool. Soc. 38: 644.

6. Anonymous, (=J.L. Baughman) 1957. Visitors from Philadelphia see one of lost seals of Gulf of Mexico. The Rockport Pilot, May 9.

7. Banks, N. 1899. A new species of the genus Halarachne. Proc. Ent. Soc. Wash. 4: 212-214.

8. Charnock-Wilson, J. 1970. Manatees and crocodiles. Orynx 10(4): 236-238.

9. Dampier, W. 1705. A new voyage round the world. . .3rd ed., vol. 2, part 2. James Knapton, London, 132 p.

10. DuTertre, J.B. 1667. Histoire générale des Antilles habitées par les Français, vol. 2. Thomas Tolly, Paris, 539 p.

11. Elliott, H.W. 1884. The monk seal of the West Indies, Monachus tropicalis Gray. Science 3(7): 752-753.

12. Gaumer, G.F. 1917. Monografia de los mamiferos de Yucatan. Dep. de Talleres Graficos de la Secretaria de Fomento, Mexico, xii + 332 p.

13. Gilmore, R.M. 1959. Is the West Indian seal extinct? Sea Frontiers 5(4): 225-236.

14. Goldman, E.A. 1951. Biological investigations in Mexico. Smithsonian Misc. Coll. 115: i-xiii, 1-476.

15. Gosse, P.H. 1851. A naturalist's sojourn in Jamaica. Longman, Brown, Green, and Longman, London, xxiv + 497 p.

16. Grant, C. 1911. Aquarium notes. Bull. New York Zool. Soc. 44: 737.

17, Gray, J.E. 1850. Catalogue of the specimens of mammalia in the collection of the British Museum. Pt. 2, Seals. Brit. Mus. (Nat. Hist.), London, v + 48 p.

18. Gunter, G. 1947. Sight records of the West Indian seal, Monachus tropicalis Gray, from the Texas coast. J. Mammal. 28(3): 289-290.

19. Gunter, G. 1968. The status of seals in the Gulf of Mexico, with a record of feral otariid seals off the United States Gulf coast. Gulf Res. Rep. 2(3): 301-308.

20. Herrera y Tordesillas, A. de. 1601. Descripción de las Indias Occidentales. Emplenta real, Madrid.

21. Hill, R. 1843. The black seal of the Pedro Shoals. The Jamaica Almanack for 1843, Companion to the Almanack, 62-67.

22. _____. 1846. Description of a seal found on a shoal south of Jamaica. Proc. Zool.. Soc, London, 1846: 80-81.

23. Kenyon, K.W. 1972. Man versus the monk seal. J. Mammal. 53: 606-615.

24. Kenyon, K.W. and D.W. Rice, 1959. Life history of the Hawaiian monk seal. Pac. Sci. 13: 215-252.

25. Kerr, R. 1811. A general history and collection of voyages and travels. . .vol. 3. Edinburgh, vii + 503 p.

26. King, J.E. 1956. The monk seals (genus Monachus). Bull. Brit. Mus. (Nat. Hist.) Zool. 3(5): 203-256.

27. Lewis, C.B. 1948. The West Indian seal. Nat. Hist. Notes, Nat. Hist. Soc, Jamaica 34: 169-172.

28. Mann, W.M. 19.30. Wild animals in and out of the zoo. Smithsonian Sci. Ser. 6: 1-362.

29. Moore. J.C. (1952) Facilities for re-establishing a breeding colony of West Indian seals at Fort Jefferson National Monument. Spec. Rep. of the Park Biologist, 3 p.

30. Moore, J.C. 195.3. Distribution of marine mammals to Florida waters. Amer. Midl. Nat. 49(1): 117-158.

31. Raun, G.G. 1964. West Indian seal remains from two historic sites in Texas. Bull. Texas Archeol. Soc. 35: 189-192.

32. Ray, C.E. 1961. The monk seal in Florida. J. Mammal. 42(1): 113.

33. Rice, D.W. 1960. Population dynamics of the Hawaiian monk seal. J. Mammal. 41(3): 376-385.

34. Rice, D.W. 1964a. The Hawaiian monk seal--rare mammal survives in Leeward Islands. Nat. Hist. 73(2): 48-55

35. Rice, D.W. 1964b. The Hawaiian monk seal. Oryx 7(6): 295-300.

36. Sloane, H. 1707. A voyage to the islands Madera, Barbados, Nieves, S. Christophers and Jamaica. . .vol. 1. Published by the author, London.

37. Smith, B. 1945. Memoir of Do. de Escalante Fontenada respecting Florida. Miami, 77 p.

38. Townsend, C.H. 1906. Capture or the West Indian seal (Monachus tropicalis) at Key West, Florida. Science 23: 583.

39. Townsend, C H. 1909. The West Indian seal at the aquarium. Science 30: 212.

40. Townsend, C H. 1923. The West Indian seal. J. Mammal. 4: 55.

41. True, F.W. and F.A. Lucas. 1886. On the West Indian seal (Monachus tropicalis Gray). Rep. U.S. Nat. Mus. 1884: 331-335.

42. Ward, H.A. 1887. The West Indian seal (Monachus tropicalis). Nature 35: 392.

43. Ward, H.L. 1887. Notes on the life history of Monachus tropicalis, the West Indian seal. Amer. Nat. 21:257-264.

44. Wirtz, W.O., II. 1968. Reproduction, growth and development, and juvenile mortality in the Hawaiian monk seal. J. Mammal. 49(2): 229-238.

Paper 13

Current Status of Seals in the Northern Hemisphere

by

D. E. Sergeant

Fisheries Research Board of Canada, Arctic Biological Station,
P.O. Box 400, Ste. Anne de Bellevue, Quebec

INTRODUCTION

To review such a vast field evenly is an impossible task for one man. Although I helped dissect a harbour seal at Chefoo, North China in April 1938 (described as an immature Phoca vitulina richardi by Leroy 1940) and carried out a little work with P. vitulina in Great Britain (Sergeant 1951), my main experience has been with harp seals Pagophilus groenlandicus and hood seals Cystophora cristata in eastern Canada (Sergeant 1965). Elsewhere I have travelled, chiefly as a guest of other workers, on the Pacific coast of North America to view the Otariidae of that coast, and have made brief visits to the coasts of Romania and Spain partly in search of news of monk seals. Having admitted my geographical bias, I hope that other workers by their comments will help to fill the gaps in my knowledge.

I do not want to speak too generally here about the status of sea mammals in the modern world and will refer readers interested in this subject to an earlier statement (Sergeant MS 1970).

There seem to have been three episodes in the history of the relationship of man in the northern hemisphere to coastal seals.

1. A history of exploitation of resident species for oil, furs and meat, lasting from prehistoric times in Europe (J.G.D. Clark 1946) to the early nineteenth century, or later in remote areas--up to the present day in the Arctic, for example (Magdalenian man was culturally, if not ethnically, the precursor of the modern Eskimo).

2. A period, dating from the rise of important sea fisheries in the nineteenth century, when seals received less direct usage and came into conflict with man as predators on fish. Most notable has been our concern in the North Atlantic with Phoca vitulina and Halichoerus grypus, and in the North Pacific with Eumetopias jubata and Zalophus californianus, as predators on salmon.

3. A modern phase which concerns itself with the protection of seals. This may perhaps best be dated from the enactment cf the first Grey Seals Protection Act in Britain in 1914 (Lockley 1966).

These three episodes are not mutually exclusive, because on a considerable scale man still uses seals for fur, oil, leather and meat; seals still eat desirable salmon; and more and more the viewing of protected animals becomes attractive to city dwellers. The problems that arise may be categorized as:

1. The protection of diversity in maintaining threatened and endangered species.

2. The maintenance of sustainable yields of more abundant, managed species.

3. The problem of population increase in protected species.

I will draw examples from each category to illustrate the kind of problems that occur.

Maintenance of threatened species

Maintenance of the monk seals Monachus spp. represents one of the most acute problems facing us.

As may be seen by reference to the Red Data Book for Mammals (I.U.C.N. 1972) the Caribbean species M. tropicalis is probably extinct. One can only hope that by some miracle, an undiscovered or closely guarded secret cay retains a breeding colony, but this seems unlikely, in view of the densely peopled archipelagos and the meat hunger of its peoples[1].

Conversely, I do not think we need to concern ourselves too much with the fate of Monachus schauinslandi of the Hawaiian archipelago (Kenyon and Rice 1959). It is safeguarded by the Bureau of Sport Fisheries and Wildlife of the United States government under the scrutiny of the people of one of the world's best informed democracies.

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1 Diana Magor (personal communication) reports that the coastal inhabitants of British Honduras readily kill manatees Trichechus manatus for food.

The threatened species for which there is some hope is the Mediterranean monk seal Monachus monachus. Here I have recently had the opportunity to discuss the problem with Dr. J.A. Valverde, Consejo Superior de Investigaciones, Paraguay 1, Sevilla, Spain, who gave me the essence of his carefully thought out plan, due to go into action in a year or so.

As is known to readers of the Red Data Book, monk seals now exist only in scattered pockets in the Mediterranean, where the only self-contained colony is said to be in eastern Morocco. On the Atlantic coast, however, there are colonies in Morocco and Spanish Morocco. These colonies are subject to several risks, ranging from those of possible political instability in the region to the use cf nylon gill nets, for fishing along the coast, in which Dr, Valverde has seen or heard of six seals being caught.

Briefly, his plan is to carry out thorough studies cf existing colonies of monk seals in Spanish Morocco. If all indications are favourable, he would transport seals to their former range, in Mediterranean Spain, where two possible types of site present themselves--sea caves on the mainland, and remote islands. He apparently favours the. cave, where he believes the seals could be barred in and fed for a transitional period, thereafter released. The most original part of the proposal, however, is a psychological one: to make the nearest coastal city custodians of the seals, thereby harnessing human pride in the service of conservation. I believe this suggestion could well be copied elsewhere.

I believe that the main threat to monk seals has been disturbance by man, both by fishermen on remote islands, and by tourists on beaches and in caves. Insofar as tourism increases, the threat by fishermen may decrease as these men increasingly become tourist guides. However, the gun and nylon gill net remain potent threats to rare seals. Also, increasing tourism e.g. to caves.,' poses a real threat to the habitat; but harnessing the interest of coastal communities toward "their" seals, rendering them partially a tourist attraction, seems well worth exploring.

There remains the question; what is the size of the residual Monachus monachus stock in the western fringe of its old range? Is it enough for extensive transplants or will these have to be made in successive stages? First of all, I think we need to support Spain in this effort, by money if desired and know-how, then work eastwards. I am sure that Mediterranean countries will be interested in restoring this species; for example, in 1969 I saw stuffed family groups in two museums in Romania (in Tulcea and Bucharest) coming from the now presumably extinct mainland colony at Cape Caliakra, Bulgaria.

Legal protection for monk seals exists in France, Italy, Yugoslavia, Greece, and Bulgaria. IUCN should explore avenues to extend this protection to all Mediterranean countries and to set up sanctuaries in sites of old or residual colonies, which might then be replenished either by natural recolonization or by transplantation.

I recognise the problem of creating a sanctuary for something that does not now exist there, but possibly the sanctuary could be a general marine one.

If the worst comes to the worst we might even consider the possibility of using Monachus schauinslandi as seed stock for old M. tropicalis and M. monachus habitat.

Maintenance of Managed Species

Abundant or once abundant species provide fur, oil, leather and meat in perhaps that order of value. Probably they will always do so. Extremist positions are to exterminate a species by hunting, which is untenable to conservationists; or to leave it entirely alone, which is probably going to prove untenable to fisheries interests, in view of the increasing intensity of human fisheries on even the small pelagic species (Gulland 1970). In this, extremist positions (Davies 1971) have been misleading. Seals are by no means taken for "fun furs". In Newfoundland, in the most recent years, utilization of both flippers and carcass meat of harp seals for human food has increased.

We are left with that old desideratum of the population biologist--maximum sustainable yield.

In practice, this ideal state has very seldom been attained in management of fisheries (including those for seals) without prior overexploitation. The reason, I think is not just human greed, but the state of the art. It is very difficult, without immense prior research, to prove that an intensifying industry has reached the point of taking just enough of a crop; much easier to demonstrate that it has taken too much. One may then introduce restrictive legislation, and reduce the fishery until research shows recovery of stocks.

Just this stage was reached by the 1930s with the Pribilof fur seals, which have since reached saturation of numbers; and is being reached now with the harp seals of the White Sea. The Soviet Union, after virtually totally protecting this herd in 1966 in agreement with Norway, has now begun a cull again, taking 27,000 young seals and a research cull of 1,000 older seals in 1971 (L. Popov, ed., MS 1972). Norwegian scientists have published nothing recently on the status of harp and hood seals at the West Ice near Jan Mayen Island, but private reports speak of stocks of both species as

in a depressed state. The population of at least harp seals at the West Ice seems indeed to have been in a depressed state since about 1890, judging by the catch figures given by Rasmussen (1957). At the Newfoundland ice fields, heavy exploitation continues for harp and hood seals by both Canada and Norway. The harp seals arc now taken under national quotas which have been lowered, although the total quota figures have not so far been much less than estimates of local production of young. Public opinion however has been brought to bear on the problem. The bright spot in this area has been protection by Canada of the Gulf of St. Lawrence herds of harp seals from airborne hunting since 1970, and hunting by large ships since 1972, so that the seals are free to increase. Total protection was also given to the few Gulf-breeding hood seals by Canada in 1965. These closures have brought a minor but real human problem of restriction in their way of life to the land-based hunters of the Magdalen Islands, Quebec.

Protection in the Gulf of St. Lawrence has led to the possibility of the public viewing massed harp seals in the way that only hunters and biologists have been able to do hitherto. Mr. Brian Davies is investigating this possibility, but with small capital. My view is sceptical; the weather is so variable in March, the whelping season, that an orderly flow of visitors is not possible. Moreover, helicopters and not ski-equipped aircraft are needed because cf the broken ice, and these are expensive to operate. Therefore, the possibility of a profitable enterprise is small. However, IUCN might well use capital to investigate the costs of a trial enterprise. Experienced aircraft operators resident at the Magdalen Islands, now out of business, might be persuaded to give it a trial, and Canadian law might be modified to allow tourists to land on the ice near the seals. Potential viewers are said to be numerous. Major costs and problems would undoubtedly lie in the realm of insurance of aircraft and people.

A possible solution to the management of harp seals has some resemblance to Dr. Valverde's in. that it calls on national pride. Let the USSR exclusively manage the White Sea herd of harps, Norway the West Ice herds of harp and hoods, Canada the Gulf and Front herds of harps and hoods. Then the world may see which nation can best manage its "home" stocks. Denmark, which has an interest in the status of both the western and central stocks of harp and hood seals for the benefit of its Greeniandic citizens, will benefit from good management by both Canada and Norway.

The problem of population increase in protected species

Grey seals have been legally protected in Great Britain increasingly since 1914 (Lockley 1966) and in eastern Canada in part since 1949 (Mansfield 1966). Their numbers have increased in both areas to the point that locally fishermen complain of their depredations on netted salmon, mackerel

and herring, and damage to nets, while their contribution as final hosts to the total load of codworm Terranova decipiens, absolutely and relative to other seal species, increases. Therefore, culls have been instituted in both countries, and where possible, profit is achieved by the sale of pelts. To this extent, the grey seal has again joined the ranks of exploitable species. The problem arises of what to do in parks. In Britain, according to Coulson (1972), population increase and increased pup mortality cf grey seals at the Farne Islands has led to a plan for institution of a cull at this reserve, in the hope cf lessening pup mortality and habitat destruction. Coulson criticizes this plan, and suggests as an alternative, toleration cf a high natural pup mortality together with protection of the habitat, as by fences. The debate must it seems be resolved by the British public, given the alternatives set clearly before them. In financial terms, sale of pelts would probably cover costs of culling, but the alternative of fencing might be quite expensive. In Canada, a winter cull is expensive since the majority of the seals whelp on ice, and a helicopter is used to land men and cull the seals. The cull is a joint Government-industry enterprise. The pelts of moulted seal pups, being the most valuable, are sought and sold. Sable Island with a good population of grey seals is left alone because of its remoteness and lack of human inhabitants, including inshore fishermen. The natural increase of its grey seals however tends to repopulate mainland colonies, which acts against the effects of a cull.

There arc currently no known concentrations cf grey seals in eastern Canadian parks, though Sable Island seems likely to gain some type of park status in the future.

Local anomalies

The status of Phoca vitulina, everywhere a sedentary species, varies greatly geographically. In the estuary called the Wash in Britain its numbers have remained stable or increased over 20 years (Sergeant 1951; Vaughan 1971) but its habitat may become reduced in the future if proposed water storage schemes (Anon 1970) come to pass. In Holland numbers have declined due to hunting (van Bemmel 1956) and possibly from the combination of a variety of environmental insults ranging from oil to mercury (Koeman 1971).

It should be said, however, that no conclusive lethal effects of either pesticides or mercury on seals have yet been demonstrated anywhere. The Dutch seals which died full of mercury were not aged. In eastern Canada, the amount of mercury in the ivers of harbour and grey seals increases with age or size of animals, but no deleterious effects have been detected (Armstrong and Sergeant, 1972). Greatest suspicion falls on the unusually high abortion rates of California sea lions Zalophus californianus in

colonies situated close to sewer outfalls proved to contain high levels of DDT (Odel 1970). The unexpectedly high mortality of recent age classes of Pribilof fur seals Callorhinus ursinus by contrast, have been very tentatively linked with heavy commercial fishing for pelagic fishes such as Alaska pollack Theragra chalcogramma, a major food of fur seals (A.M, Johnson, personal communication). In both cases more research is needed, and is undoubtedly underway, to uncover root causes.

In eastern Canada, a bounty on harbour seals in the Maritime Provinces has existed since 1949 in order to reduce codworm incidence. This bounty was extended in 1952 to Newfoundland and Labrador, where codworm incidence is only appreciable around the south and west coasts of Newfoundland. Field biologists were not consulted before the measure was introduced.

Harbour seals are now rare in the Maritime Provinces except where fishermen do not bother to shoot them, e.g. in some parts of Prince Edward Island. They are now rare enough in some areas of Newfoundland that fishermen complain, while sending in jaws as bounty claims, that they cannot obtain seals for fresh meat when they need it.' At Prince Edward Island, a special provision in the Canadian Fisheries Regulations (Canada 1971) is now needed to protect one tourist operator from flying bullets. It protects harbour seals locally from July 1 to September 30, roughly the tourist season.

It is clear that the decline of the species in eastern Canada, and the incipient rise in tourism, require a more sensitive approach to the management of this population than a blanket bounty with a growing list of exceptions. Perhaps the problem will be solved by the increase that is taking place in the number of National and other types of parks in eastern Canada having a coastline. At the new Forillon Park in Gaspé, Quebec, harbour seals breed and are protected, with fines for infringements. Lat us not think, however that total protection will be an ultimate answer any more than for grey seals; less than 30 km distant by sea are salmon rivers and a salmon hatchery. As the seals increase predation likely will increase causing wrathful fishermen to make representations. A compromise of some kind will probably prove necessary.

Suggestions for Action by IUCN

As considerations for IUCN action on the problems listed on page 114, I omit category (3)--thc increase of protected species--as comprising problems capable of being resolved by affected member states. I also omit consideration of the possible effects of insecticides and heavy metals on seals, on the ground that since the principal emitters of these polluters are the industrial nations, they are here again capable of evaluating effects and taking appropriate action.

Category (2), control of the exploitation of abundant or potentially abundant species, can be undertaken by national bodies or, on the high seas, by appropriate international bodies such as ICNAF, the Norwegian-Soviet Seal Treaty, and the Interim Commission on North Pacific Fur Seals. Such bodies would, however, be greatly strengthened by the participation of watchdog citizen groups, among which in the international forum, there is none better qualified than IUCN!

This leaves a few gaps, such as the hunting of Phocidae of the North Pacific, which does not seem at present to be policed by any international body. This could lead to a "tragedy of the commons". I understand that the U.S.A. and U.S.S.R. have exchanged information on populations and the IUCN could perhaps gather information from these two nations at this meeting on the status cf ice-breeding largha P. vitulina, ribbon seal Histriophoca fasciata, and bearded seal Erignathus barbatus in the North Pacific.

This leaves for most urgent consideration the really threatened stocks and species. I believe that the world here can be divided, as in so many cases, into the Rich Nations and the Poor Nations. The poor nations are usually protein hungry, or so preoccupied with economic betterment that conservation is a fringe activity. Rich nations can and usually do put their own house in order. Through IUCN they can offer administrative and scientific knowledge, and if desired, financial aid, toward the restoration of rare species for the enjoyment of future generations. To this end I append some suggested priorities, more as a subject for debate than as a finalised proposal.

Lastly I am grateful to certain unpublished sources as the basis for ideas, notably to Karl Kenyon, for his long and active chairmanship of the American Society of Mammalogists, and to my Canadian colleagues, Arthur Mansfield, Edward Mitchell and Keith Ronald. For hospitality in overseas seal visits, I am grateful to Burney LeBoeuf and his colleagues at the University of California, Santa Cruz, U.S.A. and to Bill Vaughan and Nigel Bonner at the Natural Environment Research Council's Seal Research Unit, Lowestoft, U.K.

Appendix I.

Suggested Priority Programmes

A. Monachus monachus

1. Identify numerical status in Spanish Morocco and Morocco.
2. If numerous enough for transplant, investigate ways and means from experience with transplanting other species.

3. Identify most fruitful sites for protection in anticipation of transplants to Mediterranean sites.

4. Investigate home ranges and migrations, physiology (especially heat and salinity tolerances), feeding. In view cf low numbers, such studies will probably have to be by observation rather than by collection, except from seals accidentally caught in nets.

In view of Spain's advanced thinking in this field, it is suggested that IUCN or WWF should investigate Spain's needs in expertise and funding for this project. IUCN should also approach Morocco with the aim of a survey of existing and potential coastal nature reserves suitable for monk seals. These studies should be made preferably by a Moroccan biologist.

B. Zalophus californianus, Asiatic population.

This population is apparently extinct in Japan (see Red Data Book). It is recommended that IUCN approach Mainland China in order to investigate the status of the race in its former range which apparently extended south to the Yangtze. Swinhoe (1870) stated that it or another sea lion was found in southern Japan, and on islands at the mouth of the Yangtze, as reported by river pilots. Possibly confusion with P. vitulina richardi occurred here.

If the race is extinct, the possibility of reintroduction from the Californian population might be investigated, presumably in suitable National Parks, or similar sites, in Japan, China or Korea.

C. Phoca vitulina (richardi)

The present status of this species on the Chinese mainland coast might also be investigated. Leroy (1940) stated that "seals are not uncommon on the Shantung coast." Fauvel (cited by Leroy) described it from Shantung peninsula and Chefoo (Yentai) region on the islands Hai Loutai and Hai Nioutao.

Appendix II

Commendations

It is suggested that IUCN/WWF commend nations which have instituted management programmes for, and achieved restoration of, populations of Pinnipeds. Examples might be: The U.S.S.R. for restoration of the population of harp seals in the White Sea (Popov MS 1972); Mexico and the U.S.A. for restoration of Guadalupe fur seal Arctocephalus townsendi and northern sea elephant Mirounga augustirostris at Guadalupe and islands to the northward (Hubbs 1956; Radford, Orr and Hubbs 1965).

REFERENCES

1. Anon. 1970. Barrages. Boost for the Wash. Nature 227: 1181-1182

2. Armstrong, F.A.J. and D.E. Sergeant, 1972. Mercury in seals from eastern Canada. J. Fish. Res. Bd. Canada, in press.

3. Bemmel, A.C.V. van, 1956. Planning a census of the harbour seal (Phoca vitulina L.) on the coasts of the Netherlands. Beaufortia 54: 121-132.

4. Canada. 1971. Seal protection regulations. CP 1971-1614. Information Canada, Ottawa Fs4-30/1971.

5. Clark, J.G.D. 1946. Seal hunting in the Stone Age of North-Western Europe: A study in economic prehistory. Proc. Prehistoric Soc. 12: 12-48.

6. Coulson, J. 1972. Grey seals on the Farnes--kindness kills. New Scientist 54(792): 142-145.

7. Davies, Brian. 1971. Savage luxury. Slaughter of the baby seals. London Souvenir Press. 214 p.

8. Gulland, J. 1970. The resources of the sea. Sea Frontiers, 16: 210-219. Miami International Oceanographic Foundation.

9. Hubbs, C.L. 1956. Back from oblivion. Guadalupe fur seal still a living species. Pacific Discovery 9: 14-21.

10. IUCN. 1972. Red Data Book vol. 1. Mammalia. New edition. Morges, Switzerland.

11. Kenyon, K.W. and D.W. Rice, 1959. Life history of the Hawaiian monk seal. Pacific Science, July: 215-251.

12. Koeman, J.H. 1971. Kwik in det Nederlandse Kustmilieu. "T.N.O.-nieuios" 26: 402-409.

13. Leroy, P. 1940. (Phoca richardii at Chefoo, N. China). Bull. Fan Memorial Inst. Biol., Zool. Ser. 10: 62-68.

14. Lockley, R.M. 1966. Grey seal, common seal. London, Andre Deutsch, 175 p.

15. Mansfield, A.W. 1966. The grey seal in eastern Canadian waters. Canadian Audubon Magazine, 28(4): 161-166.

16. Odell, D.K. 1970. Premature pupping in the California sea lion. Proc. Seventh Annual Conf. on Biol. Sonar and Diving Mammals, 185-190. Stanford Res. Inst.

17. Popov, L.A. (Ed.) 1972. Report on the Soviet sealing industry and research work in the northeastern Atlantic. MS 19 p. V.N.I.R.O., Moscow, V. Krasnosel'kaya 17.

18. Radford, K.W., R.T. Orr and C.L. Hubbs, 1965. Reestablishment of the northern elephant seal (Mirounga augustirostris) off central California. Proc. Calif. Acad. Sci. (4) 31: 601-612.

19. Rasmussen, B. 1957. Exploitation and protection of the East Greenland seal herds. Norsk. Hvalfangst-Tid. 1957(2): 45-59.

20. Sergeant, D.E. 1951. The status of the common seal (Phoca vitulina L.) on the East Anglian coast. J. Mar. Biol. Assoc. 29: 707-717.

21. Sergeant, D.E. 1965. Exploitation and conservation of harp and hood seals. Polar Record 12: 541-551.

22. Sergeant, D.E. MS 1970. Sea mammals and man; a look at the future. ICES Marine Mammal Committee CM 1970/N:4, 6 p., Mimeo.

23. Swinhoe, R. 1870. Catalogue of the mammals of China south of the Yangtze River and of Formosa. Proc. Zool. Soc. 613-653.

24. Vaughan, R.W. 1971. Aerial survey of seals in the Wash. Seals Research Unit, NERC, Occ. Publ. 2: 11 p.

Paper 14

Galápagos Fur Seal (*Arctocephalus galapagoensis*)

by

Robert T. Orr

California Academy of Sciences, San Francisco, California

INTRODUCTION

The Galápagos fur seal has been known since the discovery of the archipelago in 1535. However, it was not described until 1904, when Edmund Heller named it *Arctocephalus galapagoensis* in his report on the "Mammals of the Galapagos Archipelago." The following year Allen (1905) placed *A. galapagoensis* as a synonym of *A. philippi*. In 1954, King, working on Pacific coast otariids, suggested that the Galápagos fur seal was most closely allied to *Arctocephalus australis*, which occurs along the adjacent coast of South America, and reduced it to a subspecies of that species. In the same year Sivertsen (1954) raised it to a full species, *Arctocephalus galapagoensis*. Four years later Scheffer (1958) concurred with King's previous conclusion and reduced it to a subspecies of *A. australis*. Most recently Repenning, Peterson and Hubbs (1971) have again accorded the Galapagos fur seal full specific status.

It is obvious that the *Arctocephalus* population on the Galápagos has been derived from *A. australis* of the adjacent South American coast of Peru and Chile and arrived in the archipelago as a result of westward drift with the Peruvian current in times past. Whether or not it should be accorded specific or subspecific rank is obviously a matter of opinion. A brief summary of this nomenclatural hassle was made by the writer (Orr 1966).

Physical Features

The Galápagos fur seal represents the smallest member of the southern fur seal genus *Arctocephalus*. No external body measurements are available, but Sivertsen (1954) and Repenning, Peterson and Hubbs (1971) have given cranial measurements. In the field the species shows the short, pointed muzzle so characteristic of other members of the genus, a feature that readily distinguishes it from the endemic sea lion (*Zalophus californius wollebaeki*) with which it is sympatric. These fur seals also differ from sea lions in other external bodily features, especially the shape of the neck, which is quite thick in contrast to that of *Zalophus,* and in colour.

The front and sides of the muzzle as well as the underparts of the body are a light tan, contrasting with the grizzled grey-brown fur of the back and sides. The ears are light tan except along the margins. The posterior vibrissae are dark while those situated more anteriorly on the muzzle are light proximally, becoming dark distally. The skin on the flippers is blackish. There is relatively little sexual dimorphism in size.

Distribution

Fur seals were once very common in the Galápagos Islands, judging from the numbers of individuals taken by the early sealers. Baur (1897) records 5,000 skins secured in 1823 alone. By the time of the Hopkins Stanford Galápagos Expedition in 1898-99 the number of fur seals had been so reduced, according to Heller (1904), that no well defined rookeries were believed to remain. Townsend (1903) reported that no fur seals had been observed in recent years, although Banning (1933) mentions the capture of half a dozen individuals on Tower Island by the Hancock Expedition of 1933.

It was not untii 1957 that a sizable colony of fur seals was discovered on James Island by Eibl-Eibesfeldt (1958). Later Lévêque (1963) indicated a continued increase in the fur seal population of the islands. He noted about 500 individuals on the east coast of Isabela. In August 1962 Brosset (1963) observed 60 individuals at James Bay on James Island and four on Santa Cruz Island at the entrance of the channel that separates it from Baltra Island; he also observed four on Tower Island in November of that year. The number in the area he described on Santa Cruz Island increased to 14 in January 1963.

Perry (1970a) indicated that well established colonies were recently seen along the south and southwest coasts of Fernandina, between Punta Mangle and Cabo Hammond, and on Isabela at Cabo Marshall, south of Punta Garcia, Punta Essex and Punta Tortuga, as well as at Isla Pinta. The same report mentions 200-300 fur seals at James Bay on James Island and probably up to 100 individuals at Buccaneer Bay on the same island. Other permanent but small colonies were reported on Wolf Island, on the east coast as well as within Darwin Bay on Tower Island, on the south and east coasts of Seymour Island, in the south channel between Baltra and Santa Cruz islands, and 20 or 30 individuals on the northwest coast of Pinzon Island. Perry (1970b) further noted a colony found in May on Isla Espanola at Punta Suarez. This group contained 33 individuals, mainly males.

From the foregoing figures, which obviously are far from complete, it is clear that there has been an increase in the Galápagos fur seal population during the past 30 or 40 years and that presently, as a conservative estimate, there appears to be considerably more than 1,000 individuals

distributed on at least ten islands. From north to south these islands are Wolf, Marchena (where a sick individual was observed and reported to me by Peter Kramer in 1971), Tower, Isabela, Fernandina, James, Pinzon, Seymour, Santa Cruz and Hood.

This increase, from a population that was depleted almost to extinction, has been slow and the species is still far from past the danger point. Within the past decade there have been instances of fur seals shot on James Island, where a salt mine was opened in 1962. However, further depredation here was stopped by the intervention of the Ecuadorean Fish and Game Service, and subsequently the operation of the mine was terminated.

Behavioral Pattern

Like most members of the genus Arctocephalus that have been studied, Galápagos fur seals prefer rocky areas where there are sea caves that are relatively inaccessible. In August 1971, the writer visited the fur seal colony at James Bay on the west side cf James Island. The salt mine at Espumilla Beach was no longer operating and within a quarter of a mile of that site a dozen fur seals were observed. They did not allow as close approach on land as sea lions nor were they as accessible. For the most part they tended to lie in shaded situations on lava ledges above the water or very close to it and moved into the sea when a person came near. In the water they approached one closely, even coming up to my mask when I was snorkeling in a grotto.

In swimming they often assume a vertical position with the tail up and the head down and tend to spin around almost constantly so that the body is rotating on its long axis. None was observed any distance at sea, unlike the sea lions which frequently are encountered several miles from shore.

The only evidence of reproduction on this occasion was the discovery on August 23 of a small pup which had been dead for several months. All of the other animals seen were immatures or adults.

Disease

In late 1970 and early 1971, an epizootic affected the sea lion population of the Galápagos Islands, causing a fairly high die-off. Although the exact cause was not determined, the symptoms included the presence of numerous lesions on the skin. This epizootic fortunately subsided about June of 1971 and few diseased sea lions were to be found on any of the islands visited by the writer in August of that year.

Our only knowledge of the effect of this epizootic on the fur seal population is a communique received by the writer from Peter Kramer, Director of the Charles Darwin Research Station at Academy Bay on Santa Cruz Island, dated June 25, 1971. He stated (translating a letter from Juan Black, an official, of the Galápagos National Park Service who surveyed the epizootic):

> "Marchena, 24 May 1971.
>
> I found a dead male fur seal (near the camp on the southwest coast of Marchena), apparently affected by the same disease as the sea lions. He is rotting and blown up, exactly as the sea lions. He also has the skin swellings, some closed, others open, as in the sea lions in the same stage of decomposition. It seems that many fur seals died; I am observing only very few of them in an area where many had been on our previous visit in November 1970. - I saw a fur seal with a big swelling in the neck. But he seems to be all right otherwise."

Diseased sea lions were also reported observed on Marchena and Santiago islands (Kramer and Villa R. 1971).

Future

The future of the Galápagos fur seal will depend upon careful protection in the coming years. It is a species much more restricted in habitat than the endemic population of the California sea lion and therefore one whose numbers will probably never come anywhere near that of the latter species, One feature in its favour is the type of habitat it selects--sea caves which are relatively inaccessible and in which individuals are not easily seen.

It is to be hoped that the epizootic which affected the California sea lions so adversely will not recur for some years to come, especially in view of the fact that some fur seals did contract the disease. However, the fact that the two species are generally segregated as far as habitat is concerned is fortunate.

REFERENCES

1. Allen, J.A. 1905. Mammalia of southern Patagonia. Repts. Princeton Univ. Exped. Patagonia, 1896-1899, 3(1): 210 p.

2. Banning, G.H. 1933. Hancock Expedition of 1933 to the Galápagos Islands; general report. Bull. Zool. Soc. San Diego 10: 1-30.

3. Baur, G. 1897. On the distribution of marine mammals. Science 5: 956-957.

4. Brosset, A. 1963. Status actuel des mammifères des îles Galapagos. Mammalia 27: 323-338.

5. Eibl-Eibesfeldt, I. 1958. Wonders of a Noah's ark off the coast of Ecuador. Unesco Courier, 11th year, (1): 20-23.

6. Heller, E. 1904. Mammals of the Galápagos Archipelago, exclusive of the Cetacea. Papers of the Hopkins Stanford Galapagos Expedition, 1898-1899. Proc. California Acad. Sci. (3)3: 233-250.

7. King, J.E. 1954. The otariid seals of the Pacific coast of America. Bull. British Mus. Nat. Hist., Zool. 2: 309-337.

8. Kramer, P. and J. Villa R., 1971. Conservation and Scientific Report from the Charles Darwin Research Station, no. 23, p. 4.

9. Lévêque, R. 1963. Le statut actuel des vertebrés rares et menacés de l'archipel des Galapagos. Terre et Vie 4: 397-430.

10. Orr, R.T. 1966. Evolutionary aspects of the mammalian fauna of the Galápagos, p. 276-281. In: The Galápagos; Proceedings of the Galápagos International Scientific Project of 1964, ed. R.I. Bowman. Univ. California Press, Berkeley.

11. Perry, R. 1970a. Conservation and Scientific Report from the Charles Darwin Research Station, no. 18, p. 5.

12. Perry, R. 1970b. Conservation and Scientific Report from the Charles Darwin Research Station, no. 19, p. 9.

13. Repenning, C.A., R.S. Peterson and C.L. Hubbs, 1971. Contributions to the systematics of the southern fur seals, with particular reference to the Juan Fernández and Guadalupe species, 34 p. In: Antarctic Pinnipedia, ed. W.H. Burt. Antarctic Res. Ser., vol. 18, Amer. Geophys. Union, Washington, D.C.

14. Scheffer, V.B. 1958. Seals, sea lions, and walruses; a review of the Pinnipedia. Stanford Univ. Press, Stanford, Calif. x + 179 p.

15. Sivertsen, E. 1954. A survey of the eared seals (family Otariidae) with remarks on the antarctic seals collected by M/K "Norvegia" in 1928-1929. Det. Norske Videnskaps-Akademi i Oslo. Scientific Results of the Norwegian Antarctic Expedition 1927-1928 et seq., Instituted and Financed by Consul Lars Christensen, 36: 1-76.

16. Townsend, C H. 1930. The Astor Expedition to the Galápagos Islands. Bull. New York Zool. Soc. 33: 135-155.

Paper 15

The Ross Seal (Ommatophoca rossi)

by

R. Hofman, A. Erickson and D. Siniff[1]

University of Minnesota, Minneapolis, Minnesota 55455, U.S.A.

Description

The Ross seal Ommatophoca rossi is the rarest and least well known of the four true Antarctic phocids. It was first described and named by Gray (1849-1375) from two specimens collected during the voyage of H.M.S. Erebus and H.M.S. Terror under the command of Sir James Ross Clark.

Perhaps the most distinguishing characteristics of this seal are the large eye orbits and unique vocalization from which the common names––big-eyed seal and singing seal––are derived. When disturbed, a Ross seal is easily classified since it will normally raise its head to assume the readily identifiable singing posture (see Ray 1970, p. 405). Numerous references to inflated laryngeal pouches are found in the literature but King's (1969, p. 26) dissections of a male and female failed to note any sort of laryngeal or vcstibular sac. A broad head, short snout, small mouth and small teeth contrasting markedly with other Antarctic seals.

The basic coat colour is dark grey to chestnut on the dorsum with contrasting silvery-white on the venter. Anteriorly, the light and dark merge about the eyes to give the appearance of a mask. Often there are broad dark stripes from the chin to the chest and along the sides of the neck. Most adults bear small scare about the neck and shoulders which Wilson (1907) has attributed to intraspecific aggression.

There are conflicting reports in the literature as to the Ross seal's body size in relation to other Antarctic seals. King (1964) lists maximum recorded lengths of 9 feet 10 inches for an adult male and 8 feet 3 inches for an adult female. Bonner and Laws (1964) felt that the Ross seal was

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Table I. Ross Seal Collections 1969-1972.

Specimen Number	Date	Sex	Location	Standard Length	Curvilinear Length	Axillary Girth	Front Flipper	Rear Flipper	Weight
69-34	3/22/69	Kale	65-18-6S/ 49-07W	81.0 in. (205.7 cm)	85.0 in. (215.9 cm)	55.0 in. (139.7)	15.5 in. (39.4)	17.0 in. (43.2)	446 lbs. (202 Kg)
69-35	3/22/69	Male	65-10.8S/ 49-11W	79.05 (201.9)	81.0 (205.7)	52.5 (133.4)	15.0 (38.1)	14.0 (35.6)	425 (193)
71-35	1/25/71	Male	76-43.5S/ 167-17E	66.0 (167.6)	75.0 (190.5)	46.5 (118.1)	14.5 (36.8)	14.0 (35.6)	270 (122)
72-009	1/23/72	Female	70-25S/ 88-05W	86.5 (219.7)	88.0 (223.5)	54.0 (137.2)	17.25 (43.8)	15.75 (40.0)	425 (193)
72-013	1/29/72	Male	69-25S/ 96-39W	78.0 (198.1)	80.0 (203.2)	44.5 (113.0)	15.5 (39.4)	14.75 (37,5)	300 (136)
72-014	1/29/72	Female	69-25S/ 96-39W	92.75 (235.6)	96.0 (243.8)	57.0 (144.8)	17.75 (45.1)	18.0 (45.7)	450 (201)
72-016	1/29/72	Female	69-25S/ 96-39W	77.25 (196.2)	81.25 (206.4)	49.5 (125.7)	15.25 (38.7)	16.0 (40.6)	325 (147)
72-017	1/30/72	Male	70-0S/ 98-57W	78.25 (198.8)	83.25 (211.5)	50.0 (127.0)	16.0 (40.6)	15.5 (39.4)	300 (136)
				79.9 (202.9)	83.7 (212.6)	51.1 (129.8)	15.8 (40.1)	15.6 (39.6)	312 (141.5)

in the size range of the Weddell seal and that reported sizes are biased by a predominance of immature animals. Our data however do not support this hypothesis. Table I shows the measurements from eight individuals that we have handled--the largest a 450 pound female measuring 7 feet 8 3/4 inches in a straight line from the tip of the nose to the tip of the tail. In comparison, then, the Ross seal is more nearly in the size range of the crabeater seal rather than the Weddell seal.

Similarly, the foreflippers have been subject to conflicting reports. Racovitza (1900) and Barrett-Hamilton (1901) said they were small while Wilson (1907) and Browm (1915) noted that they were large. We have normalized the standard flipper measurements to body length and find the relationship: leopard seal > crabeater seal > Ross seal> Weddell seal (see Table II). As might be expected the predatory leopard seal has the greatest relative flipper length. The differences are not statistically significant ($P < .05$) but this is due to the large variance probably caused by the difficulty in accurately defining a point where the flipper originates.

King (1969) notes that the Monachinae and Ommatophoca in particular are the most advanced of the phocids in respect to the progressive specialization toward a more flipper-like forelimb for positive swimming action. Modifications include reduction in nail size, shortening of the 5th digit, elongation of the 1st digit and, in the Ross seal, elongated epiphyses and cartilaginous extension that further increase the length of the flipper.

Table II --Comparative Flipper Lengths

	Front Flipper Length / Body Length	Hind Flipper Length / Body Length	N
Leopard Seal	.229±.052	.179±.044	16
Crabeater Seal	.201±.043	.187±.035	40
Ross Teal	.199±.020	.196±.025	8
Weddell Seal	.176±.025	.176±.019	30

Natural History

Very little is known about the life history or ecology of Ommatophoca. Cephalopods are thought to be the principle dietary staple (Hamilton 1901; Wilson 1907; Brown 1915; Solyanik 1965) and there is some evidence that Ross seals feed on cephalopods of a larger size than do other seals (King. 1969).

Population and reproductive studies on the Ross seal are essentially non-existant. Eight males and seven females were collected during the 1964 sealing expedition in the M. V. Polarhav and on the basis of these specimens, Øritsland (1970b) tentatively lists longivity at 12 years, with males and females achieving reproductive status in 3-4 years and 2-7 years respectively. Pupping has not been observed but is thought to occur on the circumpolar ice in November-December. Øritsland (1970b) reports a 101 cm. foetus collected on 23 September, 1964 and estimates length at birth to be 105 cm. or longer while King (1969, table II pg. 30) suggests a length of 120 cm. and weight of 27 kg. at birth. Erickson et al. (1972) report recent corpora lutea and implanted blastocysts in two Ross seals collected in the Amundsen Sea on January 29, 1972. These bits of evidence suggest that breeding occurs in late December or early January. Currently, Dr. Akhouri Sinah of the Veterans Hospital, St. Paul, Minnesota, is performing light and electron microscopy studies on the reproductive tracts of 3 male and 3 female Ross seals collected last year in the Amundsen and Bellinghausen Seas and it is expected that these analyses will contribute substantially to the scant knowledge of the reproductive picture of this species.

Distribution

The Ross seal has a non-regular, circumpolar distribution in the pack ice surrounding the Antarctic continent (Erickson et al., in press). Fewer than 50 sightings of this species were reported prior to 1940 (Bertram 1940) and R.M. Laws (1962, p. 448) was able to plot all 120 known records. Less than 200 Ross seal sightings (see Figure 1) had accumulated prior to 1972 when Erickson et al. (1972), aboard the U.S.C.G.C. Southwind in the Bellinghausen and Amundsen Seas, tallied 133 individuals while conducting shipboard and helicopter strip censuses over an area of 1628 square miles. Additional Ross seals were observed outside the census strips and during non census periods therefore these observers were able to match or exceed all cumulative sightings prior to this cruise.

Most sightings of Ross seals have been of solitary individuals but Mawson (1915) reported 6 near Haswell Island on January 21-22, 1914 and Bonner and Laws (1964) reported 5 on a single ice floe. C R. Robertson (personal communication) on January 11, 1965 saw a total of 13, including a group of 4 and a group of 3, during the Western Ross Sea-Balleny Island Expedition. Between. December 29, 1965 and January 13, 1966, Ray (1970) observed 22 in

Figure 1. Ross seal sightings

the western Ross Sea but in the same general area in January-February 1971 we observed only two Ross seals (Erickson et al., 1971). The Ross Sea was essentially clear of ice during the duration of the 1971 cruise and our observations surely reflected the absence of suitable habitat.

The distribution of the Ross seal appears directly related to the nature of the pack ice. King (1964) states that it is almost exclusively found in the heavier pack ice and Gilbert and Erickson (in preparation) note that most of the Ross seals observed in the Amundsen and Bellinghausen Seas were in six to eight octa pack ice regardless of the relative size of the ice floes. The Ross seal was found in a majority of their surveys and they estimate that a maximum of five percent of the population in the Amundsen and Bellinghausen Seas could have been harvested without using icebreaker or helicopters.

Population Estimates

Øritsland (1970a, Table I) summarized the known data on the relative abundance of Antarctic seals and calculates that 1.3% of the seals in the Antarctic pack ice are Ross seals. This figure compares closely with the 1.5% population composition figure subsequently developed by Erickson et al. (1972) for the Ross seal in the Amundsen and Bellinghausen Seas.

Census data are meager and densities calculated from them are variable and low. Only 4 of 4,742 seals counted in 552.47 NM^2 of census in the Weddell Sea (a density of .007/NM^2) were Ross seals (Erickson et al. 1970), as compared to a density of 0.301/NM^2 found by Eklund and Atwood (1962) in the Southern Indian Ocean-l05°-112°E longitude. In the western Ross Sea, Ray (1970) found densities varying between 0.04-0.4/NM^2.

Laws (1953a) estimated 10,000 Ross seals in the Falkland Island Dependencies and Scheffer (1958) listed the total Antarctic population between 20,000-50,000. Eklund and Atwood (1962) projected their density estimate to 2,200,000 NM^2 of pack ice with surface cover between 0.3-1.0 percent to arrive at a total population of 51,400 Ross seals. Gilbert and Erickson (op. cit.) found an overall density of 0.109/NM^2 between 85°W-135°30'W in the Bellinghausen and Amundsen Seas and estimated a minimal 28,968 Ross seals in 215,771 NM^2 of pack ice.

Discussion and Conclusions

Although only limited information exists on the population size of the Ross seal, the total number is seemingly as great or greater than several northern species such as the grey seal Halichoerus and ribbon seal Histriophoca (Scheffer 1958). The patchy nature of sightings and the results of recent helicopter surveys in heavy pack ice (Gilbert and Erickson, op. cit.) suggest that densities might be considerably higher

in the more inaccessible regions of the pack ice ecosystem which have have been inadequately worked; however Siniff et al. (1968) and Erickson et al. (1969, 1970, 1971) did not find the concentrations of Ross seals in the heavy pack of the Weddell Sea, which Bonner and Laws (1964, p. 179) predicted as possibly occurring there.

As previously stated, Ross seal densities are variable and low, thus it is difficult to extrapolate census data to arrive at a total population estimate. Seasonal and yearly variation in the size and nature of the pack ice zone have been shown to influence crabeater seal densities (Eklund and Atwood, 1962; Erickson et al, 1971) and probably have a similar influence on Ross seal densities. 50,000 is an often quoted total population estimate for Ross seals (King 1964; Eklund and Atwood, 1962; Scheffer 1958) but this is almost surely a minimal number. If the .109/NM^2 density estimate of Gilbert and Erickson is projected to the 2,200,000 NM^2 of available habitat estimated by Eklund and Atwood (op. cit.) a total Ross seal population of 239,800 is indicated. A population size of 104,000-650,000 is suggested if the composition estimate (1.3% Antarctic seals = Ross seals) is compared to calculated crabeater numbers--8,000,000 Eklund and Atwood (1962) and 50,000,000 Erickson et al. (1971). Therefore, 100,000-150,000 seems to be a reasonable and perhaps conservative population estimate for use in assessing the status of the Ross seal stock.

In any event, no evidence exists that suggests that the Ross seal should be considered an endangered species. There has been essentially no commercial harvest of the species and its non-aggregating nature coupled with a restricted habitat naturally protects it from all but air or icebreaker-supported operations.

The Conference on the Conservation of Antarctic Seals, London, 3-10 February 1972, proposed total protection from commercial exploitation in the resulting Convention for the Conservation of Antarctic Seals. Necessary provision is made in Article 4 for special permits to take Ross seals for scientific purposes since meaningful knowledge on the species is unlikely to be developed unless collections are made. Small scientific collections from limited areas are unlikely to have long term effects on total numbers or distribution since the Ross seal's association with the variable pack ice zone would suggest that it is highly mobile and does not congregate in local breeding aggregations.

The low density of Ross seals in the Antarctic is of particular interest because this density is not associated with man induced mortality factors. Food resources could be the primary limiting factor regulating the population but we have insufficient knowledge to suggest a mechanism by which this could function. The preferred habitat of the Ross seal seems to be in pack ice somewhat similar to that selected by crabeater seals,

therefore space seems to be quantitatively ample but could be qualitatively deficient if the food resource is not suitably distributed under the preferred ice cover. There have been no reports of the scarring commonly seen on crabeater seals thus Ross seals appear to be relatively unaffected by killer whale or leopard seal predation. Alternatively, however, there may be no survivors of predatory attacks: thus population regulation by predator pressure cannot be entirely ruled out. Finally, the Ross seal might have broad niche overlap with the crabeater seal and/or Weddell seal, which through interspecific aggression or competition might contribute to its low numbers. Hard data are missing and it is difficult to even have an intuitive feeling for the stability of the population. The population could be naturally stabilized at low densities, growing or declining toward extinction. Possibly the extirpation of Antarctic whale stocks may have had some related effect on the Ross seal through modification of energy use in the Antarctic food web.

Virtually nothing is known about the activity patterns, breeding habits, behaviour or ecology of the species. Directed scientific inquiry is indicated but the difficulty in obtaining or regularly observing animals has inhibited progress. Similarly there has been little progress toward understanding the biology of the crabeater seal which is 90 times more numerous than the Ross seal. Research in the pack ice ecosystem is needed but proposed projects requiring icebreaker support during the pupping and breeding seasons (October-December) have received low priority and no support.

King (1969) in her description of the Rose seal anatomy states, "The many peculiarities and diversity of structure that came to light during the work on the Ross seal are mainly concerned with swimming, with location, capture and eating of food and, probably with the appreciation of sound." In comparison to other phocids, the eyes, teeth, skull and vocalizations are most unique and suggest the desirability of comparative studies.

REFERENCES

1. Barrett-Hamilton, G.E.H. 1901. Résultats du voyage du S.Y. Belgica 1897-99. Zoologie, Seals, pp. 1-20, Buschman, Anvers, Belgium.

2. Barrett-Hamilton, G.E.H. 1902. Mammalia. Rept. Coll. Nat. Hist. Ant. Reg. Voy. "Southern Cross", pp. 1-66.

3. Bonner, W.N. and R.M. Laws, 1964. Seals and sealing. In: Antarctic Research; A Review of British Scientific. Achievement in Antarctica, R. Priestley, R.J. Adie and G. de Q. Robin eds., pp. 163-190. Butterworths, London.

4. Brown, R.N.R. 1913. The seals of the Weddell Sea: Notes on their distribution. Scottish Nat. Ant. Exped., Rept. Sci. Res. Voy. S.Y. 'Scotia' 1902, 1903, 1904, Vol. 4, No. 13, pp. 185-198; 9 Pls.

5. Charcot, J. 1911. The Voyage of the 'Why Not?' in the Antarctic; The Journal of the Second French South Polar Expedition, 1908-1910, translated by P. Walsh. Hodder and Stoughton, New York, 315 pp.

6. Eklund, C R. 1964. Population studies of Antarctic seals and birds. In:. Biologic Antarctique, Premier Symposium, Paris, 1962, R. Carrick, M. Holdgate and J. Prevost eds., pp. 415-419. Hermann, Paris.

7. Eklund, C.R. and E.L. Atwood, 1962. A population study of Antarctic seals. J. Mammal. 43: 229-238

8. Erickson, A.W., D.R. Cline and R.J. Hofman, 1969. Population Study of seals in the Weddell Sea. Antarctic J.U.S., 4, 99-100.

9. Erickson, A.W., R.J. Hofman, W.L. Thomas and R.J. Oehlenschlager, 1970. Seal survey in the south Shetland and South Orkney Islands. Antarctic Journal of the U.S., Vol. 5, No. 4, pp. 130-131.

10. Erickson, A.W., D.B. Siniff, D.R. Cline and R.J. Hofman, 1971. Distributional ecology of Antarctic seals. In: Proc. Symposium on Antarctic Ice and Water Masses, Tokyo, Japan, 19 Sept. 1970, ed. Sir George Deacon, pp. 55-75. S.C.A.R.

11. Erickson, A.W. and J. Gilbert (in press). Seal survey in the Bellinghausen and Amundsen Seas. Antarctic J.U.S.

12. Erickson, A.W., R.J. Hofman and D. Kuehn (in preparation). The Distribution of Antarctic Seals. Map Folio Series, Am. Geographic Society.

13. Gilbert, J. and A.W. Erickson (in preparation). Census results of seal surveys in the Bellinghausen and Amundsen Seas.

14. Gless, E.E. and E.A. Hicks, 1968. Entomological studies at Hallett Station. Antarctic J.U.S., 3: 123.

15. Gray, J.E. 1844-75. The zoology of the voyage of H.M.S. Erebus and Terror, 1839-43. I. Mammalia I, The seals of the Southern Hemisphere. London, E.W.. Jansen.

16. Ingham, S.E. 1960. The status of seals (Pinnipedia) at Australian Antarctic stations. Mamma1ia 24: 422-430.

17. Kenyon, K.W. 1967. Antarctic seal observations, February 1967. Unpubl. repts., U.S. Fish Wildlife Serv., Sandpoint Nav. Sta., Seattle, Washington, 17 pp.

18. King, Judith E. 1964. Seals of the World. British Museum (Natural History), London.

19. King, Judith E. 1968. The Ross and Other Antarctic Seals. Trans. Australian Museum, Sydney, Vol. 15, No. 1.

20. King, Judith E. 1969. Some Aspects of the Anatomy of the Ross Seal, Ommatophoca rossi. British Antarctic Survey, Scientific Reports No. 63, p. 1-54.

21. La Grange, J.J. 1962. Notes on the birds and mammals on Marion Island and Antarctic (SAME). J. South Afr. Biol. Soc. 3: 27-84,

22. Laws, R.M. 1953a. The seals of the Falkland Islands and Dependencies. Oryx 2: 87-97.

23. Marr, J.W.S. 1935. The South Orkney Islands. Discovery Repts., Vol, 10, pp. 283-382, Pls. 12-25.

24. Mawson, D. 1915. The Home of the Blizzard. Lippincott, Philadelphia, 305 pp.

25. Medvedev, L.P. and V.A. Boronin, 1967. Seal observations during the 12th voyage of the "Ob". Sov. Ant. Exped. Info. Bull., No. 7; pp. 84-85 (Engl. tr.). Elsevier, Amsterdam.

26. Mossman, R.C. 1908. The South Orkneys in 1907. Scottish Geogr. Mag., 24: 348-355.

27. Noble, J. 1893. Illustrated Official Handbook of the Cape and South Africa.

28. Øritsland, T. 1968. Sealing and seal research in the southwest Atlantic pack ice, September-October 1964. Proc. SCAR Symposium on Antarctic Ecology, Cambridge, England, 28 July-3 August 1968: 2 pp.

29. Øritsland, T. 1970a. Biology and population dynamics of Antarctic seals. In: Antarctic Ecology, M.W. Holdgate ed., Vol 1, pp. 361-366. Academic Press, London.

30. Øritsland, T. 1970b. Scaling and seal research in the south-west Atlantic pack ice,, Sept.-Oct. 1964. In: Antarctic Ecology, M.W. Holdgate ed., Vol. 1, pp. 367-376. Academic Press, London.

31. Perkins, J.E. 1945. Biology at Little America III, the west base of the United States Antarctic Service Expedition, 1939-1941. Proc. Am. Phil. Soc., 89: 270-284.

32. Pohle, H. 1927. Die Pinnipedier der Deutschen Sudpolar-Expedition 1901-1903. In: Deutsche Sudpolar-Expedition 1901–1903, E. von Drygalski ed., Vol. 19: 449-462. W. de Gruyter, Berlin.

33. Polkey, W. and W.N. Bonner, 1966. The pelage of the Ross seal. Bull. Mo. 8, Brit. Ant. Surv., pp. 93-96.

34. Ray, C. 1970. Population ecology of Antarctic seals. In: Antarctic Ecology, M.W. Holdgate ed., Vol. 1, pp. 398-414. Academic Press, London.

35. Robertson, C.J.R. 1970(17 March). Personal communication from Western Ross Sea-Balleny Islands Expedition 1965.

36. Scheffer, V. 1958. Seals, Sea Lions, and Walruses; A Review of the Pinnipedia. Stanford Univ. Press, Stanford, 179 pp.

37. Shackleton, E. 1909. The Heart of the Antarctic. Lippincott, Philadelphia, 2 vols., 365 and 451 pp.

38. Siniff, D.B. and D.R. Cline, 1968. Population dynamics of Antarctic seals (IWSOE--1968). Antarctic J.U.S., 3: 86-87.

39. Siniff, D.B., D.R. Cline and A.W. Erickson, 1970. Population densities of seals in the Weddell Sea, Antarctica, in 1968. In: Antarctic Ecology, M.W. Holdgate ed., Vol. 1, pp. 377-394. Academic Press,. London.

40. Solyanik, G.A. 1964. Some information on Antarctic seals. Sov. Ant. Exped. Info. Bull., No. 5; pp. 179-182 (Engl. tr.). Elsevier, Amsterdam.

41. Wilson, E.A. 1907. Pinnipedia. Nat. Ant. Exped., 1901-1904, Nat. Hist. Vol. 2, No. 1, pp. 1-66.

42. Wilton, D.W., J.H.H. Pirie and R.N.R. Brown, 1908. Zoological log. Scottish Nat. Ant. Exped., Rept. Sci. Res. Voy. S.Y. 'Scotia', 1902, 1903, 1904, Vol. 4, Zool., Pt. 1, 103 pp.

43. Zenkovich, B.A. 1962. Sea mammals as observed by the round-the world expedition of the Academy of Sciences of the U.S.S.R. in 1957/58. Norsk Hva1fangsttid., 51: 198-210.

Paper 16

The Juan Fernandez Fur Seal

by

Anelio Aguayo L.

Departamento de Oceanologia, Universidad de Chile,
Vina del Mar, Chile.

INTRODUCTION

Two papers about this species have been published in Chile (Aguayo and Maturana, 1970; Aguayo 1971). A third paper in preparation will have to wait until we obtain more comparative material.

On the other hand two important papers have been recently published in U.S.A. (Hubbs and Norris, 1971; Repenning, Peterson and Hubbs, 1971).

Present status.

In Table I the fur seals observed on Juan Fernández Archipelago between 1965-1970, are summarized.

Table I. ––Fur seals counted on Juan Fernández Archipelago, Chile, between 1965-1970[1]

Observer	Year	Place	Number	Census
N. Bahamonde	1965	Más Afuera	200	Incomplete
D. Bourne	1966	Santa Clara	8	Incomplete
K. Norris	1968	Más a Tierra	50	Incomplete
A. Aguayo-R. Maturana	1969	Más a Tierra	170-192	Complete
A. Gonzalez	1969	Más Afuera	257-267	Complete
A. Aguayo-D. Torres	1970	Más a Tierra	231-246	Complete
A. Aguayo-D. Torres	1970	Más Afuera	470-500	Complete
A. Aguayo-D. Torres	1970	Santa Clara	4	Complete

[1] Data from Aguayo, Maturana and Torres (1371) and Hubbs and Norris (1971).

It is now clear that not less than seven to eight hundred fur seals exist on this Archipelago.

In Table II is shown the only two fur seals counted on Isla San Ambrosio in 1970.

Table II ––Fur seals on Isla San Ambrosio, Chile, June 26, 1970.

Observers	Place	Number
R. Gilmore A. Aguayo J. Jehle J., D. Hunsaker D. Torres S. Bowen	Isla San Ambrosio (26° 20' S, 79° 58' W).	2

The fur seals at San Ambrosio numbered only two in our count, but these probably represented more individuals, which we hope will increase into a large, permanently breeding colony in the near future. Seasonal lobster fishing close to the rocks, however, may interfere in the increase. The two fur seals at San Ambrosio were the first reported there for perhaps a century and a half (Gilmore 1971).

Present knowledge.

We know now about the original teeming abundance, near-extinction, range, lack of association with Arctocephalus australis and Otaria flavescens, former association with Mirounga leonina, habitat and habitas of the Juan Fernández fur seal, thanks to the comprehensive paper of Hubbs and Norris (1971). No studies have been made of age, growth rates, etc.

Taxonomic considerations.

The taxonomic position of the Juan Fernández fur seal is in dispute.

Peters (1866) described it as Otaria (Arctophoca) philippi. Gray (1869) raised the subgenus Arctophoca to generic level. Allen (1905) included Arctophoca in the synonymy of the genus Arctocephalus.

King (1954, 1964) and Scheffer (1958) accepted the genus Arctocephalus instead of Arctophoca. Sivertsen (1954) revived the generic name Arctophoca, and Mann (1957), agreed.

Repenning, Peterson and Hubbs (1971) said; "The philippi-townsendi complex is in some ways distinctive, but classing these 2 species (only provisionally held to be distinct) a separate genus, Arctophoca, seems unwarranted". However, Aguayo and Torres (in preparation) said: "The Genus Arctophoca should be restored, for among other reasons its peculiar geographical distribution, dental formula and cranial morphometry".

REFERENCES

1. Aguayo, A. and R. Maturana, 1970. Primer censo de Lobos Finos en el Archipiélago de Juan Fernández. Biología Pesquera, Ministerio de Agricultura, Chile, No. 4: 3-15, figs. 1-2, 1 pl.

2. Aguayo, A. 1971. The present status of the Juan Fernández fur seal. K. Norski Vidensk, Selsk, Skr. 1: 1-4, figs. 1-2.

3. Aguayo, A., R. Maturana and D. Torres, 1971. El Lobo Fino de Juan Fernández. Rev. Biol. Mar. Valparaiso, 14(3): 135-149, figs. 1-4, 3 pls.

4. Aguayo, A. and D. Torres (in preparation). Contribution to the present knowledge of the Juan Fernández fur seal.

5. Hubbs, C.L. and K.S. Norris, 1971. Original teeming abundance, supposed extinction, and survival of the Juan Fernández fur seal. Antarctic Pinnipedia, Antarct. Res. Ser., 18: 35-52, figs. 1-5. AGU, Washington, D.C.

6. Gilmore, R.M. 1971. Observations on Marine Mammals and Birds off the Coast of Southern and Central Chile, Early Winter 1970. Antarctic Journal. 6(1): 10-11.

7. King, J. 1954. The Otariid Seals of the Pacific coast of America. Bull. Brit. Mus. (Nat. Hist.), Zool. 2: 311-337.

8. King, J. 1964. Seals of the World. Brit. Mus. (Nat. Hist.), London, 154 pp.

9. Mann, F.G. 1957. Clave de deterrainación para las especies de mamíferos silvestres en Chile. Inv. Zool. Chil., 4: 89-128.

10. Repenning, C.A., R.S. Peterson and C.L. Hubbs, 1971. Contribution to the systematics of the southern fur seal, with particular reference to the Juan Fernández and Guadalupe species. Antarctic Pinnipedia, Antarct. Res. Ser., 10: 1-34, figs. 1-9. AGU, Washington, D.C.

11. Scheffer, V.B. 1958. Seals, sea lions and walruses. A review of the Pinnipedia. Stanford University Press, Stanford, 179 pp.

12. Sivertsen, E. 1954. A survey of the eared seals (fam. Otariiddae) with remarks on the Antarctic seals collected by M/K "Norvegia" in 1923-1929. Det. Norske Videnskaps-Academi i Oslo. Sci. Results Norweg Antarctic. Exp. 1927-1928 et seq. Lars Christensen No. 36: 1-76, figs. 1-46.

Paper 17

The Current Status of Seals in the Southern Hemisphere

by

R.M. Laws

British Antarctic Survey, Monks Wood Experimental Station,
Abbots Ripton, Huntingdon, U.K.

I have found the task of reviewing the statue of southern seals in a short paper difficult, but have tried to give an indication of the status of the stocks and the current trends in numbers. For several species adequate information is lacking, but in general there seems to be little cause for concern, and none are endangered to the same extent as some of the northern stocks. I have dealt with all stocks except the Juan Fernández fur seal Arctocephalus phillppi, the Galapagos fur seal A. galapagoensis, and the Ross seal Ommatophoca rossi. These are dealt with by other contributors.

Southern fur seals

Repenning et al. (1971) define eight species of Arctocephalus, only five of which are considered here; they also give a useful distribution map.

Arctocephalus pusillus, the South African fur seal, has been exploited commercially for over three hundred years and there are 22 colonies on or near the south and south west coasts of South Africa. After 1870, legal authority was established over the seal rocks and conservation practices implemented. There has been no attempt to exploit at the maximum sustainable yield level and since 1936 all cows have been protected, though yearling females are taken. In recent years the catch has been confined mainly to animals in their first year, aged about 9 months for skins. This winter catch has increased steadily from 27,289 in 1950, to 76,694 in 1971, of which 827, were taken from mainland colonies. The annual catch of bulls has declined in recent years from about 3,000 in the early 1950's to 812 in 1969, the last year for which statistics are available (Rand 1972).

Government sealers account for about 30 percent of the catch; the rest are taken by private sealers under licences, which specify quotas, and methods of killing; royalties are paid.

It is difficult to get objective information on the current state of the population and subjective evidence suggests that it may have increased over the past ten or twenty years. This impression is mainly derived from the extension of breeding animals to new areas (P.B. Best, pers. comm.).

Aerial surveys were undertaken in November, 1956, when almost all colonies were photographed, and November, 1967, when the survey was much less complete. According to Rand (1972), comparison of the aerial counts shows that the numbers of territorial bulls have remained "remarkably constant", although the example he gives is not very convincing. In fact, if we compare those colonies for which data are available from both surveys, there is a 12% decrease in bull numbers in 1967 as compared with 1956, and an even greater decline in total numbers. However, even quite small seasonal differences can greatly influence counts.

Rand (1972) suggested that the island populations are exploited at their maximum sustainable level, but elsewhere "natural growth has exceeded man-induced mortality". He suggested that "about 70,000 pups can currently be expected from all the herds", but this has already been exceeded in 1970 and 1971. The yearling seals have been hunted by very similar methods over the years and Rand suggested that the kills provide indices of abundance. There has been an increase in the catch per unit effort from 16-17 to 20-22 pups/sealer/day, but bulls are no longer keenly sought and their declining catch cannot be taken as representing a declining stock. However, the total size of the stock is not known and there is a need for more quantitative information relating the level of exploitation to stock size. Nevertheless this is one of the better known species of Arctocephalus.

Over the years there have been many complaints by fishermen (seine netting for pilchard and anchovy) about the interference by fur seals in their operations. In one recent month 45,000 rounds of ammunition were sold to fishermen at Wolf Bay. The recorded distribution of wounded seals is correlated with the fishing grounds. Another possible consequence of disturbance by fishermen is the hundreds of abortions that have been reported from the breeding colonies (Best, pers. comm.).

I have little information on the A. pusillus stocks in Tasmania and Eastern Australia. At the turn of the century protective legislation was enacted and only seals found damaging nets and lines may be destoyed. Lewis (1929) gave estimates of 5,000-6,000 at Seal Rocks and 3,000-5,000 at Lady Julia Percy Island. Pizzey (1964) thought that there might be 5,000 at Seal Pocks and a total of 20,000 off the southern coast but this total may include A. forsteri. It seems likely that numbers have remained stable or increased in the last 50 years and the stock is not endangered. However, more reliable estimates of numbers are desirable.

Arctocephalus forsteri of New Zealand and South West Australia has also apparently been increasing in numbers in the past 20-30 years but "data on present distribution and numbers are insufficient to ascertain the real status of the species" (Stirling 1970, 1971).

The history of the fur seal in New Zealand is that of the other southern hemisphere stocks. Formerly there were large breeding colonies on the South Island and other islands to east and south. Early 19th century sealing reduced the stocks and recovery was followed by a further reduction about 1870. In 1875 sealing was prohibited from October-May, leaving a 4 month open season. In 1894 a total ban was enforced until 1913-1916, when there was a 3 month open season; then none were killed until 1946 when a limited harvest of about 1,000 was authorised. Falla (1953) estimated the New Zealand population at less than 50,000. Recovery has been slow but the appearance and increase of permanent non-breeding herds in the Cook Strait area (41°S.), that is well north of the breeding range (south of 45°S.), is encouraging. At Campbell Island only 71 pups were counted in 1958 (Bailey and Sorensen, 1962).

Shaughnessy (1970) on the basis of work on transferrin types suggests that fur seal may have been exterminated from South and Western Australia, with subsequent recolonization from New Zealand. However, the transferrin types of New Zealand and Macquarie Island specimens were not identical with material from Australian specimens.

King's (1969) population figures for Australia were acknowledged to be "not very reliable" and they seem to have been low. For example, according to Stirling (pers. comm.) King's figure of "probably 200" on the South Neptunes is under by a factor of 10 at the peak of the pupping season, and he suggests that the population in South and Western Australia is within the range 8,000-15,000. The species is completely protected there, though a few are taken for scientific purposes or zoological gardens. There are also conservation areas designated as prohibited areas, fauna reserves and fauna sanctuaries.

It has been suggested that the indigenous fur seal of Macquarie Island was a different species from A. forsteri, possibly A. gazella or A. tropicalis (Csordas and Ingham, 1965; Falla 1962). The original fur seal was exterminated in the decade 1810-1820 and recolonization, by A. forsteri, began at some time between 1919 and 1948, at first in a restricted area at the north end of the island. The species is legally protected by Tasmania which administers the island. Maximum counts increased from 174 in 1950 to 474 in 1963, almost all non-breeding animals, but several pups have been born since 1955. This is a pattern very similar to the documented recolonization of the South Orkney and South Shetland Islands by A. gazelia (see below). Csordas and Ingham (1965) suggested that availability of food for the pups may determine the future success of this breeding population, although this is certainly not a limiting factor for A. gazella at Bird Island, South Georgia.

Arctocephalus gazella is another species which has undergone a considerable increase in numbers, particularly in the western part of its range. Bonner (1968) has discussed at length the early sealing methods and history and the recovery of the stocks at islands of the Scotia Arc. Weddell (1825) calculated that by 1822 at least 1.2 million fur seals had been taken at South Georgia and that the species was virtually extinct there. The peak annual catch in the South Shetland Islands was in 1820-21 when at least 47 American and British vessels were involved. In that season about a quarter of a million seals were taken and many thousands killed and lost. There was a partial recovery by the 1870's when the stock was again virtually exterminated, and the last fur seals taken commercially at South Georgia were 170 in 1914. Since 1916 the species has been protected, except for limited numbers taken for scientific purposes.

Bonner (1968) has described the growth of the stock at Bird Island, South Georgia. Careful counts by the "Discovery" Investigations in 1933 and 1936 indicated that the population then was of the order of a hundred animals. A total of 59, including 12 pups were counted on Bird Island on 19 December 1936. Twenty-one years later a count of pups made in 1957 showed a total of about 4,500 pups and Bonner calculated that the total population was about 15,000 animals. Successive annual censuses were made up to 1963 and showed a rapid increase, to some 11,500 pups in 1963. Research at Bird Island was resumed in 1971 by the British Antarctic Survey (B.A.S.) and results sO far are very encouraging. The pup total for Bird Island was about 22,000 (M.R. Payne, pers. comm.) suggesting a total population of over 70,000 if Bonner's factor is applied.

At the same time additional colonies have become established on the north-western part of the main island of South Georgia and data on them are being accumulated by the B.A.S. There has also been an increase in other parts of their former range. In 1947 I recorded the first fur seal to visit Signy Island, South Orkney Islands, in recent years. Since then the numbers have increased and now counts in excess of a hundred are not uncommon. These are mainly adult males which haul out in February to April. One fur seal tagged at South Georgia was sighted at Signy Island and pale coloured animals like those reported from South Georgia are also seen (at least 3 individuals in 1971). A count throughout the South Orkney Islands in February 1971 gave a total of 2,035 animals, of which 93% were males (Laws, unpublished).

Breeding was first recorded at Meier Point (B.A.S. unpublished records) in 1955 and 1956 and at Michelsen Island in 1956 (Øritsland 1960). Counts at Michelsen Island and southern Powell Island have increased from 111, including 11 pups, in 1956 to 559, including 28 pups in 1959 (B.A.S. unpublished records) and to 923, including 39 pups in 1971. In the 1971

survey breeding groups were also found at Monroe Island (6 pups) and Gosling Island (16 pups), making a total of at least 61 pups born in the group in 1971.

Similar though smaller increases have been recorded from the South Shetland Islands. O'Gorman (1961) reported 42 fur seals on Livingston Island in 1953, and in 1959 two pups were born at Cape Shireff, Livingston Island (one of which was found dead). Aguayo and Torres (1968) counted about 200 fur seals on Livingston Island and about 300 on Elephant, Cornwallis and Clarence Islands in 1966. They reported small breeding colonies at Elephant Island and Livingston Island. Erickson et al. (1970) counted 204 on the north-west side of King George Island in January 1970. In February 1971 a seal count at Cape Shireff gave a total of 201 fur seals, including 27 pups (B.A.S. unpublished records), that is twelve years after the first recorded breeding.

The South Sandwich Islands appear never to have supported a large population; it had been virtually eliminated by 1881 and a visit ten years later yielded 400 skins. From 1892 until 1960 there are no records. In 1960 about 400 were seen on a beach on Visokoi Island, including several black pups. In March 1962 about 800-900 were seen including 550 and many pups on the Visokoi beach mentioned above, and ten pups on Saunders Island (Holdgate 1963). Budd and Downes (1969) concluded that there has been a real increase in numbers at Heard Island since 1955 and consider a continuing increase likely. While the Australian Station (ANARE) was occupied from 1947 to 1955 fur seals were frequent summer visitors, but the largest number was 50 and no firm evidence of breeding was found. A subsequent visit in 1963 showed increased numbers, to about 500, and a less complete survey in 1965 gave comparable results. These visits provided the first evidence of breeding; two suckling pups were seen in 1963, but none in 1965. The origin of these visitors is unknown, but is possibly Kerguelen.

At Kerguelen the species was abundant in the nineteenth century but was thought to have been exterminated. The recent history is summarised by Budd and Downes (1969). None were seen in 1929 by the Norwegian sealers but a single male was seen in 1951 and several small animals in 1952. No other sightings were reported until 1967 when 143 were reported, but no births have been recorded as yet. These counts relate to only a small part of the coastline (Prévost, in litt.) and there may be larger colonies, including breeding animals, still unrecorded. However, Budd and Downes (1969) conclude that on the evidence available fur seals appear to be less numerous than on Heard Island and come from an unknown population.

On Bcuvetøya there wan an estimated breeding stock of 1,000-1,200 in 1927-29, even after the "Norwegia" had taken 000 fur seals in 1927 (Sivertsen 1954). In 1964, about 500 animals were seen, breeding was confirmed, and Holdgate et al. (1968) suggested an annual pup recruitment of 150-180.

Throughout its range but most markedly at South Georgia there is unequivocal evidence for population increase in A. gazella. It appears to be nowhere endangered, except possibly at Kerguelen, where Prévost (in litt.) remarks that on occasion foreign vessels come to collect numbers "plus ou moins importantes" of seals. These "pirates" are uncontrollable at Kerguelen owing to the size of the island and the sheltered harbours offered by the many inlets and islands. It is not possible to say whether these are accidental and limited to the collection of a few skins, or more organized.

Arctocephalus tropicalis is another species that appears to be thriving after near extinction last century, with a total population probably now in excess of 20,000. Some 13,000 bred at Gough Island in 1955-56 and some hundreds at Inaccessible (Holdgate 1965). Rand (1956) reported not more than 500 on Marion Island, including 160-170 adult males. Paulian (1956) estimated the total stock, excluding Gough Island, at 3-4,000.

At the Ile Amsterdam a recent study by Segonzac, to be published shortly, indicates an increasing population. In 1956 there were an estimated 2,318 including 500 pups, whereas by 1970 the numbers had increased to 4,868 including 1,498 pups (Prévost, in litt.).

A. australis is one species which is probably not increasing at present, though there arc few indications of serious decreases. The largest numbers are in Uruguay where it breeds on six islands. The largest colony numbers about 56,000 and several thousand seals are taken each year in government controlled sealing operations (Vaz Ferreira 1950). Carrara (1952) surveyed the pinniped colonies of Argentina and presented an estimate of 1,850 for the two known colonies on Isla Escondida and Isla de los Estados. Two years later he revised this to 2,700 of which only 400 were on Isla Escondida. There appear to be no quantitative data on its occurrence on Chilean coasts, but it is relatively scarce. The species has been protected since 1965, but there is probably more or less intensive poaching. In Peru it has been protected since 1959 and the estimated population in 1966 was 4,000-5,000. The only known breeding colony, numbering about 2,000, is at the foot of cliffs on the Paracas peninsula (Grimwood 1968).

This species has had full protection in the Falkland Islands since 1921, but is probably here also subject to sporadic poaching. In 1965 and 1966, aerial photographs and ground counts indicated a total of less than 14,000, very similar to the figure I obtained 15 years earlier for the same colonies. Local reports of a large fur seal colony on Beauchêne Island, about 30 miles south of East Falkland proved "to be pure conjecture" and on several visits since 1963 no fur seals have been seen. This population had recovered from the nineteenth century sealing by 1936 when hundreds were seen off the island. Their disappearance since then must have been due to unlawful sealing in recent decades (Strange 1965, 1972).

Except in the case of the Uruguay colonies which are managed, it seems likely that the more isolated colonies are subject, to a greater or lesser extent, to illegal sealing from time to time. There is probably little that can be done about this at present, and the species, with a world population cf some 80,000, is not endangered. It is desirable to obtain more up to date information on the status of the South American colonies.

Southern sea lions

Otaria byronia is the most abundant species, with a distribution confined to South America and the Falkland Islands. Unfortunately there is little up to date information on population sizes or trends.

According to the Vaz Ferreira (1950) there were 44,000 on Lobos Island, Uruguay. The distribution and size of the Argentine colonies was established by air and ground surveys carried out by Carrara (1952, 1954). In his first report he gave a total population of 140,000 in 1949, later raised to 170,000 in 1954. The apparent increase may not be real but a result of better counting techniques. About 4,000 a year were taken by sealers from 1949-1951.

Sea lions have been protected by the Chilian Government since 1965, and their status and population size are probably similar to the stock in Argentina. In Peru where it was formerly very numerous, the stock had been severely depleted by indiscriminate hunting. Kellogg (1942) estimated that 75,000 skins were being taken annually on the coast of Peru. In four months in 1941-42, one dealer was able to buy nearly 37,000 skins of the sea lion and fur seal, A. australis, taken on a short stretch of the coast. Although hunting has been prohibited since 1959, substantial numbers are still killed illegally, mainly by small boat fishermen whose nets are damaged on occasion. The total population was estimated at 20,000 in 1966 (Grimwood, 1968). I have not been able to find more recent, reliable information on the status of the species in South America.

In the Falkland Islands Hamiltaon (1939) made detailed counts of 77,880 pups and estimated the total population size at some 380,000. In commercial sealing ventures under licence nearly 40,000 were taken in 1928-31 and 1935-38. Only 3,045 were taken in 1949-52 by another company, which was not able to reach its quota. In 1962 and 1963, a licence was issued for 1,500 to be taken. Meanwhile preliminary investigations had indicated that there had been a drastic decline in the size of the stock. In subsequent aerial surveys, in 1965 and 1966, only 5,516 pups were counted and after making various optimistic corrections the total population was estimated at no more than 30,000 (Strange 1972). The reason for this dramatic decline is not known. Strange suggests that perhaps Hamilton's figures were obtained during the peak period of a long term cycle in numbers, or that environmental changes were the cause, and he ruled out exploitation as a cause of the decline. A population decline of about 92%, if real, gives considerable cause for alarm, and further monitoring of this stock is urgently needed.

Up to date reliable figures for the other populations are also badly needed. Assuming that there has been no drastic decline in numbers the total population could be of the order of 440,000, not very different from Hamilton's estimate of the total Falkland Island stock in the 1930's, but if a decrease in numbers has occurred in South America comparable in scale to the supposed change in the Falkland Islands population, then the stocks could now number less than 50,000.

Neophoca cinerea, the Australian sea lion, is now confined to the coast of South Australia. There is little published information, but the population is small. Scheffer (1958) gives stock size of 2,000-10,000 and recently Stirling (pers. comm,) has suggested about 2,000-5,000. It is now completely protected in South Australia; some specimens are taken for scientific purposes or zoos, but this is strictly controlled. The species has important potential as a tourist attraction because some colonies are near to population centres. Each year over 20,000 people come on bus tours to Seal Bay, Kangaroo Island, mainly from Adelaide (Stirling, pers. comm.).

Phocaretos hookeri, the New Zealand sea lion, is another little studied species. Scheffer (1958) suggested a population of 10,000-50,000 but Stirling (pers. comm.) considers a more realistic figure would be 2,000-5,000. Its breeding range is confined to Campbell, Snares and Auckland Islands although individuals have visited New Zealand and Macquarie Island from time to time. Although both species are adequately protected the Email sise of the stocks gives cause for concern and more precise estimates of the stock sizes are needed.

Elephant seals

Mirounga leonina the southern elephant seal, suffered like the sea lions and fur seals from the activities of 19th century sealers, but throughout its range has made a good recovery.

Elsewhere I have discussed the distribution of the species and estimated the total world population at 600,000±100,000 (Laws 1960); there is no reason to alter this figure. The three main stocks are centred on South Georgia, Îles de Kerguelen and Macquarie Island. It now has full protection, but the French authorities know that occasionally foreign vessels take elephant seals, especially at Kerguelen where there is little prospect of controlling these pirates (Prévost, pers. comm.).

At South Georgia a licensed industry operated from 1910 and 259,076 bulls were taken up to the 1964 season, since when there has been no commercial sealing, although licences have been put out to tender. The history of management and the revisions to the regulations in 1952 have been described (Laws 1960). These followed my findings that the stocks in two divisions were declining as a result of over exploitation; this was corrected and Bonner (1958) was able to report that the damage had been repaired and the condition of the stocks gave no cause for alarm. The island is divided for sealing into four divisions and two reserves where no sealing is allowed. Three divisions were worked each year, one being unworked in rotation. Annual quotas, totalling 6,000, were fixed for each Division according to estimates of the size of the stocks in each Division. The catch was restricted to adult bulls above a designated minimum length; tooth samples for agoing, representing 5% of the catch in each Division, were collected and analyzed; a Government sealing inspector was appointed to control the operations. Analyses showed that following introduction of the new regulations the average age of the catch increased; at the same time the catch per unit effort rose, the oil yield increased and the length of the season was shortened.

Following the cessation of sealing in 1964 it is possible that there has been an increase in numbers. However the elephant seal, which feeds on fish around South Georgia and Îles de Kerguelen, may have been affected by the recent activities of fleets of Russian factory trawlers. Their efforts are directed at the subadult and adult population of Notothenia rossii. The first exploratory fishing at South Georgia, in which up to 40 trawlers were involved, took place from the summer season 1965/66 to 1970/71. I understand that 240,000 tons of fish were taken in one season. It is difficult to assess the affect of fishing at this level because we have no reliable estimate of the size of the fish stocks, but it is possible that overfishing has occurred. However, the young stock of N. rossii are inaccessible to exploitation, inhabiting the inshore kelp beds

(Macrocystis) and several years of heavy overfishing would have to take place before the immature stocks were affected. I am informed that 15-20 Russian trawlers are working around the Îles de Kerguelen with a probabl production of 120,000 tons a year. The French authorities are also concerned about the conservation of the fish stocks, and here again it could have serious implications for the elephant seals. If confirmed this would be a reversal of the usual interaction between fishing interests and seals.

A feature of elephant seal biology in recent decades has been the southward extension of their range. Large numbers haul out in the summer in the South Orkneys and South Shetland Islands and small breeding colonies are established. Tagging returns indicate that they come from South Georgia. The total summer haul out in the South Orkneys is substantial and a count in February 1971 gave a total of 3,459, and in the South Shetland Islands Aguayo (1970) counted about 25,000. Ingham (1957) drew attention to the regular presence of a small moulting group on the Antarctic continent. At Signy Island, South Orkney Islands, they are at the limit of their breeding range and natality and pup survival has varied in relation to ice conditions. Breeding was first confirmed in 1947. Between 1948 and 1958 the number of births varied from 30-44; it fell to only 3-10 between 1963 and 1967, but has subsequently risen to 20-30, In 1971, a total of 27 were born but only 15 survived (B.A.S., unpublished reports).

Antarctic Seals

Earlier estimates of the numbers of Antarctic seals have been based on very little quantitative data and have involved gross extrapolations. Eklund and Atwood (1962) made the first serious attempt at estimating the populations of crabeater seals Lobodon carcinophagus, leopard seals Hydrurga leptonyx and Ross seals Ommatophoca rossi in the Antarctic pack ice, bated on transect censuses in the Ross Sea and between longitudes 105° and 112°E, They presented a statistical analysis of their data on density and extrapolated the findings to the mean pack ice area in January. Their resulting estimates for population sizes were about 5-8 million crabeater seals, 152,000 leopard seals and 51,400 Ross seals. Øritsland (1970b) also gave density estimates for a relatively small area.

More recent attempts to census Antarctic seals over a large area in 1968, 19G9 and 1970 were described by Erickson et al. (1970). This work indicated that total populations are much higher than the earlier estimates. An estimate of crabeater numbers in the Weddell Sea area was based on a total of about 1,900 km^2 of pack ice sampled over three seasons, and a total of under 5,000 seals actually counted. A figure of 8.2-10.6 million was obtained by correcting for time of day and extrapolating to the larger area of similar pack ice. On further extrapolation to the whole

Antarctic pack ice zone. Erickson et al. (1970) speculate that the world population of this species is between 50 and 75 million. This is not a reliable estimate but clearly previous population estimates have been very conservative. Erickson subsequently reported on censuses made in 1971/72 in the Bellingshausen and Amundsen Seas, covering an area of 2,900 km^2 (Anon. 1972a and b). Over most of the area the average seal density was similar to the previous figures for the Weddell Sea (< 2 km^2), but densities as high as 29.5 km^2 were found in parts of the Bellingshausen Sea. This finding strengthens conclusions from the earlier work and confirms that the crabeater seal population is very large indeed.

The percentages by species in these counts were 92-97% crabeater and 1-3% leopard seal. Applying them to calculated numbers of crabeater seals (say 8 million to 50 million) suggests that the leopard seal population size may be in the range of 127,000-800,000. However, Øritsland (1970a) reviewed other data on relative abundance and gave 83% crabeater to 7%. leopard seal. A conservative population estimate would be 250,000-500,000

The population size of the total stock of Weddell seals, Leptonychotes weddelli, is difficult to assess, but there are about 48,000-52,000 Weddell seals in the western Ross Sea (Stirling 1969). This is a reliable estimate, based on aerial census of fast ice areas representing 30% of the coastline and ship borne and helicopter observations in pack ice (330 km^2 sampled), corrections being made for time of day. A conservative total population estimate would be of the same order as that of the leopard seal.

As regards the Antarctic seals then, there is currently no cause for concern, but Stirling (1971) has documented a situation involving Weddell seals which indicates their vulnerability to intensive localized cropping. Another stock of this species which is very vulnerable is the relict population which breeds at Larsen Harbour, South Georgia, well north of the species' usual range. Only 25-30 pups were born each year and maximum numbers counted at any one time were 64, including 40 adults. Numbers may have increased with protection from sealers since 1918 (B.A.S., unpublished reports).

Sealing

In 1892/3 the sealer "Jason" sailed for the Antarctic to hunt right whales. None were found and so 6,335 sealskins were taken from the western side of the Antarctic Peninsula. In the following season three sealing vessels and a transport ship sailed, their main objective being sealing. Their catch was 26,223 sealskins (one a fur seal) and 4,100 barrels of blubber, but the expedition was regarded as a failure (Lie 1956). There appear to have been no further commercial expeditions for Antarctic seals until 1964, when the "Polarhav" carried out exploratory sealing between the South Shetland and South Orkney Islands. The total number of seals killed was 861, of which 85% were crabeater seals and 1.3% leopard seals.

2,372 seals were reported killed and captured in the Antarctic Treaty area from 1964-1969, mainly for dog food. By species the annual numbers taken were as follows: crabeater seal, average 250 (maximum 731), leopard seal 28 (108) and Weddell seal 179 (234) (Laws 1972). These numbers are insignificant in relation to the population estimates given earlier and the permissible annual catches under the Agreed Measures and the recently concluded Convention for the Conservation of Antarctic Seals.

Conservation measures

Holdgate (1970) discussed Antarctic conservation in more detail than is possible here. The Antarctic Treaty, which came into force in June 1961, applies to the area south of 60° S. It includes detailed conservation measures, termed the Agreed Measures, for the Conservation of Antarctic Fauna and Flora. They are based on scientific advice from the Scientific Committee on Antarctic Research (SCAR), through its Working Group on Biology, and were initially applied as Guidelines. The Ross seal and all fur seal species are specially protected and there are also Specially Protected Areas, where all seals receive protection. They provide protection from killing, wounding, capture and molestation of other species, but permits may be issued under certain circumstances to take seals in limited quantities. Data on numbers taken under these permits are exchanged between the participating governments.

Because States' rights on the high seas arc reserved, nations retain the right to take seals at sea. Therefore Interim Guidelines for the Voluntary Regulation of Antarctic Pelagic Sealing were proposed in 1966 by the SCAR Working Group on Biology, and extended in 1968. Their provisions gave special protection to some species and areas, provided for the recording of numbers killed and the regulation of activities on the basis of scientific knowledge. At the Fifth Consultative Meeting of the Antarctic Treaty a Draft Convention for the Regulation of Antarctic Pelagic Sealing, based on the Voluntary Guidelines was examined, but the Sixth Consultative Meeting in 1970 decided that this should be considered outside the framework of the Antarctic Treaty, since conservation of seals within the sea does not fall within the scone of the Treaty.

A conference was held in London in February 1972, at which the Treaty governments were represented and a Convention for the Conservation of Antarctic Seals was successfully concluded. This was opened for signature by the governments concerned in June 1972, but does not enter into force until subsequently ratified by at least seven of these governments. To date eight participating states have signed.

The Convention applies to the sea areas south of 60°S, though provision is made for reporting catches in the area of floating ice north of 60°S. It is complementary to the Agreed Measures under the Antarctic Treaty and replaces the Guidelines for the Voluntary Regulation of Antarctic Pelagic Sealing. The Convention recognizes the vulnerability of Antarctic seals to commercial exploitation, their importance as a resource and the need to regulate any future harvesting. The Annex to the Convention details specific conservation measures. Provision is made for special permits, exchange of information and scientific advice, future meetings of the contracting parties, review of operations, at regular intervals, and provision for amendments.

The Annex specifies Permissible Catch Limits (which are subject to review) of 175,000 crabeater seals, 12,000 leopard seals and 5,000 Weddell seals in any one year. From the foregoing review of current knowledge of the stocks of these species it is clear that these limits are extremely conservative. Ross seals, elephant seals and fur seals are completely protected and the adult stock of Weddell seals is protected during the period when it is concentrated on fast ice and therefore vulnerable to sealing. There is a closed season between 1 March and 31 August, and a series of six sealing zones, each of which is to be closed to sealing, from year to year, in rotation. Three Seal Reserves are listed in which it is forbidden to kill or capture seals.

Provision is made for the exchange of information, including, by zones and months, statistical information on all seals killed and particulars of ships involved. When an industry begins, reports of the number of seals killed or captured will be made to SCAR in the form and at intervals requested by SCAR. Biological information will also be provided to SCAR, which can also request additional information or material. SCAR has agreed to:

(a) assess the information received, to encourage exchange of scientific data, to recommend research programmes, to recommend data to be collected by sealing expeditions and to suggest amendments to the Annex;

(b) report when the harvest of any species of seal in the Convention area is having a significantly harmful effect upon the total stocks of the species or disturbing the ecological system;

(c) notify the Depositary Government, which will report to the other Contracting Parties, when SCAR estimates that the permissible catch limits for any species are likely to be reached. Each Contracting Party will then take steps to stop sealing for that species by its nationals or ships, until the Contracting Parties decide otherwise.

This Convention is probably unique in that it makes detailed provisions for conserving species on the high seas before a potential industry has developed. There is provision for the adoption of further measures, when an industry starts, such as a scheme of international inspection. Because of the low level of the Permissible Catches, the provision for reporting the catches and stopping sealing, and for further meetings to consider action, there is no doubt that it will provide protection for the Antarctic seals which has previously been lacking.

REFERENCES

1. Aguayo, A.L. 1970. Census of Pinnipedia in the South Shetland Islands. In: Antarctic Ecology, M.W. Holdgate ed., pp. 395-97. Academic Press.

2. Aguayo, A.L. and Torres, D. 1968. A first cencus of Pinnipedia in the South Shetland Islands, and other observations on marine mammals. In: Symposium on Antarctic Oceanography, Santiago, Chile. Scott Polar Research Institute, 166-8.

3. Anon. 1972. Midseason field activities, December 1971-January 1972. Antarctic J.U.S. 7, no. 2: 33.

4. Anon. 1972b, Late season field activities (February-March 1972), Antarctic J.U.S. 7, no. 3: 65.

5. Bailey, A.M. and Sorensen, J.H. 1902. Subantarctic Campbell Island. Proc. Denver Mus. Nat. Hist. no. 10.

6. Bonner, W.N. 1950. Exploitation and conservation of seals in South Georgia. Oryx 4, no. 6: 373-80.

7. Banner, W.N. 1968. The fur seal of South Goergia. Br. Antarct. Surv., Sci. Rep. no. 56: 1-81.

8. Budd, G.M. and Downes, M.C. 1969. Population increase and breeding in the Kerguelen fur seal, Arctocephalus tropicalis gazella, at Heard Island. Mammalia 33: 58-67.

9. Carrara, I.S. 1952. Lobos marinos, pinguinos y guaneras de las Costas del litoral maritimo c islas adyacentes de la Republica Argentina. Univ. Nac. de La Plata, Fac. Cienc. Veterin. Catedra de Higiene e Industrias, Publ. Espec., 189 pp.

10. Carrara, I.S. 1954. Observaciones sobre el estado actual de las poblaciones de pinnipedos de la Argentina. Eva Peron, Argentina, (Privately published) 17 pp.

11. Csordas, S.E. and Ingham, S.E. 1965. The New Zealand fur seal, Arctocephalus forsteri (Lesson) at Macquarie Island, 1949-64. C.S.I.R.O., wildl. Res. 10: 83-99.

12. Eklund, C.R, and Atwood, E.L. 1962. A population study of Antarctic seals. J. Marmal. 43, no. 2: 229-38.

13. Erickson, A.W., Hofman, R.J., Thomas, W.L. and Oehlenschlager, R.J. 1970. Seal survey in the South Shetland and South Orkney Islands. Antarctic J.U.S. 5, no. 4: 130-31.

14. Erickson, A.W., Siniff, D.B., Cline, D.R. and Hofnan, R.J. 1971. Distributional ecology of Antarctic seals. Symposium on Antarctic Ice and Water Masses, Tokyo, 19 Sept. 1970, Scientific Committee on Antarctic Research, 55-76.

15. Falla, R.A. 1953. Southern seals: population studies and conservation problems. Proc. 7th. Pacific Sci. Congr. 4: 706.

16. Falla, R.A. 1962. Exploitation of seals, whales and penguins in New Zealand, Proc. N.Z. Ecol. Soc. 9: 34-38.

17. Grimwood, I. 1968. Endangered mammals in Peru. Oryx 9, no. 6: 411-21.

18. Hamilton, J.E. 1939, A second report on the southern sea lion, Otaria byronia (de Blainville). Discovery Rep. 19: 121-64.

19. Holdgate, M.W. 196.3. Fur seals in the South Sandwich Islands. Polar Rec. 11, no 73: 474.

20. Holdgate, M.W. 1965. The fauna of the Tristan da Cunha Islands. Phil. Trans. Roy. Soc. B 249, no. 759: 361-402.

21. Holdgate, M.W. 1970. Conservation in the Antarctic. In: Antarctic Ecology, M.W. Holdgate ed., pp. 924-45. Academic Press.

22. Holdgate, M.W. Tilbrook, P.J. and Vaughan, R.W. 1968. The biology of Bouvetsøya. Br. Antarct. Surv. Bull. no. 15, 1-7.

23. Ingham, S.E. 1957. Elephant seals on the Antarctic Continent. Nature, Lond. 180: 1215-16

24. Kellogg, R. 1942. ' Tertiary, Quaternary and Recent mammals of South America and the West Indies. Proc. 8th. Amer. Sci. Congr., Washington, 1940, 3: 445-73.

25. King, J.E. 1969. The identity of the fur seals of Australia. Aust. J. Zool. 17, no. 5: 841-53.

26. Laws, R.M. 1960, The southern elephant seal (Mirounga leonina Linn.) at South Georgia. Norsk Hvalfangsttid. 49, nos. 10 & 11: 466-76, 520-42.

27. Laws, R.M, 1972. Seals and birds killed and captured in the Antarctic Treaty Area, 1964-69. Polar Rec. 16, no. 101.

28. Lewis, F. 1929. Report on an investigation into the feeding habits etc. of seals in Victorian waters. Dept. of Fisheries and Game, Victoria, Australia.

29. Lie, J. 1956. 70 years - Lars: Christensen and his times. Norsk Hvalfangsttid. 45, no. 2: 80-86.

30. O'Gorman, F.A. 1961. Fur seals breeding in the Falkland Islands Dependencies. Nature, Lond. 192: 914-16.

31. Øritsland, T. 1960. Fur seals breeding in the South Orkney Islands'. Norsk Hvalfangsttid. 49, no. 5: 220-5.

32. Øritsland, T. 1970a. Biology and population dynamics of Antarctic seals. In: Antarctic Ecology, M.W. Holdgate ed., pp. 361-66. Academic Press.

33. Øritsland, T. 1970b. Sealing and seal research in the South-west Atlantic pack ice, Sept.-Oct. 1964. In: Antarctic Ecology, M.W. Holdgate ed., pp. 367-76. Academic Press.

34. Paulian, P. 1956. Exploitation, destruction et protection des pinnipèdes. Terre et Vie 1: 1-10.

35. Pizzey, G. 1964. Splendid isolation. Animals, 3, no. 17: 450-53.

36. Rand, R.W. 1956. Notes on the Marion Island fur seal. Proc. zool. Soc. Lond. 126: 65-82.

37. Rand, R.W. 1972. The Cape fur seal, Arctocephalus pusillus. 4. Estimates of population size. Investl. Rep. Div. Sea Fish., S. Afr. 89: 1-28.

38. Repenning, CA., Peterson, R.S. and Hubbs, C.L. 1971. Contributions to the systematics of the southern fur seals, with particular reference to the Juan Fernandez and Guadelupe species. Amer. Geophys. Union, Antarct. Res. Series 18: 1-34.

39. Scheffer, V.B. 1958. Seals, sea lions and walruses. Stanford Univ. Press, 179 pp.

40. Shaughnessy, P.D. 1970. Serum protein variation in southern fur seals, Arctocephalus spp., in relation to their taxonomy. Aust. J. Zool. 18: 331-43.

41. Sivertsen, E. 1954. A survey of the eared seals (family Otariidae) with remarks on the antarctic seals collected by M/K Norvegia in 1928-1929. Det Norske Vidensk. Akad. Oslo, Sci. Res. Norweg. Antarct. Exped. 1927-1928 et seq. , instituted and financed by Consul Lars Christensen, 36: 1-76.

42. Stirling, I. 1969. Distribution and abundance of the Weddell seal in the Western Ross Sea, Antarctica. N.Z. J. Mar. Freshwat. Res. 3: 191-200.

43. Stirling, I. 1970. Observations on the behaviour of the Hew Zealand fur seal (Arctocephalus forsteri). J. Mammal. 51, no.4: 766-78.

44. Stirling, I. 1971a. Studies on the behaviour of the South Australian fur seal, Arctocephalus forsteri (Lesson). I. Annual cycle, postures and calls, and adult males during the breeding season. Aust. J. Zool. 19: 243-66.

45. Stirling, 1. 1971b. Population aspects of Weddell seal harvesting at McMurdo Sound, Antarctica. Polar Rec. 15, no. 98: 653-67.

46. Strange, I.J. 1965. Beauchêne Island. Polar Rec. 12, no. 81: 725-30.

47. Strange, I.J. 1972. Wildlife in the Falklands. Oryx 11, no. 4: 241-57.

48. Vaz-Ferreira, R. 1950. Observaciones sobre la Isla de Lobos. Revta. Fac. Hum. Cienc. Repub. Uruguay, 5: 145-76.

49. Weddell, J. 1825. A voyage towards the South Pole, perforraed in the years 1822-24. Longmans, London, 276 pp.

APPENDICES

Appendix 1

Note on Alternative Ecological Zones for Sealing in the Antarctic

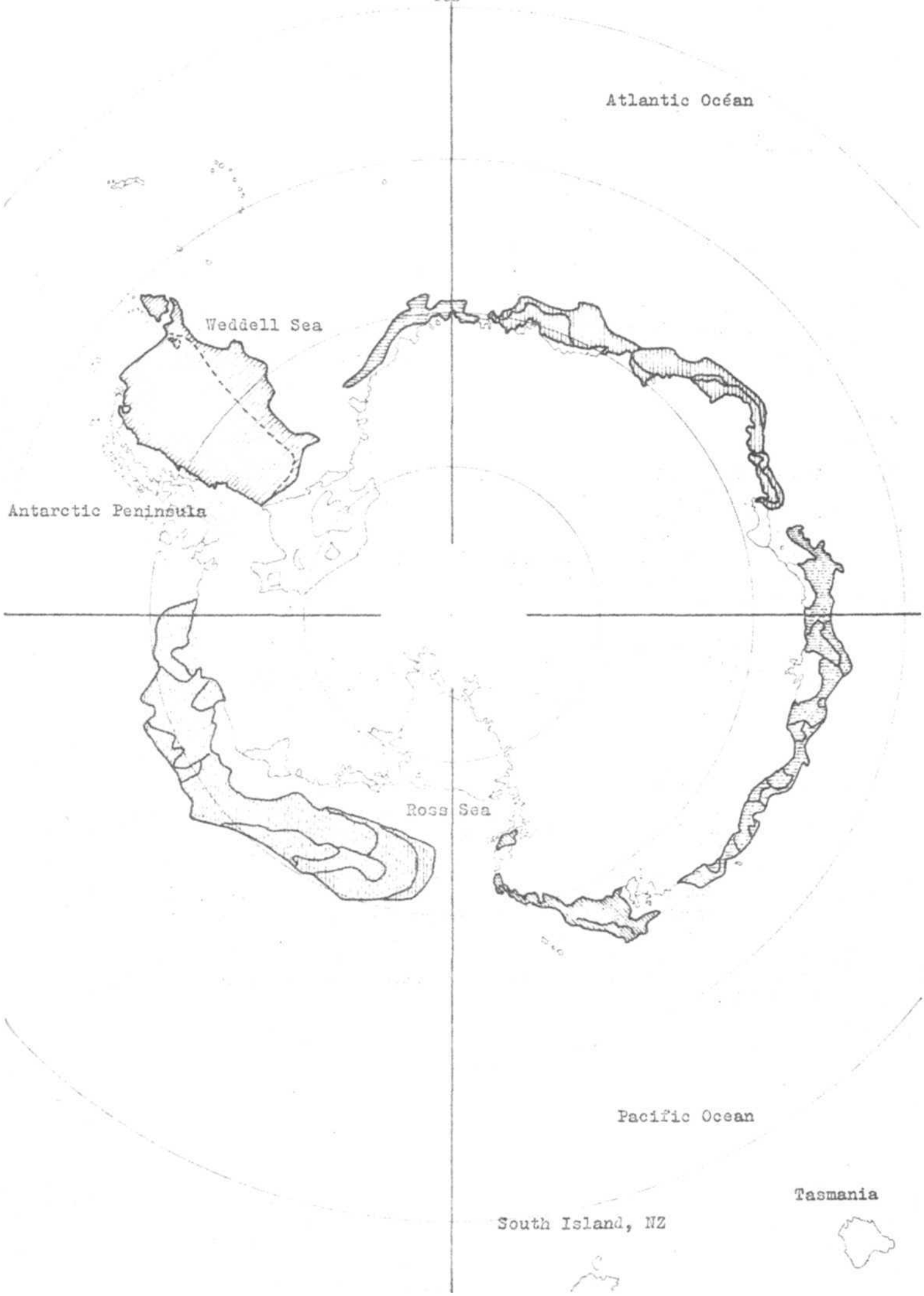
by

Albert W. Erickson

University of Idaho, Wilderness Research Center
Forestry Building, Moscow, Idaho/83843, U.S.A.

The Map which follows, depicts the normal distribution of the Antarctic ice pack at the tine of its minimal extent in March. As indicated during our discussions in Guelph, the discreteness of individual Antarctic seal stocks is very likely closely associated with the six ice pack regions identified on the map. It is on the basis of this rational that the seal specialist group meeting in Guelph recommended that the management sectors selected by SCAR for managing Antarctic seals were inappropriate and should be redrawn using the ice pack regions as the management units.

These are as follows: A major area of pack in the western Weddell Sea (45° to 60° w), a minor area along the eastern Weddell Sea (5° E to 40° W), the pack of the Amundsen and Bellingshausen Seas (80° to 175° W), a small pack area along the Oates Coast (145° to 175° E), a narrow pack area extending along the Wilkes Land Coast (75° to 140° E) and another area along the Queen Maud Land Coast (5° to 70° E).


Atlantic Océan
Weddell Sea
Antarctic Peninsula
Ross Sea
Pacific Ocean
Tasmania
South Island, NZ

Appendix 2.

Grey Seals in the Baltic

by

W. N. Bonner

Seals Research Division, Institute for Marine Environmental Research, National Environment Research Council, Fisheries Laboratory, Lowestoft, Suffolk, U.K.

INTRODUCTION AND DISTRIBUTION

The Baltic Sea lies between latitudes 54° and 66° N and covers an area of approximately 440,000 km^2. It is a shallow sea, with an average depth of a little over 50m. As precipitation and river discharge considerably exceed evaporation it has a lower surface salinity than the North Sea, with which it communicates via the Kattegat and Skagerrak, varying from about 6-8 parts per thousand in the south to about 3-G parts per thousand in the north of the Gulf of Bothnia.

Three species of seal occur today in the Baltic. These are the Ringed seal Pusa hispida botnica, the Grey seal Halichoerus grypus, and the Common, or Harbour, seal Phoca vitulina vitulina. Harp seals Pagophilus groenlandicus occurred in the Baltic in earlier times (Clark 1946), but have not been recorded since about 1000 A.D.

Grey seals and Ringed seals are about equally abundant and are more numerous than Common seals. Lockley (1954) estimated that the Baltic population of Grey seals numbered about 5,000, which figure Davies (1957) thought a considerable underestimate. Haglund (1961, quoted in Curry-Lindahl 1965) suggested 10,000; Hook (1964), more than 5,000, perhaps approaching 10,000; Smith (1966), 5,000. Hook & Johnels (1972) consider the population to have diminished markedly in the last 10 years. Host of these estimates, where they are not pure guesses, are based on the number of seals submitted each year for bounty payments. It would be of great value to make a more reliable estimate of the population, though, as several authors pointed out, there is no obvious way of doing this.

Lockley (1954) considered the main headquarters of the species in the Baltic to be the Gulf of Bothnia, with very much smaller numbers in the western Baltic and Kattegat. Hook (1964) showed its range as extending over the whole of the Gulf of Bothnia, along the south-western shore of the Gulf of Finland and south to the Gulf of Danzig, with a coastal distribution westwards as far as the border between Poland and Germany. On the west side of the Baltic the Grey seal is shown as extending as far south as Öland. Curry-Lindahl (1965) shows Grey seals as inhabiting the whole of the Gulf of Finland, though absent from the Gulf of Riga and further south. On the Swedish coast he shows the range of the Grey seal extending as far as Malmö in the extreme south of Sweden and with a further distribution up the west Swedish coast, though he recognizes that some of these seals are of British or Norwegian origin. Wolk (1969) has given an account of the distribution of the species in the southern Baltic. Grey seals occurred in Danish waters in historical times but are now extinct as breeding animals (Møhl 1970).

Hook and Johnels (1972) have drawn attention to the innumerable skerries and islets that fringe the Baltic coasts of Sweden and Finland. Called 'skärgård' in Sweden, these provide important haul-out places for seals in the virtually tideless Baltic. Skärgård are rare south of a line from the entrance of the Gulf of Riga to the south of Öland.

The approximate range of the Grey seal in the Baltic today is shown in figure 1, based on Hook (1964 and pers. comm.).

Although there is a possibility of some mingling of the North Sea Grey seals with the Baltic stock, it seems unlikely that there is any significant gene exchange as the Baltic seals breed February-March while those on the North Sea coasts breed October-December. The extinct Danish population belonged to the Baltic group, producing its pups in January and February (Bynch 1801. quoted in Møhl 1970). Curry-Lindahl (1965) states that the breeding season was December-January, but does not give the source of his information. This isolation of the Baltic seals has been described by Davies (1957). Archaeological evidence shows that Grey seals were present in the Ancylus Lake (which in Mesolithic times occupied the site of the Baltic) and Davies argues that they must have entered the Ancylus Lake during the existence of the Yoldia, or more probably the Rhabdonema Sea, an event which can be dated with some precision at 9-10,000 years ago. During the 3,000 years of the existence of the Ancylus Lake the Grey seals there were totally isolated from the rest of the stock and Davies suggests that differentiation of the breeding season took place at this time. The subsequent formation of the Littorina Sta allowed Baltic Grey seals to spread into the Kattegat, where the remains are found in abundance at Neolithic sites.

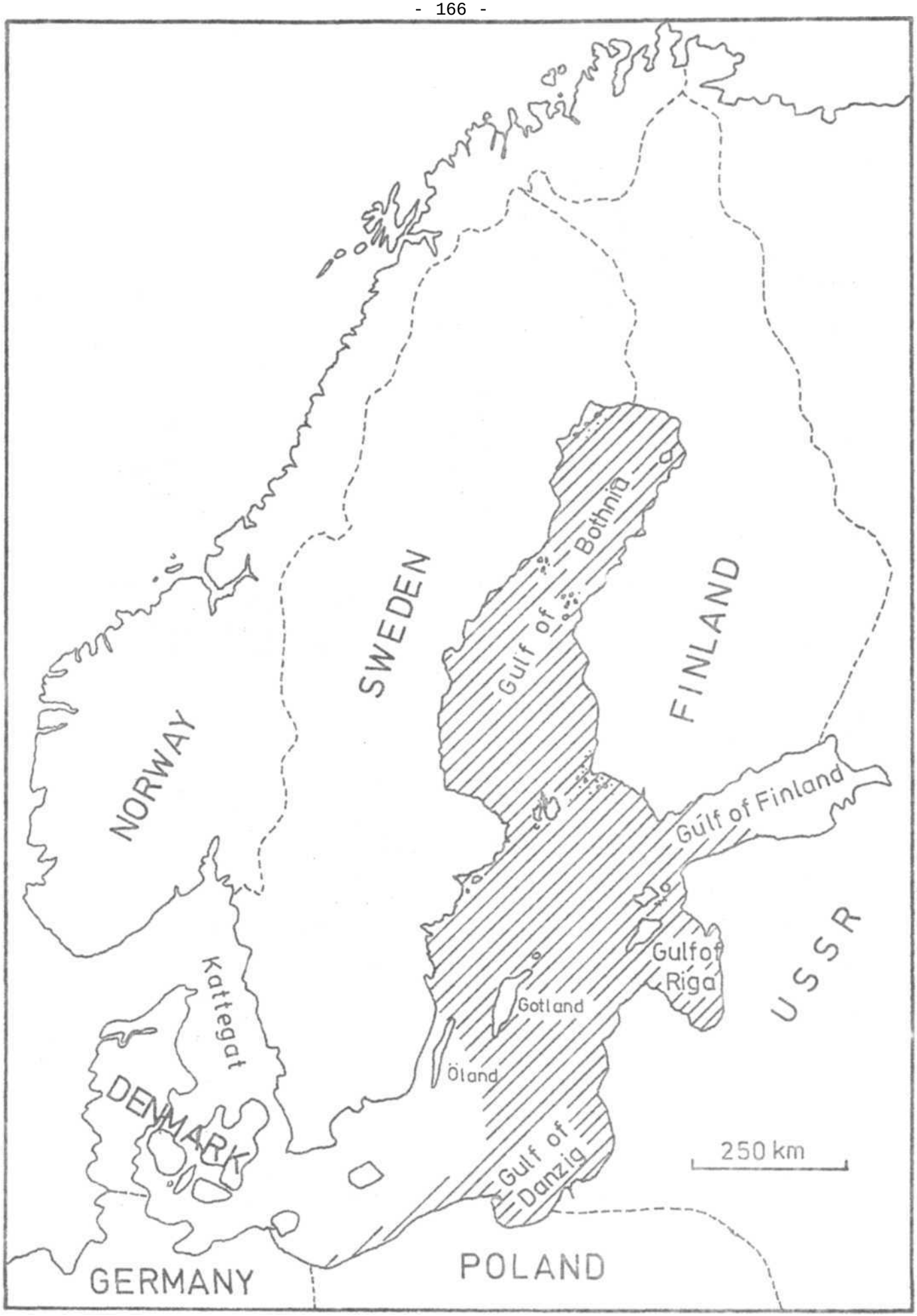


Figure 1. Approximate distribution of Grey seals in the Baltic (from Hook. 1964).

Breeding

Breeding takes place in late February-March on suitable types of ice, known locally as 'seal ice', usually comprised of ice-floes frozen together and seldom less than 25 cm, thick (Hook and Johnels, 1972). Hook (1964) reported one or two records of breeding on rocky skerries (skärgård) and suggested it was possible that the pups had been born on ice and later transferred to the rocks when the ice became unsafe.

Curry-Lindahl (1965) states that the Baltic Grey seal is plygamus, loosely-organized harems being formed on the ice around certain males. Hook and Johnels (1972) found indications that colonial breeding was giving way to scattered breeding with no firm divisions between communities, and that there was some evidence of polygamy being replaced by monogamy with isolated cow/bull pairs. These authors have drawm attention to the great influence of the climatological factors affecting the formation and drift of the sea ice on the breeding of the seals. They suggest that pupping dates may vary from year to year, to coincide with the availability of suitable breeding ice.

The pup is suckled by its mother for about 3 weeks and moults its natal white fur at between 4 and 5 weeks (Curry-Lindahl 1965). Two tagged Baltic pups recovered at about 3 and 6 months old were considerably heavier than marked pups from the Fame Islands at the same stage (Hook and Johnels, 1972) which led Bonner (quoted by these authors) to suggest that it was possible that Baltic seals, which are born at a season which allows them to begin independent feeding in improving weather conditions, might have an enhanced growth rate.

Baltic Grey seal pups appeared very healthy; of 70 pups seen in their breeding habitat none showed external signs of sepsis, pneumonia, starvation or any other disease that might be fatal. No dead pup was ever found on the ice. Storm conditions causing formation of pressure ice and break-up of the breeding platform could severely reduce the chances of survival of pups (Hook and Johnels, 1972).

Feeding and Damage to Fisheries

Søderberg (1971a) examined 175 stomachs and intestines of Baltic Grey seals of which 78 percent contained recognizable food and identified 20 fish species and a single mollusc (the common mussel, Mytilus edulis). These fish species together occurred in more than 50 percent of the stomachs examined; there were herring (Clupea harengus) in 23.5 percent, cod (Gadus callarius) in 21.0 percent and salmon (Salmo salar) in 13.0 percent. The next most abundant fish was also a salmonid, the sea

trout (Salmo trutta) which was found in 6.6 percent of the stomachs examined. As the main part of Søderberg's material came from the period May to September, he considers salmon is probably under represented in the sample.

Salmon fisheries are of considerable importance to the nations bordering the Baltic and nearly three-quarters of the annual catch is taken at sea. Søderberg (1969) reported that according to the Swedish fishermen's organizations the average seal damage to the salmon fisheries during the years 1959-61 was as follows:

Damage to fishing gear	-	13,500	Sw. crowns
Damage to catch	-	207,000	" "

And for 1964:

Damage to fishing gear	-	41,000	Sw. crowns
Damage to catch	-	402,000	" "

These figures correspond to between 1 and 2 percent of the value of the whole Swedish east coast catch. Søderbcrg made a special investigation of seal damage around Gotland, where some 75 percent of the seal damage occurs. He found that the crews of 13 boats participating in his survey reported 0.96 percent of seal damaged salmon in the catch in the 1968-69 season and 0.32 percent in the 1969-70 season. During the period of the investigation the damage to gear was very small. Søderberg concludes from these data that although seals may have been the cause of serious damage to fisheries in the past, this is not the case now.

A significant indirect cause of damage by Grey seals to fisheries in the waters around the British Isles and off Canada is the harbouring by the seals of an anisakine nematode, Terranova (Porracaecum) decipiens, the larvae of which infest cod and other gadoids, reducing their commercial value. Hook and Johnels (1972) report that nematodes collected from Baltic Grey seals stomachs were identified as Contracaecum osculatum and that Terranova was not found, despite the importance of cod in the diet of the seals. They suggested that the worm or one of its intermediate hosts might require a higher salinity (see also Søderberg 1972a).

Hunting and Bounties

Seal hunting must have been a traditional occupation around the Baltic since man first arrived there. Hook (1964), Søderberg (1970, 1971b and 1972b) and Hook and Johnels (1972) have described hunting. The use of a rifle is nowadays general, though some pups are clubbed on the ice. In the early part of this century expeditions into the ice by boats

provisioned for several weeks were made from both Sweden and Finland. New occupations in the timber industry have attracted hunters to more permanent work and today very few boats go out from Sweden and those from Finland are much reduced in number. Hunting now tends to be opportunistic and takes place mostly in the summer and autumn, though hunting on the ice is still practised by the crews of Finnish trawlers in the central Baltic.

Bounties for dead seals are paid by both Sweden and Finland, though other countries bordering the Baltic which in the past have paid bounties do so no longer (Table 1).

Table I ––Payment of Bounties

	Started	Ended
Sweden	1900	–
Finland	1909	–
Denmark	1889	1927
Germany	1890	1919
Latvia	1927	1939

(From Hook and Johnels, 1972 and Søderberg, pers. comm.)

Current rates of bounty in Sweden are 30 Sw.kr. for an adult (all species) and 15 Sw.kr. for a pup killed before 1 May (all species). In Finland the bounty since 19G9 has been 40 F.M. for Ringed seals and 20 F.M. for Grey seals (both adults and pups carry the same bounty). Swedish fishermen are asking for an increase in bouncy rates, though Finnish fishermen from Aland want seals protected in the breeding season as they regard them as a valuable quarry which should not be exterminated (Søderberg 1969). Sweden in 1968, passed a new law which restricted to professional fishermen the right to hunt seals on other people's hunting grounds. The Swedish government is currently considering providing protection for seals in some east-coast areas. Seals are already protected on the Swedish west coast (Søderberg 1972b).

Figure 2. Numbers of Grey seals submitted for bounty payments, 1930-1970. (from Hook & Johnels, 1972).

Hunting statistics are derived almost solely from bounty payments and most of the older returns do not distinguish the species of seals. Probably many seals are killed which are not recovered, or if recovered are not submitted for bounty claims. Søderberg (1970) gives data from which it can be determined that there was an average of 75 active Grey seal hunters in Sweden during the period 1966-1969 and that they accounted for an average of 3.24 Grey seals each annually, or an annual total of 240. In a later paper (1972b) Søderberg briefly refers to there being probably less than 20 men who engage in sealhunting from Sweden in the winter. Søderberg's figures for 1966-69 (which are corrected totals) do not show a declining tendency over the 4 years studied. However, Hook and Johnels (1972) present data which show a marked decline in Grey seal catches since the decade 1930-1939 (Figure 2).

Because not all catch figures have distinguished between the seal species, it is not possible to suggest the size of the hunting harvest. Still less can this be converted to a level of hunting mortality as no reliable figure exists for a stock assessment. Søderberg is careful to point out that his data show the intensity of hunting and not population fluctuations. Hook and Johnels (1972) conclude that the reduction in the level of bounty claims could correspond to a reduction in population and suggest that the population of both Grey and Ringed seals in the Baltic are at an all time low. Søderberg (1971b), on the other hand suggests that the social changes which have caused the virtual cessation of ice hunting in the winter may have favoured the Ringed seal in the Gulf of Bothnia. He records that the number of Ringed seals in the central Baltic has increased in the 1960's.

Wolk (1969) has described the reduction of the Grey seals in the southern Baltic. He attributes the virtual disappearance of the species not only to heavy hunting pressures from about 1912-1920, but also to a series of severe winters impeding repopulation.

Pollution and Seals

Jensen et al. (1969a and b) and Hook and Johnels (1972) have reported on organochlorine and mercury residues in Baltic Grey seals. The former found that in Grey seals from the Baltic Sea proper, from the Stockholm archipelago and from the Gulf of Bothnia, the concentrations of total DDT and PCB were about 10 times greater than those found in seals from Great Britain, Canada or the Netherlands'. Hook and Johnels (1972) reported 7 Grey seals from the Baltic with muscle concentrations of 165 mg/kg total DDT and 44 mg/kg PCB (all measurements are given on a wet-weight basis). These may be compared with concentrations of 0.34-0.19 ppm total DDT and 2,02±1.61 ppm PCB from a sample of 4 Grey and 5 Common seals (no interspecific difference) from East Anglia (Heppleston 1972).

Two Grey seals from Gotland had 1.2 and 0.5 mg/kg mercury in their muscles and 5 from the Swedish Baltic coast ranged from 0.3-3.3 mg/kg, mean 1.2 mg/kg, mercury. No comparable values are available for muscle-mercury concentrations elsewhere in Europe but Bligh and Armstrong (1971) report an almost identical concentration (1.13 ppm) in muscle from 11 Grey seals from Canada.

It would appear that while organochlorine contamination of Baltic seals is very high indeed, the mercury values are of the same order as those encountered elsewhere, but it should be emphasized that the data are very scanty. Neither Jensen et al. nor Hook and Johnels report any evidence of pathological conditions in seals that might be associated with pollution but the latter warn that there may be direct or indirect effects from pollutants on seals in the Baltic, and clearly regard the levels found as a potential threat to the seals.

Conclusions

1. The size of stock of Baltic Grey seals has been estimated at between 5 and 10,000, but no reliable objective estimate exists.

2. There is little evidence of significant damage to fisheries by Baltic Grey seals.

3. Bounty claims from Sweden and Finland show a marked decline since 1930. It is not clear how closely these correlate with the catch of seals as there has been some lessening of hunting pressure in this period. However, it is the opinion of some authors that the stock is at a low level and declining.

4. Organochlorines and mercury have been found in Baltic Grey seals. The concentrations of the former are very high. No associated pathological effects have been recorded.

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REFERENCES

1. Bligh, E.G. and Armstrong, F.A.J. 1971. Marine mercury pollution in Canada. ICES C M. 1971 E: 34 13 pp. (mimeo).

2. Bynch, L. 1801. Om saelhunde-fangsten paa Anholt. Iris og Hebe, Maanedskrift april, 1-23. København. (quoted in Møhl 1970).

3. Clark, J.G.D. 1946. Seal-hunting in the stone age of north-western Europe: a study in economic prehistory. Proc. Prehist. Soc. Lond. 12: 12-48.

4. Curry-Lindahl, K. 1965. The plight of the Grey seal in the Baltic. Oryx. 8: 38-44.

5. Curry-Lindahl, K. 1970. Breeding biology of the Baltic Grey seal (Halichoerus grypus). Zool. Garten. 38(1/2): 16-29.

6. Davies, J.L. 1957. The geography of the Grey seal. J. Mammal. 38, 3: 297-310.

7. Haglund, B. 1961. Säl. Stockholm, 200 pp.

8. Heppleston, P.B. 1972. Organochlorines in British Grey seals. ICES C.M. 1972 N: 7 4 pp. (mimeo).

9. Hook, O. 1964. The distribution and breeding of the Grey seal in the Baltic. Proc. Seals Symposium, Cambridge, 9 September, 1964: 75-84.

10. Hook, O. and Johnels, A.G. 1972. The breeding and distribution of the grey seal (Halichoerus grypus Fab.) in the Baltic Sea, with observations on other seals of the area. Proc. R. Soc. Lond. B. 182: 37-58.

11. Jensen, S. et. al. 1969a. DDT and PCB i marina miljöer. Fauna och flora 4, Argang 64: 142-148.

12. Jensen, S. 1969b. DDT and PCB in marine animals from Swedish waters. Mature, Lond. 224: 247-250.

13. Lockley, R.M. 1954. British Mammals. The Atlantic Grey seal. Oryx 2: 384-387.

14. Møhl, U. 1970. Fangstdyrene ved de danske strand - den zoologiske baggrund for harpunernc. KUML. Aarbog for Jysk Arkzoologisk Selskab, 397-329. København.

15. Smith, E.A. 1966. A review of the world's Grey seal population. J. Zool. Lond. 150: 463-489.

16. Søderberg, S. 1969. Investigations on seals in the Baltic. ICES C.M. 1969 No. 3. 3 pp + 6 appendices (mimeo).

17. Søderberg, S. 1970. Säl och jaktstatistik. Fauna och flora 4, Argang 65: 138-144.

18. Søderberg, S. 1971a. Commercial damage and feeding habits of seals in the Baltic: A preliminary report. ICES C.M. 1971 No. 3 5 pp. + 1 fig. (mimeo).

19. Søderberg, S. 1971b. Sealhunting in Sweden and Finland during the 20th Century. ICES CM. 1971 No. 2 4 pp. + 2 figs. + 2 tables (mimeo).

20. Søderberg, S. 1972a. Sälens födoval och skadegörelse på la::fisket i Ostersjön. Undusök. utförd på uppdrag av Svenska Ostkust-riskarenas Centralförbund. Stockholm. 60 pp. (mimeo).

21. Søderberg, S. 1972b. Gears and methods used for sealhunting in Sweden. ICES C.M. 1972 No. 8, (mimeo).

22. Wolk, K. 1969. Factors affecting seal population levels in the southern Baltic Sea. Säugetierk. Mitt. 17(2): 155-158.

Appendix 3

Press Release - 19 August 1972

Monk Seals Accorded Priority in Species Restoration Programmes for Threatened Seals of the World

Monk seals were accorded priority in species restoration programmes discussed during an international meeting of seal biologists, which took place at the University of Guelph, Ontario, on August 18-19, to consider the current status of threatened seals and long term measures for improved conservation of this important world resource. The meeting was organised by the Survival Service Commission of the International Union for Conservation of Nature and Natural Resources, which has its headquarters in Switzerland. The World Wildlife Fund provided financial support and the meeting was chaired by Prof. Keith Ronald, University of Guelph.

There are three species of monk seals, off the Hawaiian islands and in the Mediterranean and the Caribbean. The Hawaiian species is estimated to number 700-1,000; in spite of total protection from hunting, its populations appear to be declining, probably as a result of human disturbance to nursing females and their young. The Mediterranean species is estimated roughly at 500-1,000, it receives little protection and is commonly persecuted by local fishermen. The Caribbean monk seal may already be extinct.

Continued protection, closer surveillance and more detailed study of populations was also urged for the fur seals that are currently listed in the IUCN's Red Data Book of world threatened species, namely the Guadalupe, Juan Fernández and Galápagos fur seals. The first two species were rediscovered fairly recently after being presumed extinct for many years; although their populations are recovering, they are still numbered only in the low hundreds.

The governments in Korea are to be requested to initiate investigations into whether or not the Japanese sea lion may still exist along their eastern coasts, although prospects of rediscovering this animal appear remote. On the brighter side, IUCN will be recommended to delete the Ross seal of the Antarctic from its Red Data Book, as recent investigations indicate that its status is better than was originally believed and its protection is adequate.

The governments of Chile (Juan Fernandez fur seal) , Mexico (Guadalupe fur seal), Morway (Atlantic walrus in the Spitsbergen region), and U.S.S.R. (White Sea herds of the harp seal) were commended for their continuing work in the restoration of these species.

The biologists considered that harbour and grey seals, though by no means endangered species throughout their world range, will become increasingly rare along the North Sea and Baltic coasts unless pollution and concomitant factors, such as water storage in estuaries, are curbed.

Attention was drawn to the dangers of increasing tourist use of islands and coasts that form the whelping grounds of seals. The biologists proposed to offer an advisory service, through the IUCN, to nations whose tourist industries could pose a threat to seal colonies.

Whilst recognizing that some seal populations may need to be maintained at levels below their maximum size in the interests of the fishing industry, the need was stressed for careful monitoring of these populations if the risk of local extirpation was to be avoided.

A resolution was addressed to the major fishing nations and international fishing agencies urging them to allow margins in fishing quotas sufficient for the maintenance of reasonable population levels of the predator 3cal species, whether or not these species are currently exploited by man. Particular concern was expressed over the possible effects of high level catches of Alaska pollack and other fish in the Bering Sea on fur seals; of rapidly growing fisheries for capelin and polar cod in the North Atlantic on harp seals; and of the intensive fisheries around sub Antarctic islands on elephant seals.

The scientists propose to meet again in two or three years to review progress and re-assess priorities for attention in this field.