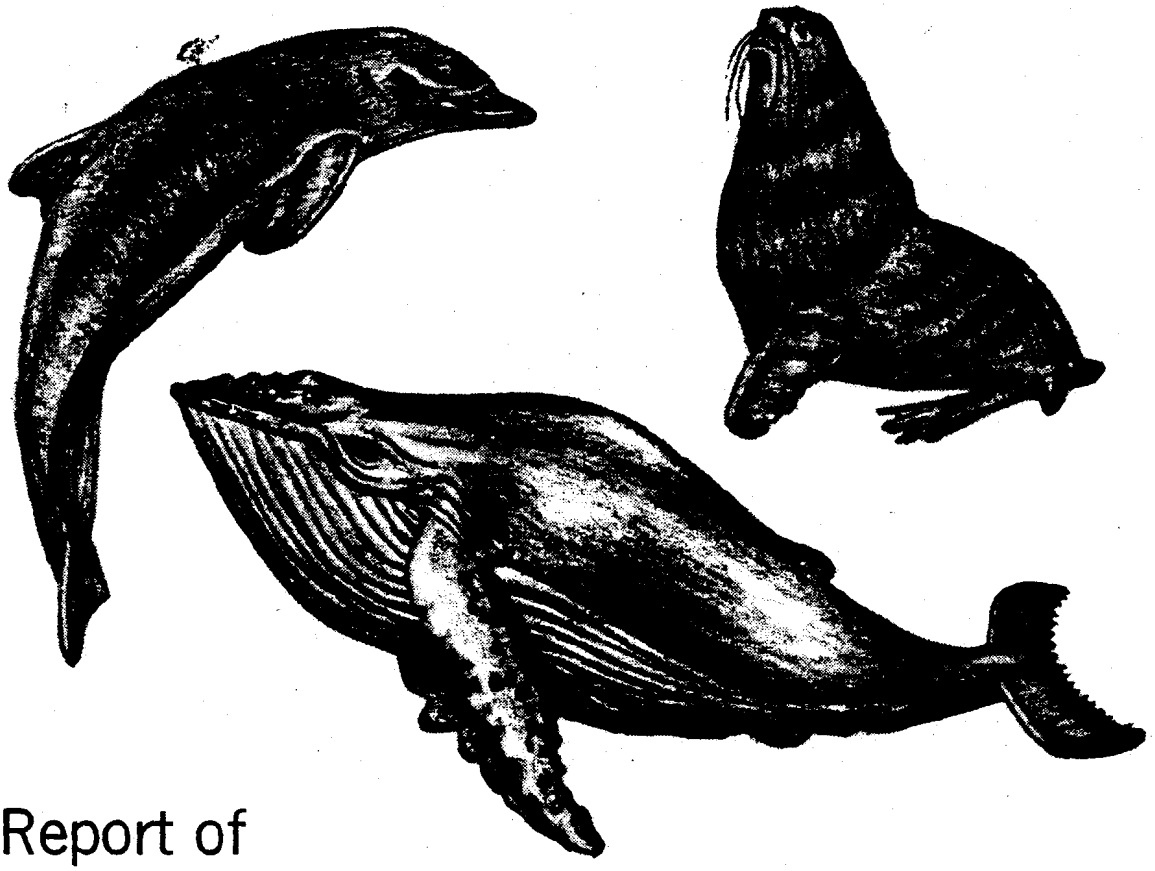
# ADMINISTRATION OF THE MARINE MAMMAL PROTECTION ACT OF 1972

## DECEMBER 21, 1972, TO JUNE 21, 1973



Report of
The Secretary of Commerce

Prepared by
The National Marine Fisheries Service
National Oceanic and Atmospheric Administration
Washington, D.C. 20235 July 1973

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## DEPARTMENT OF COMMERCE

### National Oceanic and Atmospheric Administration

### MARINE MAMMAL PROTECTION ACT

### Report of the Secretary of Commerce

Section 103(f) of the Marine Mammal Protection Act of 1972 (16 U.S.C. 1361, 86 Stat. 1027 (1972)) states that "Within six months after the effective date of this Act (December 21, 1972) and every twelve months thereafter, the Secretary shall report to the public through publication in the FEDERAL REGISTER and to the Congress on the current status of all marine mammal species and population stocks subject to the provisions of this Act. His report shall describe those actions taken and those measures believed necessary, including where appropriate, the issuance of permits pursuant to this title to assure the well-being of such marine mammals."

Section 3(12)(A) of the Act limits the responsibility of the Department of Commerce to those mammals which are members of the order Cetacea (whales and porpoises) and members, other than walruses, of the order Pinnipedia (seals and sea lions). Accordingly, there is published herewith the report of the Secretary of Commerce for the period December 21, 1972, to June 21, 1973, on the administration of the Act with regard to those mammals.

Issued at Washington, D.C., and dated July 27, 1973.

FREDERICK B. DENT,
*Secretary of Commerce.*

ADMINISTRATION OF THE MARINE MAMMAL PROTECTION ACT OF 1972, DECEMBER 21, 1972, TO JUNE 21, 1973

REPORT OF THE SECRETARY OF COMMERCE

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Prepared by The National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Washington, D.C. 20235, July, 1973.

*Introduction.* This report is pursuant to requirements of section 103(f) of the Marine Mammal Protection Act of 1972 (Public Law 92-522). It covers the six-month period following the effective date of the Act, December 21, 1972, and is prepared in three parts: The first deals with actions taken to assure the well-being of marine mammals; the second sets out the current status of the stocks of marine mammals for which the Department of Commerce has responsibility; and the third part contains four appendices.

The Act, with certain exceptions, places an immediate moratorium on the taking and importation of all marine mammals and marine mammal products. It makes the Secretary of Commerce responsible for protecting whales, porpoises, seals, and sea lions, and the Secretary of the Interior responsible for all other marine mammals, specifically sea otters, walruses, polar bears, and manatees. On November 30, 1972, the Secretary of Commerce delegated authority for the functions prescribed by the Act to the Administrator of the National Oceanic and Atmospheric Administration (NOAA). On February 9, 1973, the Administrator delegated this authority to the Director, National Marine Fisheries Service (NMFS).

Three major actions were taken to facilitate implementation of the Act. The first was to create a working group comprised of representatives of the Departments of Commerce and the Interior to develop, so far as possible, joint regulations to implement the Act, and to consider, among other things, joint use of enforcement personnel and other ways of cooperating in the interest of economy and efficiency.

The second action was the publication of separate interim regulations by each Department on December 21, 1972, the effective date of the Act.

The third action taken to facilitate immediate implementation of the Act was to reprogram $700,000 and 15 personnel positions from other NMFS/NOAA programs during the balance of fiscal year 1973. Accordingly, $300,000 and four positions were allocated to a porpoise-tuna research program, and $400,000 and 11 positions were allocated to administration and enforcement in NMFS headquarters and in the five regional offices. Prior to passage of the Act, NOAA had already recognized a need for studies on the problem of porpoise mortalities in the Eastern Tropical Pacific Ocean tuna purse seine fishery and had made $250,000 and personnel available to commence work during late summer, 1972.

Significant occurrences between December 21, 1972, and June 21, 1973, are summarized below.

Fifty applications for undue economic hardship exemptions were received and acted upon. Of these, 13 were approved, three denied, four withdrawn, and 30 are pending.

Meetings were held with States, the fishing industry, and environmental and conservation groups to explain the Act, its regulations, and progress on implementation.

Fourteen formal public hearings on applications for undue economic hardship exemptions were held in nine areas, namely, Washington, D.C.; Anchorage and Kodiak, Alaska; Terminal Island and San Diego, California; Mystic, Connecticut; Galveston, Texas; Pensacola, Florida; and Seattle, Washington. Four hearings involved scientific research; seven involved public display; and three involved taking of marine mammals for other purposes. In addition, five other applicants were heard informally at related hearings.

A hearing was held in Washington, D.C., to obtain public reaction regarding disposition of beached, stranded, injured, sick, forfeited, confiscated, and dead animals.

Public hearings are scheduled to receive comments concerning measures to reduce to the extent practicable the incidental taking of marine mammals, particularly porpoises, in commercial fishing operations.

New measures for conserving all whales were proposed to the International Whaling Commission, and additional management considerations for harp and hooded seals were recommended to the International Commission for the Northwest Atlantic Fisheries.

Studies of large whales to include development of an independent United States capability for analysis of world catch statistics and stock assessments are in the planning stage.

Tuna-porpoise studies involving fishing gear dynamics and development, life histories and surveys, and stock assessment were initiated on the Eastern Tropical Pacific Ocean tuna seine fishery.

An expanded research program on the northern fur seal was initiated, including the setting aside of St. George Island, Alaska, as a research area in order to develop additional information on the factors that govern population size.

A high-priority study was begun to acquire information on population size and distribution of the six species of pinnipeds that occur on major hauling or breeding grounds along the west coast.

Discussions were initiated with the State Department regarding its responsibility under the Act for seeking negotiation with other nations on bilateral and multilateral agreements on marine mammals.

Cooperative arrangements for enforcing provisions of the Act were discussed with the Departments of Agriculture, the Interior, Treasury, and Transportation.

Contracts were executed with ten coastal States which provide funds for enforcement of the moratorium on taking marine mammals, including investigations and appearing as witnesses in subsequent judicial actions.

Although much progress has been made in implementing the Marine Mammal Act nationally, the NMFS is aware that prompt consideration must be given to future measures necessary for conserving the world's marine mammal resources. In this regard, one of the most important needs to ensure their well-being is a much greater emphasis on collection of information on marine mammal stocks and the ecosystem in which they live. Furthermore, sufficient international protection must be sought for those species or stocks while adequate knowledge is being obtained.

*Marine Mammal Commission.* On May 14, 1973, President Nixon announced the formation of the three-man Marine Mammal Commission provided for under the Act. The Commissioners appointed are:

Victor B. Scheffer, of Bellevue, Washington, a marine mammal biologist retired from the United States Fish and Wildlife Service. He will serve as Chairman.

A. Starker Leopold, Professor of Zoology, University of California at Berkeley.

John Ryther, Chairman, Department of Biology, Woods Hole Oceanographic Institution, Falmouth, Massachusetts.

While the Commission has not yet fully assumed its role, the Commissioners have been considering their responsibilities and discussing with NMFS and others the most pressing problems facing the Commission in the next year.

When the Commission and the Committee of Scientific Advisors are functioning, the Secretary of Commerce through the Director, National Marine Fisheries Service, will consult with them regarding applications to take marine mammals for scientific research or public display as required by the Act.

The foregoing summarizes highlights of actions taken by the NMFS between December 21, 1972, and June 21, 1973, to carry out provisions of the Marine Mammal Protection Act of 1972. Details of specific activities related to implementation of the Act are discussed in the report that follows.

## PART I. ACTIONS TAKEN TO ASSURE THE WELL-BEING OF MARINE MAMMALS

*Interim regulations.* On December 2, 1972, a notice of proposed rule making was published by NMFS/NOAA in the FEDERAL REGISTER (37 FR 25731) to implement the Marine Mammal Protection Act of 1972. It was the intention of NMFS/NOAA to have interim regulations in force on December 21, 1972, the effective date of the Act. The notice proposed interim regulations relating to the taking and importing of marine mammals and marine mammal products and requested comments by December 15, 1972. Interim regulations (Appendix A) were published in the FEDERAL REGISTER on December 21, 1972 (37 FR 28177) which (1) reflected comments received on or before December 15, 1972; (2) corrected certain technical errors and omissions; and (3) set forth, in full, Subpart D—Penalties and Procedures for Assessment, previously reserved. The Department of the Interior published its interim regulations in the FEDERAL REGISTER on December 21, 1972 (37 FR 28173).

The NMFS and the Bureau of Sport Fisheries and Wildlife (Department of the Interior) are working on final regulations. These will be published in the FEDERAL REGISTER as proposed regulation revisions. Following receipt of comments from the public and others, final regulations are scheduled to become effective by early fall, 1973.

*Economic hardship exemptions.* Section 101(c) of the Act and § 216.13 of the interim regulations permits the Secretary of Commerce to grant relief to those persons who can demonstrate undue economic hardship by exempting them from the moratorium until midnight October 20, 1973. The criteria for evaluating undue economic hardship, as prescribed in § 216.13(b) of the interim regulations, are: "(1) the effect of granting the exemption on the species or population stock in question and the marine ecosystem; (2) the degree of economic hardship to be anticipated should the exemption not be granted; (3) the economic and legal alternatives available to the applicant; (4) the likelihood of the anticipated economic hardship; and (5) such of the criteria relative to the issuance of scientific research permits and/or public display permits as may be applicable to the application."

Application of section 101(c) has been conservative. To date, only 13 of the 50 applications for an economic hardship permit have been approved and none of these approvals involves the killing of any marine mammals for commercial purposes.

Although the Act declares a moratorium on the taking of marine mammals, the Act clearly intended that research on marine mammals be continued and that public displays (which maintain the health and well being of the species involved) be allowed. Such permits, however, may be granted only after a review by the Marine Mammal Commission and its Committee of Scientific Advisors. The Commission was appointed on May 14, 1973, and its Committee of Scientific Advisors was not appointed during the period covered in this report. It was therefore not possible to issue scientific or display permits, except through the application of the economic hardship exemption.

Consequently, NMFS has accepted applications for undue economic hardship exemptions from persons wishing to take mammals for scientific research or display. These exemptions were considered under the criteria set forth in §§ 216.12 and 216.13 of the interim regulations regarding undue economic hardship exemptions. While undue economic hardship must be shown in all cases to qualify for an exemption, a lesser degree of economic hardship is considered "undue" in cases involving sound scientific research which does not involve the killing of any marine mammals, than for those cases involving the kill of animals for commerical purposes.

Following a public hearing concerning an application for economic hardship exemption to allow the taking of a large number of sea lions for sale to zoos, aquaria, and others by the applicant, it was decided that applications for economic hardship exemptions involving the taking of marine mammals for the purposes of scientific research or public display would not be granted to persons or organizations engaged solely in the taking and not in the ultimate retention of marine mammals. Such exemptions would be issued only to persons or institutions such as zoos, oceanaria, or scientists ultimately responsible for care of the animals away from their natural habitat. This decision was based on the need for proper care and maintenance of marine mammals taken, and the need for control of all facilities where mammals would be maintained during taking, transport, and display or research. This policy was published April 23, 1973, in the FEDERAL REGISTER (Appendix B).

When an economic hardship exemption is granted, especially for display purposes, the exemption holder is subject to stringent requirements for the care and welfare of the animals. Requirements for care and maintenance, specified in letters of exemption issued for public display of mammals, are set forth in Appendix C.

*Additional policy determinations.* Additional policy determinations to assure the well-being of marine mammals have been made. As an example, it was learned that some tuna fishermen were experimenting with a method for catching fish which involved the attachment of a radio transmitting device to a porpoise. Upon its release, the mammal was then tracked to locate schools of tuna usually associated with porpoises. The effect of the new practice on porpoise stocks is unknown, but a decision was made that it should not be allowed to continue until more is known. Accordingly, a revision was made in § 216.2(e) of the interim regulations making this activity an illegal taking (Appendix B).

The NMFS is analyzing data gathered as a result of a public hearing in Washington, D.C., on May 22, 1973, and soon will issue a policy statement covering situations in which marine mammals are abandoned, stranded, or beached, with primary concern directed to the welfare of the animals. Further discussion of this matter is included in the section on State-Federal cooperation.

The NMFS received applications for economic hardship exemptions from 11 hunters in Alaska to harvest 11,100 seals and 13,200 sea lions for commercial sale of hides, meat, and fat. On April 11, 1973, a public hearing in Kodiak, Alaska, considered formally the requests from two of the applicants (and informally five others), during which a representative of the Alaska Department of Fish and Game estimated that NMFS could conceivably expect to receive as many as 15 additional applications for exemption from Alaskans who have commercially hunted seals and sea lions in the past. Consequently, it was estimated that requests involving approximately 51,000 animals could be forthcoming.

In view of the possible impact of the projected amount of hunting on the marine ecosystem, NMFS determined that an Environmental Impact Statement would be required, as prescribed in section 102(2)(C) of the National Environmental Policy Act of 1969, prior to action on any of the 11 exemptions requested for the taking of seals and sea lions in Alaska (Appendix B). The draft Environmental Impact Statement is being prepared by NMFS in cooperation with the State of Alaska.

*Status of exemption applications.* Although the Act does not require public hearings as a condition to the granting of exemptions under conditions of undue economic hardship, it provides for such hearings, at the discretion of the Secretary, on scientific research and display permits issued after review by the Marine Mammal Commission and the Committee of Scientific Advisors on Marine Mammals. It was obvious that there was deep public concern regarding marine mammals. Therefore, NMFS considered public hearings an important

element of policy formulation. Provision for discretionary hearings regarding economic hardship exemption requests was included in the interim regulations.

In addition to public hearings, meetings were held periodically with many interested national conservation groups, including a consortium of environmentalists and others, to explain the problems involved in implementation of the Act as well as proposed solutions.

Public hearings were held on 14 of the 50 applications received for undue economic hardship exemptions. This included four hearings on applications dealing with scientific research; seven for display; two in Alaska for commercial taking and sale of skins, meat, and fat; and one hearing on an application involving capture of live animals for sale. Of the 50 applications received (18 scientific research, 16 display, 16 other), 13 were approved (9 research, 4 display), 3 were denied (other), 4 were withdrawn (2 research, 1 display, 1 other), and 30 are pending (7 research, 11 display, 12 other). It is expected that additional hearings will be held on several of the pending applications. Table 1 summarizes actions taken on undue economic hardship applications.

Table 1. Summary of Actions Taken on Undue Economic Hardship Applications December 21, 1972, to June 21, 1973

| Scientific Research | Approved | Denied | Withdrawn | Pending | Hearing |
|---|---|---|---|---|---|
| University of California | X | | | | No |
| University of Rhode Island | X | | | | No |
| Paul A. Paulbitski, San Francisco, California | X | | | | No |
| Smithsonian Institution | X | | | | No |
| University of Texas | | | | X | Yes |
| University of California | X | | | | No |
| California State University | X | | | | No |
| University of Washington | | | | X | No |
| Scripps Institution of Oceanography | X | | | | Yes |
| Naval Biomedical Research Laboratory | X | | | | No |
| Maine Department of Sea and Shore Fisheries | X | | | | No |
| Oregon State University | | | | X | Yes |
| Alaska Department of Fish and Game | | | | X | Yes |
| University of Alaska | | | X | | No |
| University of Alaska | | | X | | No |
| State University of New York | | | | X | No |
| Naval Arctic Research Laboratory | | | | X | No |
| University of Missouri and the University of Southern California | | | | X | No |
| Total Research — 18 applications | 9 | 0 | 2 | 7 | 4 |

4 hearings held; others may be held.

Table 1 (continued). Summary of Actions Taken on Undue Economic Hardship Applications December 21, 1972, to June 21, 1973

| Display | Approved | Denied | Withdrawn | Pending | Hearing |
|---|---|---|---|---|---|
| Sea World, Inc., San Diego, California | X | | | | No |
| Seattle Marine Aquarium, Seattle, Washington | | | X | | Yes |
| Gulfarium, Fort Walton Beach, Florida | | | | X | Yes |
| Sea-Arama Marineworld, Galveston, Texas | X | | | | Yes |
| Black Hills Marineland, Inc., South Dakota | | | | X | Yes |
| San Diego Zoological Gardens, San Diego, California | | | | X | No |
| Mystic Aquarium, Mystic, Connecticut | X | | | | Yes |
| Henry Doorly Zoo, Omaha, Nebraska | X | | | | No |
| Japanese Village, Buena Park, California | | | | X | Yes |
| Detroit Zoological Park, Detroit, Michigan | | | | X | No |
| Children's Zoo, Fort Wayne, Indiana | | | | X | No |
| Quinlan Marine Attractions, North Carolina | | | | X | Yes |
| The Aquarium, Depoe Bay, Oregon | | | | X | No |
| Bob's Seafood, Morro Bay, California | | | | X | No |
| Gianfuretto Salvadori, Dover, Pennsylvania | | | | X | No |
| Undersea Gardens, Marina del Ray, California | | | | X | No |
| Total Display — 16 applications | 4 | 0 | 1 | 11 | 7 |

7 hearings held; others may be held.

Table 1.(continued). Summary of Actions Taken on Undue Economic Hardship Applications December 21, 1972, to June 21, 1973

| Other (dressed skins; sale of skins, meat and fat; live capture for sale; subsistence | Approved | Denied | Withdrawn | Pending | Hearing |
|---|---|---|---|---|---|
| Bergner International, New York City | | | X | | Cancelled |
| F. J. Woelkers, Seward, Alaska | | | | X | Yes 1/ |
| Frontier Tanning Company, Anchorage, Alaska | | X | | | No 2/ |
| Ray C. Randall, Port Williams, Alaska | | | | X | Yes 1/ |
| William Mistupaki, Kodiak, Alaska | | | | X | No 1/ 2/ |
| Andrew Nault, Kodiak, Alaska | | | | X | No 1/ 2/ |
| Jerry Richmond, Kodiak, Alaska | | | | X | No 1/ 2/ |
| Kenneth Sellers, Anchorage, Alaska | | | | X | No 1/ |
| Joe Mankins, Port Heiden, Alaska | | | | X | No 1/ |
| Jeff Graham, Port Heiden, Alaska | | | | X | No 1/ |
| Fred A. Kings, Anchorage, Alaska | | | | X | No 1/ 2/ |
| Keith C. Koonts, St. Lawrence Island, Alaska | | | | X | No |
| Roscoe Harrell, Whittier, Alaska | | | | X | No 1/ |
| David Andrews, Kodiak, Alaska | | | | X | No 1/ |

Table 1 (continued). Summary of Actions Taken on Undue Economic Hardship Applications December 21, 1972, to June 21, 1973

| Other | Approved | Denied | Withdrawn | Pending | Hearing |
|---|---|---|---|---|---|
| Sea Lions International, Santa Barbara, California | | X | | | Yes |
| Global Sea Lions, Inc., Santa Barbara, California | | X | | | No |
| Total Other - 16 applications 3 hearings held; others may be held. | 0 | 3 | 1 | 12 | 3 |
| GRAND TOTAL 50 applications 14 hearings held; others may be held. | 13 | 3 | 4 | 30 | 14 |

1/ Environmental Impact Statement will be prepared prior to final action.
2/ Heard informally in course of Woelkers-Randall hearing.

Notices of all policy determinations on economic hardship exemptions (Appendix B) and final actions taken thereon were published in the FEDERAL REGISTER. Records of the 14 hearings on economic hardship exemption applications are available for inspection at NMFS headquarters in Washington, D.C.

Hearings are usually held in the geographic area in which the applicant does business, or the location of prominent public interest, and a transcript of the hearing is made for the official record. Publication in the FEDERAL REGISTER of notices of proposed hearings affords individuals and organizations an opportunity to express their views by appearing at the hearings or by submitting written comments for inclusion in the official record. In all instances, notices of receipt of applications were published in the FEDERAL REGISTER and public comments were solicited.

Table 2 shows the number, by species, of the 318 marine mammals authorized to be taken for public display and scientific research, as of June 21, 1973.

Table 2. Marine Mammals Authorized to Be Taken for Public Display and Scientific Research Under Economic Hardship Exemption, December 21, 1972, to June 21, 1973

| Marine Mammals Common Name | Scientific Name | Public Display | Scientific Research |
|---|---|---|---|
| Beaked whale | Mesoplodon sp. | | 1 (skeleton) |
| Beluga whale | Delphinapterus leucas | 4 | |
| Gray whale | Eschrichtius robustus | | 3 |
| Killer whale | Orcinus orca | 4 | |
| Pilot whale | Globicephala melaena | 11 | |
| Bottle-nose dolphin | Tursiops truncatus | 24 | |
| White-sided dolphin | Lagenorhynchus obliquidens | 6 | 6 |
| Bearded seal | Erignathus barbatus | 6 | 10 (10)* |
| Gray seal | Halichoerus grypus | | 3 |
| Harbor seal | Phoca vitulina richardii | 21 | 70 |
| Northern elephant seal | Mirounga angustirostris | 5 | |
| Ribbon seal | Histriophoca fasciata | | 5 (5)* |
| Ringed seal | Pusa hispida | | 10 (10)* |
| Spotted seal | Phoca vitulina largha | | 20 (20)* |
| California sea lion | Zalophus californianus | 18 | 77 (75)** |
| Steller sea-lion | Eumetopias jubatus | 4 | 10 (10)* |
| TOTAL | | 103 | 215 |

(*) Animals to be sacrificed in the course of scientific research.

(**) Includes 75 aborted, stillborn or dead fetuses collected on San Miguel Island, California.

*Federal enforcement.* There have been a variety of enforcement cases handled by NMFS enforcement agents. The most notable occurred about three weeks after the Act became effective. On January 11-12, 1973, NMFS enforcement agents, responding to requests for action from the State of Mississippi, the Biloxi Humane Society, and other concerned citizens, seized one dead and five live Atlantic bottlenose dolphins that had been left unattended at the facilities of a marine mammal supplier in Biloxi, Mississippi. The dolphins were subsequently transported via truck to Fort Walton Beach, Florida, where they have since been cared for and held. Action by the Secretary against the owners of the dolphins resulted in forfeiture of the five mammals to the Federal Government. This

incident demonstrated the need for NMFS to develop a policy which would provide forfeited, stranded, or beached mammals with the best opportunity for survival. A decision on the disposition of the five dolphins will be made in the near future.

Other cases have involved investigations of reports concerning the sale of whale meat, the sale of ambergris, the alleged shooting of a whale, the taking of porpoises, and inquiries concerning the importation of marine mammal products. NMFS enforcement agents have accompanied and monitored authorized captures of marine mammals by scientific researchers and oceanaria authorized pursuant to Letters of Exemption. Inspections of applicants' facilities have also been conducted to determine adequacy for the care and maintenance of marine mammals.

*State-Federal cooperation.* Section 109 (c) of the Act authorizes the Secretary of Commerce to enter into cooperative enforcement arrangements with States. Since NMFS's enforcement capability is limited, agreements have been negotiated with ten States along the Pacific and the southeastern coasts of the United States. The purpose of these agreements is to achieve cooperative agreements with the States for prompt enforcement of Federal law and regulations, where needed, through utilization of available State personnel and equipment. Under short term contracts requiring a total monthly amount of about $37,000, the States of Alabama, Alaska, California, Florida, Georgia, Louisiana, Mississippi, Oregon, South Carolina, and Washington have agreed to enforce the moratorium on the taking of marine mammals, including making investigations and appearing as witnesses in any subsequent judicial actions. The services provided by each State vary in scope and are related to the traditional incidence of marine mammals and the need for enforcement activities. In Alaska, the enforcement efforts provided by the State are quite extensive and involves the part-time services of 82 fish and wildlife officers and State troopers, and several patrol boats and aircraft. With each State, the fixed monthly contract cost is established by determining the relative effort required, based on known considerations and potential problems. These contracts identify State officers who will be involved in enforcement activities, including estimates of time and equipment to be used. In addition, periodic reports are required by NMFS from each State under contract which summarize work performed and related information so that future contracts can be directed toward the most effective utilization of Federal funds and State resources.

Sections 109 and 112 of the Act authorize Federal cooperation with the States in the handling and disposition of marine mammals in distress, abandoned, or confiscated. Throughout the coastal areas of the United States, the problem of beached marine mammals is of great concern. The frequency with which animals are stranded varies greatly from area to area; in Florida, California, and Alaska the number of occurrences is significant. Records show that between 150–175 false killer whales (*Pseudorca crassidens*) beached themselves in the vicinity of Fort Pierce, Florida, on January 11, 1970; about 50 pilot whales (*Globicephala macrorhyncha*) came ashore near Sarasota, Florida, on August 21, 1971; and in June 1973, ten pilot whales beached themeselves near Key Largo, Florida. These are only a few of the records of beached mammals during recent years. Section 109(a)(4) of the Act authorizes a State or local government employee to assist distressed mammals. Section 216.8 of the interim regulations prescribes the authority and procedures by which State or local government employees may handle such situations. Depending on the condition of the animal, local authorities may either return the animal to its natural habitat or place it in an aquarium for care until final disposition can be determined.

In many cases, beached or stranded animals are very sick or injured and can be expected to die after a short time. States are, of course, authorized to dispose of the carcasses. In some instances carcasses have been given to scientific institutions for study. In every situation, a report is required from the State by NMFS of the circumstances concerning the taking and final disposition of an animal.

*Federal interagency cooperation.* Subsections 112 (b) and (c) of the Act authorize and direct each Federal agency to cooperate with the Secretary (Commerce and the Interior) in such a manner as may be mutually agreeable, and the Secretary (Commerce and the Interior) may enter into such contracts, leases, cooperative agreements, or other transactions, as may be necessary to carry out the purposes of the Act.

The NMFS has discussed cooperative arrangements with the Departments of Agriculture, Interior, Transportation, and Treasury. The Department of Agriculture, acting under the Animal Welfare Act of 1970 (Public Law 91–579), would enforce regulations concerning the care and maintenance of marine mammals in captivity prior to the effective date of the Act, specifying the manner in which the animals could be handled, transported, and displayed. The regulations would also specify the minimum standards for such facilities.

A memorandum of understanding between the Department of Commerce and the Department of the Interior is presently being developed which would provide for the Department of the Interior to assist the Department of Commerce in its implementation responsibilities under the Act in the inland States and at designated ports of entry where the Department of the Interior presently has agents stationed. The agreement would also provide that the Department of Commerce assist the Department of the Interior through enforcement of the Act on the high seas.

The Customs Service in the Treasury Department will assist in carrying out responsibilities related to importation of marine mammals and marine mammal products into the United States. The Coast Guard in the Department of Transportation has been asked to report violations encountered on routine sea patrols. Cooperation with other Government agencies will be explored.

*International program.* The requirements for international action prescribed in Section 108 of the Act aim to conserve and protect marine mammals throughout the world by international arrangements. The National Oceanic and Atmospheric Administration, Department of Commerce, has initiated several pertinent actions.

A proposed new Protocol to the International Whaling Convention, coordinated by all appropriate United States Government agencies, including the Departments of State and the Interior, the Council on Environmental Quality, and the Smithsonian Institution, was prepared for presentation at the International Whaling Commission meeting in London, England, on June 25–29, 1973. Comments from conservation groups and others have been included in the proposed Protocol. Negotiations relative to its adoption will take place at a future date.

The proposed Protocol incorporates into the Convention the basic provisions of the Marine Mammal Protection Act. The major changes to the Convention involve including all cetaceans; elimination of all references to consideration of commercial interests except to recognize that cetaceans have nutritional and economic values; and stipulation that cetaceans may be taken only when the populations are at optimum levels.

At the November 1972 meeting of the Inter-American Tropical Tuna Commission, the United States Delegation informed other member nations of the requirements under the Marine Mammal Protection Act. Agreements with foreign nations having tuna fishing operations similar to those of the United States fishing industry cannot be finalized until the United States has adopted regulatory provisions for its own fishermen. The foreign catch of yellowfin tuna in the Eastern Tropical Pacific amounts to about 15 percent of the total annual yellowfin catch for that area.

At the June 1973 session of the International Commission for the Northwest Atlantic Fisheries (ICNAF), the United States indicated that conservation of harp and hooded seals should include consideration of their esthetic, recreational, and ecological significance.

Section 108(b)(1)(B) requires, in consulation with the Secretary of State, a comprehensive study of the provisions of the Act as they relate to the Interim Convention on the Conservation of North Pacific Fur Seals. This is to determine what modifications may be required in the provisions of the Convention, or the Act, or both, to make them consistent with each other. This study is in progress and a report of findings is scheduled to be submitted to Congress by October 21, 1973.

South African fur seals are considered a national resource and are under regulation by the Government of the Union of South Africa. Uruguay has a similar interest in South American fur seals and South American sea lions which haul out on its territory. A request by the United States for determination of the desirability of bilateral agreements for protection of these mammals has been sent to both Governments pursuant to Section 108(a) of the Act.

A Government-wide decision has been made, with the concurrence of several prominent conservation organizations, to seek the convening of an international ministerial meeting on marine mammals to be held late in 1974. Because of the large number of nations necessarily involved, time will be required for meeting arrangements and for preparations of positions on the new and complex issues involved in negotiating a meaningful convention for protection and conservation of all marine mammals. It was, therefore, considered unrealistic by the Departments of State, Commerce, and the Interior to seek the convening of an international ministerial meeting before July 1, 1973, as called for in Section 108 (a)(5) of the Act.

The Convention on International Trade in Endangered Species of Wild Fauna and Flora, negotiated in February 1973, and signed by the United States on March 3, 1973, considers "introduction from the sea" to be a form of trade. Marine mammal species or their products which are covered by the Convention may not be brought in from the sea, imported into, or exported from any other nation party to the Convention except as provided for under the Convention. This provision may give some added protection to five species of whales and affords some needed international protection to all monk seals, two species of elephant seals, four species of fur seals, and the Ganges River dolphin.

In accordance with an agreement between the United States and the Union of Soviet Socialist Republics for cooperation in environmental conservation, a meeting of a joint working group on the problems of nature and preserves was held in Moscow January 23–31, 1973. The working group discussed problems pertaining to the conservation and regulation of marine mammal populations. The group agreed to the conduct of cooperative research on inventory methods, population dynamics and ecology of walruses and ice seals; marking of sei, fin and sperm whales for distribution and assessment information; biological investigations of gray and bowhead whales; and basic biology of other northern marine mammals.

*Coordinated Pribilof Islands-Bering Sea research.* Fur seals of the Pribilof Islands have been under study by scientists since 1867 when the Islands became a possession of the United States. Since 1956, the seal population has been studied intensively in an effort to satisfy the requirements of the Interim Convention on the Conservation of North Pacific Fur Seals.

Ongoing research has centered on development of information on causes of death among the young; determination of the number of pups born each year; determination of numbers of living adult males and all dead fur seals found on the breeding and hauling grounds; and determination of age composition of the commercial kill.

Because factors that control the population size of fur seals are not fully understood, NMFS proposed new research efforts designed to provide additional information for more effective management of the Pribilof fur seal herd. The research program, which entailed a cessation of commercial sealing on St. George Island, was presented by the United States to the North Pacific Fur Seal Commission Meeting in Tokyo, Japan, on March 19–23, 1973, and adopted by that body. Major parts of the program began this year. Other aspects will be phased in during subsequent years.

The program is designed to determine changes in population size and age and sex composition and how these relate to survival, mortality, and reproduction rates and behavior patterns. The program will describe changes in the unharvested population and rookery areas; and monitor abundance and distribution of Bering Sea fish and invertebrate stocks utilized by fur seals and other marine mammals.

*Tuna-Porpoise research and development.* A research program was developed to reduce incidental killing of porpoise taken in Eastern Tropical Pacific Ocean tuna purse seine fishing. The first priority is to respond to the requirements of section 101(a)(2) of the Marine Mammal Protection Act by reducing this mortality to a level approaching zero as quickly as possible; and secondly, to back this up with efforts to establish definitive information on the status of porpoise populations in the Eastern Tropical Pacific.

In response to this problem, an expanded porpoise program was developed at the NMFS Southwest Fisheries Center, La Jolla, California. It is presently underway and has three principal elements: (1) gear dynamics and development, (2) life histories and survey, and (3) stock assessment. Most of the effort and research funds are being channeled into gear dynamics and development, since these appear to offer the greatest promise of speedy and practical short-range reduction of mortality. The objective is to reduce incidental porpoise deaths in the tuna fishery to zero, or as near it as possible, by providing realistic solutions which are applicable for use by foreign fishing fleets as well as those of the United States. The approach is to isolate all separate causes of mortalities and to provide both preventive and remedial measures.

The life history and survey element is divided into (1) research on porpoise life studies, (2) an observer program, and (3) aerial assessment surveys. The life studies phase is essentially a continuation of ongoing studies of taxonomy, geographic distribution, life histories, growth, reproductive rates and major causes of natural mortality of Eastern Tropical Pacific porpoises. The National Marine Fisheries Service observer program provides information on porpoises killed incidentally in fishing operations, statistics on size and makeup of the catch, specimens to be used in life history studies and stock assessment, detailed observations of rescue operations during each tuna set, and other observations on porpoises and birds. Aerial observations with cameras and remote sensors, if they prove feasible, will enable rapid census of cetacean populations over vast oceanic areas. The practicality of this technique is still under study.

The porpoise stock assessment studies will incorporate observer data and results of ongoing life history studies and will lead to assessment of status of spotted porpoise (*Stenella attenuata*) stocks first, and later to spinner porpoise (*S. longirostris*) and whitebelly porpoise (*Delphinus delphis*) stocks.

Public hearings for the purpose of obtaining the views of interested parties on ways of improving commercial fishing methods and gear so as to reduce to the lowest practicable level the taking of marine mammals incidental to commercial fishing operations are scheduled on July 31, 1973, in Washington, D.C., and on August 3, 1973, in San Diego, California. The NMFS will receive views of the public concerning a variety of proposals, including (a) requiring the use of a smaller mesh "Medina" panel; and (b) requiring the training of skippers of tuna vessels in the handling of this type gear, including so-called "backing down" procedures.

## Part II. Current Status of the Stocks of Marine Mammals

*Introduction.* The following "Report on the Current Status of Stocks of Marine Mammals" was written and reviewed by scientists from universities, State agencies, and the National Marine Fisheries Service. A list of the scientists, who have assisted either by providing information or reviewing the status reports is included in the report.

Of the approximately 104 species of marine mammals throughout the world, status reports have been prepared for 66 species which are of primary concern to the United States and are the responsibility of the Secretary of Commerce under the terms of the Marine Mammal Protection Act. The Act requires a report not only on the status of each marine mammal species, but also on the population stocks. The population stocks of only a few marine mammals have been delineated and the effort needed to obtain information on exotic population stocks is beyond the scope of research being carried out at the present time.

Information about each species is summarized under six major headings. They are distribution and migration, abundance and trends, general biology, ecological problems, allocation problems, and current research. Selected references are listed at the end of each species discussion. Summary information on exist-

ing protective regulations for marine mammals is also included.

References are not cited in the report except for the paragraph on abundance and trends. Because of the importance of data on abundance and trends, information in this section is cited and citations are given in the list of references. Data on the abundance of marine mammals are difficult and costly to obtain. With the exception of a few species which have been commercially exploited, such as large whales and fur seals in the North Pacific Ocean, abundance data are usually inadequate for management purposes.

SPECIES LIST

Pinnipedia
- *Zalophus californianus* (California sea lion)
- *Eumetopias jubatus* (northern sea lion)
- *Arctocephalus australis* (South American fur seal)
- *Arctocephalus pusillus* (South African fur seal)
- *Arctocephalus townsendi* (Guadalupe fur seal)
- *Callorhinus ursinus* (northern fur seal)
- *Phoca vitulina* (harbor seal)
- *Pusa hispida* (ringed seal)
- *Halichoerus grypus* (gray seal)
- *Histriophoca fasciata* (ribbon seal)
- *Pagophilus groenlandicus* (harp seal)
- *Erignathus barbatus* (bearded seal)
- *Monachus tropicalis* (Caribbean monk seal)
- *Monachus schauinslandi* (Hawaiian monk seal)
- *Lobodon carcinophagus* (crabeater seal)
- *Ommatophoca rossi* (Ross seal)
- *Hydrurga leptonyx* (leopard seal)
- *Leptonychotes weddelli* (Weddell seal)
- *Cystophora cristata* (hooded seal)
- *Mirounga leonina* (southern elephant seal)
- *Mirounga angustirostris* (northern elephant seal)

Mysticeti
- *Balaena glacialis* (black right whale)
- *Balaena mysticetus* (bowhead whale)
- *Eschrichtius robustus* (gray whale)
- *Balaenoptera acutorostrata* (minke whale)
- *Balaenoptera edeni* (Bryde's whale)
- *Balaenoptera borealis* (sei whale)
- *Balaenoptera physalus* (fin whale)
- *Balaenoptera musculus* (blue whale)
- *Megaptera novaeangliae* (humpback whale)

Odontoceti
- *Steno bredanensis* (rough-toothed dolphin)
- *Tursiops truncatus* (bottlenosed dolphin)
- *Grampus griseus* (Risso's dolphin)
- *Lagenorhynchus albirostris* (white-beaked dolphin)
- *Lagenorhynchus acutus* (Atlantic white-sided dolphin)
- *Lagenorhynchus obliquidens* (Pacific white-sided dolphin)
- *Lagenodelphis hosei* (Sarawak dolphin)
- *Stenella attenuata, frontalis, graffmani,* and *dubia* (spotted dolphin)
- *Stenella plagiodon* (Atlantic spotted dolphin)
- *Stenella longirostris* (spinner dolphin)
- *Stenella coeruleoalba* (striped dolphin)
- *Delphinus delphis* (common dolphin)
- *Lissodelphis borealis* (northern light whale dolphin)
- *Peponocephala electra* (broad-beaked dolphin)
- *Feresa attenuata* (pygmy killer whale)
- *Pseudorca crassidens* (false killer whale)
- *Globicephala melaena* (common pilot whale)
- *Globicephala macrorhyncha* (short-finned pilot whale)
- *Orcinus orca* (killer whale)
- *Phocoena simus* and *Phocoena phocoena* (harbor porpoise)
- *Phocoenoides dalli* (Dall porpoise)
- *Delphinapterus leucas* (beluga)
- *Monodon monoceros* (narwhal)
- *Physeter catodon* (sperm whale)
- *Kogia breviceps* (pygmy sperm whale)
- *Kogia simus* (dwarf sperm whale)
- *Mesoplodon bidens* (North sea beaked whale)
- *Mesoplodon europaeus* (Antillean beaked whale)
- *Mesoplodon mirus* (True's beaked whale)
- *Mesoplodon stejnegeri* (Bering Sea beaked whale)
- *Mesoplodon carlhubbsi* (Arch-beaked whale)
- *Mesoplodon ginkgodens* (Ginko-toothed whale)
- *Mesoplodon densirostris* (dense-beaked whale)
- *Ziphius cavirostris* (goose-beaked
- *Berardius bairdi* (giant bottlenose whale)
- *Hyperoodon ampullatus* (North Atlantic bottle-nose whale)

CALIFORNIA SEA LION

(*Zalophus californianus californianus*)

*Distribution and migration.* This subspecies of the California sea lion ranges along the west coast of Mexico from about lat. 21° N to southern British Columbia, Canada. The California sea lion breeds on some Gulf of California islands northward to San Miguel Island, Calif., in lat. 34° N. Many adult and subadult males move northward along the California, Oregon, Washington, and British Columbia coasts after the breeding season.

Another subspecies occurs on the Galapagos Islands, and still another, formerly found in Japanese waters, is now extinct.

*Abundance and trends.* The California Department of Fish and Game censuses indicate that the California sea lion population reached a low level in the early 1930's in California waters, then made a steady recovery and apparently leveled off about 1961 with little variation in the counts since then (Ripley, Cox, and Baxter, 1962; Carlisle and Aplin, 1971). Rice, Kenyon, and Lluch (1965) counted 16,150 California sea lions on Guadalupe, San Benito, and Cedros Islands, Mexico, in January and February 1965. Orr, Schonewald, and Kenyon, (1970) counted this species in the Gulf of California between 1960 and 1968, and in April of 1966 made what is the most accurate total count (5,411) obtained on six islands in these waters. In United States waters, Peterson and LeBoeuf (1969) estimated that 40,000 animals were ashore on San Nicholas and San Miguel Islands during the 1967 and 1968 breeding seasons. Odell (1971) obtained minimum counts of 34,382 California sea lions on all Channel Islands in June 1964. The preceding figures indicate a total population of about 60,000, with about 20,000 animals in Mexico and 40,000 in the United States.

Mate (pers. comm.) states that the California sea lion population in Oregon numbered about 2,500 in 1968, 1969, and 1970. As many as 1,000 animals migrated through Oregon to the north during these years.

In 1972, Bigg (1973) counted 430 California sea lions in Barkley Sound off Vancouver Island on February 25. At the same time, 35 on Race Rocks off Victoria, B.C., and 10 in Dodds Narrows (lat. 49°07′ N) near Nanaimo, B.C., were counted.

Before passage of the Marine Mammal Protection Act by the U.S. Congress, California sea lions were taken by permit each year for sale to zoos, oceanaria and circuses. Daugherty (1972) states that 400 of these animals were taken in 1969 and 580 in 1970.

*General Biology.* The adult male grows to 2.1 m and 273 kg; the adult female to 1.8 m and 91 kg. Most of the pups are born in June and are about 0.8 m long and 5.4 to 6.4 kg in weight. The females usually breed 15 to 30 days after parturition and the mother and pup may remain together the first year. The males establish and defend breeding territories on land; the females move about freely. On San Nicholas Island, the pupping season begins about 15 May and last about 5 weeks, with peak during the first week in June.

During the past two or three years an increase in premature births and in the mortality rate of subadults and young adults apparently has occurred. Three potential causes have been isolated: (1) Chemical residues (polychlorinated biphenyls, DDT and metabolites); (2) a bacterium (*Leptospira*); and (3) a virus.

The greatest single cause of death in wild and captive animals is lungworm. Animals in captivity have also died from pleuropneumonia, pneumonia, and enteric infections, diseases which may also occur in wild populations.

*Ecological problems.* California sea lions associated with certain hauling grounds and rookeries have practically abandoned these areas because of harassment. Major populations are now located only on sites not easily reached by the public.

*Allocation problems.* A history of conflict exists between people for and against complete protection of this species. Some fishermen want the number of California sea lions to be controlled. A demand exists for taking these animals for display. Some conservation groups would like complete protection for the California sea lion.

*Current research.* The following organizations are conducting research on the California sea lion: Biological Sonar Laboratory, Fremont, Calif.; University of California, Santa Cruz, Calif.; University of California, Berkeley, Calif.; California Academy of Science, San Francisco, Calif.; Humboldt State College,

Arcata, Calif.; and Fisheries Research Board of Canada, Nanaimo. The National Marine Fisheries Service conducts research on this species incidental to a fur seal project on San Miguel Island off California.

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NORTHERN (STELLER) SEA LION

(*Eumetopias jubatus*)

*Distribution and migration.* The northern sea lion is found in continental shelf water from the Sea of Japan and northern Honshu, Japan, northward around the North Pacific Ocean rim to the Okhotsk and Bering Seas and southward to the California Channel Islands. Some seasonal movements occur in parts of its range. Examples of such movements are differences in the winter and summer distribution of these animals in the Bering Sea, and the post-breeding movements of males in central California.

*Abundance and Trends.* Kenyon and Rice (1961) estimated the world population at between 240,000 and 300,000 in 1961. No published estimates of the total population have been made since that time. Alaska has 202 known rookeries and hauling grounds. The Alaskan population has increased considerably since the early 1900's and now exceeds 200,000 and may be near maximum levels in many areas (Alaska Department of Fish and Game, 1973). Since 1964, several thousand pups have been harvested annually in Alaska until 1973 when the Marine Mammal Protection Act became effective; 6,546 were taken in 1972.

Kenyon and Scheffer (1962) made six aerial and one surface survey along the Washington coast between 1949 and 1959 and stated that the population did not exceed 500. Pearson and Verts (1970) estimated the Oregon population at 1,078. The California Department of Fish and Game makes periodic aerial censuses of sea lions in California. Carlisle and Aplin (1971) have given the following figures for sea lions in California north of Pt. Conception: (1958) 7,053; (1961) 6,675; (1965) 4,998; (1969) 7,156; and (1970) 5,189. They consider these to be northern sea lions, although small numbers of California sea lions are known to occur north of Pt. Conception at the time the census is made.

The northern sea lion ranges to the Channel Islands group south of Pt. Conception. In the Channel Islands, the population peaked at about 2,000 in the late 1930's and has declined since (Bartholomew, 1967). In 1972, the San Miguel Island population was estimated by DeLong (pers. comm.) at 30 to 35 plus a few pups.

*General biology.* The adult males grow to 3.0 m in length and over 900 kg in weight. Adult females reach 2.0 m and almost 300 kg. Males may mature sexually by age 5 years, but hold breeding territories first at age 7 or 8. Females can produce young at age 5 or 6. Pupping takes place in June and early July and newborn pups weigh 16 to 23 kg. Females breed 10–14 days after parturition. Some pups remain with their mothers the first year. The pup sheds its dark chocolate birthcoat for tan adult pelage in the autumn of birth. The adult male maintains a territory 40 to 60 days, and the female may be territorial for several days after her pup is born. Northern sea lions favor isolated locations with some shelter, free access to the sea, and freedom from human harassment. Colonies may become established on rock outcrops, boulder, cobblestone, and coarse sand beaches. The northern sea lion feeds on a variety of fish and cephalopods.

*Ecological problems.* Northern sea lions in some areas compete with other pinnipeds for rookery and hauling ground space. Excessive disturbance by humans of sea lions on their rookeries and hauling grounds has caused the animals to abandon these areas.

*Allocation problems.* Northern sea lions have damaged gear and destroyed fish in the halibut longline, salmon purse seine, gillnet, and troll fisheries. The species has also destroyed herring in herring pots and has been accused of biting and sinking inflated plastic buoys used to mark crab pots. This species has considerable esthetic and recreational value.

*Current research.* This species has its center of abundance in Alaska where the Alaska Department of Fish and Game's management and research investigations have been directed primarily at determining abundance and distribution, and the effects of harvesting operations on rookery populations.

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### South American Fur Seal

### (*Arctocephalus australis*)

*Distribution and migration.* Two major populations of the South American fur seal, identifiable only by size, are found, one on the Falkland Islands (Islas Malvinas) and the other on coastal Uruguayan Islands. Minor populations of this species occur in Argentina, Chile, and Peru. The adults are on the Uruguayan breeding grounds in November and December, and offshore up to 200 miles east on the edge of the continental platform during the austral winter. An extreme northern record for the South American fur seal was of one identified at Rio de Janeiro, Brazil.

*Abundance and trends.* In 1972, the Uruguayan population was estimated at 252,000. This population grew from an estimated 129,000 in 1960 to an estimated 174,000 in 1965. Other populations are also increasing. Information on abundance and trends was furnished by Isaías Ximénez, Uruguayan Government biologist.

*General biology.* Adult males on the Falkland Islands grow to 159 kg, whereas those in Uruguay reach only 136 kg; the females weigh 33–48 kg. Males are polygamous and establish territories in early November. Most of the pregnant females arrive on the rookeries in mid-November, and form small harems of about six animals. Within 6–7 days, each female bears a single pup and breeds 2–3 days later. The pup is usually weaned by July, although some may nurse for nearly a year. Most males first breed at age 7 and the females at age 3. Uterine implantation of the blastocyst probably occurs in March. Gestation, including the period of delayed implantation, lasts nearly one year. Most of the animals leave the rookeries during the austral winter. On the rookeries, the fur seals are in close contact with South American sea lions, *Otaria flavescens*. Main causes of death in order of importance are from sporadic storms, which wash large numbers of pups out to sea; the seven-gilled shark; and probably the killer whale, which is common around the larger rookeries. The South American fur seal has 10 species of endoparasites, but no heart or lung worms. Nasal mites infest this species.

*Ecological problems.* Offshore oil wells are planned in the near future which may result in an ecological hazard.

*Allocation problems.* The species has esthetic, educational, and economic values. The Government of Uruguay annually harvests male fur seals on the islands. The harvest in 1972 and 11,000 and in 1973 will be 12,500.

*Current Research.* Long-term research on this species is carried out by the Governments of Uruguay and Argentina. In addition, short-term projects are carried out by the Natural History Museum of Montevideo and the Smithsonian Institution.

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### South African (Cape) Fur Seal

### (*Arctocephalus pusillus*)

*Distribution and migration.* The South African fur seal breeds on the mainland and coastal islands of southern Africa from Cape Cross (South West Africa) to Algoa Bay (South Africa). This species shows no definite seasonal migration, but disperses widely while feeding. A marked adult was seen in deep-sea trawling grounds 450 miles from its birthplace. Young seals in their first year (November to October) frequent protected bays and areas near their places of birth.

*Abundance and trends.* No current data are available on the total South African fur seal population, however, Rand (1972) estimates about 19,500 mature territorial males and about 273,000 mature females on mainland and island rookeries. Commercial sealing now appears to be keeping the population fairly stable (op. cit.). First year pups (about 9 months) and a small (unknown) number of second year animals of either sex are harvested in the winter (June-September), although all cow seals are protected (op. cit). In 1950, the winter harvest totaled 27,289 pups and has increased to 76,694 in 1971 (Laws, in press). The summer kill of surplus adult males (October-December) has declined from 3,000 in the early 1950's to 812 in 1969 (Rand, 1972).

*General biology.* The adult males weigh 204.2–317.6 kg and grow to 2.3 m long; females weigh 90.7–113.4 kg and are 1.5–1.8 m long. In late October, when most of the older pups are weaned, the first adult males come ashore to establish territories and harems; pregnant females arrive about a week later. In November and early December, the female bears a single pup (twins are rare), mates 5–6 days later, then leaves its pup for the first time and feeds for 1–2 days at sea. Subsequent nursing-feeding cycles extend to 4–5 days on land and 7–10 days at sea. Implantation of the blastocyst in the uterus is delayed until April or May. Thus, gestation is 7–8 months, but may be longer for some females that mate for the first time in their second year. At birth the pup is about 0.76 m long and averages 6.4 kg. Food consists of fish, cephalopods, and various small crustaceans.

The South African fur seal has stomach nematodes, a cestode and an acanthocephalan in the intestine, mites in the nasal cavity and pulmonary tubes, and an ectoparasitic louse.

*Ecological problems.* Sharks and killer whales are natural predators.

*Allocation problems.* Local fishermen engage in scattered and illegal killing of seals, contending that the animals interfere with their expanding purse-seine fishery. Seals occasionally feed on fish protruding through the meshes of otter trawl nets or taken by line fisheries.

*Current research.* A marking program on some rookeries is carried out by the South and South West African governments to measure herd size, annual recruitment, natural and harvest mortality, and movements.

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### Guadalupe Fur Seal

### (*Arctocephalus townsendi*)

*Distribution and migration.* The distribution of *A. townsendi* in the 18th and 19th centuries is unknown. The Guadalupe fur seal was believed extinct during two periods (1895–1926; 1928–49). One adult male was observed on San Nicolas Island in 1949, and breeding animals were rediscovered at Guadalupe Island in 1954. Subsequently individual animals have been reported at Cedros Island, Baja California, and others have been sighted on San Miguel Island each year since 1968.

*Abundance and trends.* The last Guadalupe fur seal was commercially harvested from the islands of southern California and Baja California in 1894. The populations of Guadalupe fur seals on the Guadalupe and San Benito Islands apparently once numbered in the thousands. Rice et al. (1965) counted 285 of these mammals on Guadalupe Island and suggested that the population was growing rapidly and may contain as many as 600 animals, including those in the water.

*General biology.* Biological information on this species is scarce. No specimens have been collected since their recent rediscovery. The males are almost 1.8 m long. Males appear somewhat smaller and females considerably larger than *Callorhinus ursinus*. *A. townsendi* can be separated from *C. ursinus* by its narrow, pointed muzzle and the extension of pelage beyond the wrist onto the dorsum of the foreflipper. It is separated from *Zalophus californianus* by its distinctive underfur.

The pups are born in June and July. Although breeding has not been observed, a post partum estrus probably occurs, which would extend the breeding period into August. The adult males establish territories in isolated caves that have access to the sea or among large boulders close to the splash zone. Single or small groups of breeding territories are distributed along 20 km of the eastern shoreline of Guadalupe Island. The harems contain 1–10 females.

The feeding habits of *A. townsendi* are unknown. The adult males apparently spend considerable time at sea; all sightings at other islands have occurred during the nonbreeding season. The females may not migrate long distances from Guadalupe Island.

*Ecological problems.* Increasing numbers of human visitors to Guadalupe Island are subjecting the animals to more disturbance. Plans exist to develop the island for the tourist trade. Such development would increase disturbance and could reduce the amount of available breeding habitat for fur seals. Because they breed only on Guadalupe Island, the seals need complete protection from undue disturbance and habitat modification.

*Allocation problems.* None known.

*Current research.* The University of California makes periodic censuses of this species.

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### Northern Fur Seal

### (*Callorhinus ursinus*)

*Distribution and migration.* Most of the animals are on their breeding grounds from May through November to bear young and to breed. They otherwise are found at sea along the continental shelf from the Bering Sea south along both sides of the North Pacific Ocean to latitude 32° N. Some intermingling of eastern and western Pacific populations occurs at sea and on land, primarily among males younger than age 6 years.

*Abundance and trends.* Beginning in 1956, a program of reducing the population of Pribilof Islands fur seals was begun with the expectation that the rate of survival would improve (Roppel et al., 1963) and result in an increased yield of pelts. By 1968, it had become evident that the herd had been reduced to a level somewhat below that of maximum sustainable yield, and that an increase in the number of pups born was desirable. Thus, no female fur seals have been harvested in the Pribilof Islands since 1968 with the expectation that the population would increase. However, less than average survival of several year classes, the cause of which is not understood, has prevented the expected increase. In 1969 and 1970 the number of pups born was estimated to be 304,000 and 306,000, respectively, and in the past the maximum yield of furs was produced when about 400,000 pups were born. In the 1969–72 period when no females were commercially harvested on the Pribilof Islands, an average of about 37,500 males were taken.

Apparently the Commander Islands fur seals have not become reestablished on a considerable portion of their original rookery area. Consequently, this population should increase to a higher level. It is likely that the Robben Island population is near the maximum. Johnson (1972) estimates the abundance of northern fur seals by breeding islands, as follows:

| *Location of fur seal rookeries* | *Estimated number of northern fur seals (in thousands)* |
|---|---|
| Pribilof Islands | 1,200 |
| San Miguel Island | <1 |
| Commander Islands | 265 |
| Robben Island | 165 |
| Kuril Islands | 15 |
| Total | 1,645 |

*General biology.* The adult male weighs 227–318 kg, and the female 36–59 kg. Newborn pups average 4.5 (female) to 5.4 kg (male). The male is polygamous and establishes his territory in late May and early June. Most of the pregnant females arrive on the rookeries in late June and early July, when they form harems of 1–100 animals. Within 3 days of her arrival, the female bears a single pup (twins are rare), breeds 2 days later, then begins nursing-feeding cycles of 2 days on land and about 8 days at sea within a 200-mile radius. Implementation of the blastocyst is delayed until November. Most of the males first breed at age 10, and few live longer than 15 years. Immature fur seals arrive in descending order of age, the males beginning in mid-June and the females in late July. Some 1-year-olds haul out in September and October, but most fur seals return first at age 2. Most of the animals have left the rookeries by December. The adult males winter in northern waters, pregnant females usually migrate as far south as southern California, and young animals of both sexes are found throughout that range.

The main causes of death among pups on the rookeries are, in order of importance: emaciation-malnutrition syndrome, hookworm disease, bacterial infections, injuries, and perinatal hemorrhagic syndrome. Pathogenic bacteria thus far isolated include: *Clostridium perfringens, Proteus mirabilis, Salmonella enteriditis,* and *Leptospira* sp. A

psittacosis group virus has been reported, but the clinical syndrome caused by the agent has not been described. Three other virus isolates from diseased fur seal pups are presently being characterized.

The fur seal has filariid worms, stomach ascarids, intestinal flukes, cestodes, hookworms, and acanthocephalans, and nasal mites, but no heart or lung worms. Hookworms and sucking lice parasitize the newborn.

*Ecological problems.* Northern fur seals concentrate within their body tissues contaminants such as pesticides and heavy metals. For example, mercury compounds have been found in fur seal liver, large quantities of which have been eaten by residents of the Pribilof Islands. No evidence exists that consumption of fur seal liver has been a health hazard, but following the discovery of mercury in this organ, little liver has been eaten by the people. The effect of contaminants on the health of fur seals is unknown.

*Allocation problems.* In the North Pacific Ocean and Bering Sea, fur seal and commercial fisheries may be in competition for the same species of fish. Harvesting of fur seals on the Pribilof Islands has been criticized in recent years by animal protection organizations that would prefer esthetic and educational rather than economic use of the resource.

*Current research.* Long-term research is financed and carried out by the Governments of Japan, Canada, the U.S.S.R., and the United States. Short-term projects are frequently carried out on the Pribilof Islands by university professors or graduate students.

In 1973 St. George Island was designated by the North Pacific Fur Seal Commission as an area of intensive research where no commercial harvest would take place for some period of years.

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HARBOR SEAL

(*Phoca vitulina*)

*Distribution and migration.* The harbor seal is found in the North Atlantic Ocean from the ice pack south to France and Georgia and in North Pacific Ocean waters from the Arctic Ocean south to Baja California and southern Japan and Korea. Populations that breed on the ice in the Bering and Okhotsk Seas are distinct from those that breed on land. *P. v. largha*, the ice-inhabiting form, lives in the seasonal pack ice in winter and spring, bearing and nurturing its pup there, and moves toward the coasts when the ice retreats. The coastal forms (*P. v. richardi* and *P. v. kurilensis* in the North Pacific; *P. v. vitulina* and *P. v. concolor* in the North Atlantic) are more sedentary. The harbor seal is the predominant near-shore seal in ice free waters north of 35° N. latitude.

*Abundance and trends.* Overall, the world population of harbor seals appears to be high and stable. About 750,000 are present in the North Pacific area (Alaska Department of Fish and Game, 1973; Bigg, 1969; Chapskii, 1966) and about 150,000 in the European North Atlantic region (Chapskii, 1966).

*General biology.* Harbor seals of all subspecies are of medium size; large adults of both sexes are from 160 to 180 cm long and weigh from 130 to 150 kg. Pups weigh from 9 to 12 kg and are about 80 to 90 cm long at birth. Adults of the ice-inhabiting form pair in March for the duration of the breeding season, and a white-coated pup is born to each pair, on the ice, usually in March or April. Adults of the coastal form congregate on islets and bear dark-coated pups, usually in May to July. The pups of each form nurse 4 to 6 weeks, in which time the weight is more than doubled: Males of both forms become sexually mature at 4 to 5 years of age; females at 3 or 4 years. Breeding is annual, and the period of pregnancy (including delayed implantation) is about 10.5 months. Maximum longevity is at least 35 years. Adults of both forms are gregarious outside the breeding season. The diet of the harbor seal, which varies according to season and location of specific populations, includes primarily pelagic, demersal, and anadromous fishes, cephalopods, and crustaceans. Almost all of the adult seals have anisakid round worms and corynosomid acanthocephalans, and, occasionally, high infestations of anopluran lice. The latter seem associated with filarial heart worms and may be vectors. Toxoplasma has been reported in captive animals, but its presence in wild seals is not verified.

*Ecological problems.* In some parts of its range, the harbor seal contributes to high worm infections in fish, notably codfish. This animal is extremely sensitive to disturbance, and may leave an area temporarily or even permanently after continual harassment by people, equipment, or aircraft. Contamination of the environment with pesticides, heavy metals, and other contaminants may be a problem for the land-breeding harbor seal because it frequently inhabits the relatively closed waters of bays and estuaries where these contaminants are likely to concentrate.

*Allocation problems.* These seals damage commercial fishing gear and compete with man for such fish as herring, smelt, whitefish, and salmon.

*Current research.* Ongoing research in California, Washington, British Columbia, Alaska, the U.S.S.R., and Japan is aimed toward the identification of North Pacific populations and describing their distribution and movements, reproductive biology, feeding habits, growth, physiology, and ecology.

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RINGED SEAL

(*Pusa hispida*)

*Distribution and migration.* The ringed seal is circumarctic in distribution in the ice pack. In the North Pacific Ocean it is found in the Bering, Chukchi, and Okhotsk Seas and in the permanent ice pack of the Polar Basin. In winter, most ringed seals occupy areas of land-fast ice, but nonbreeding adults and juveniles may be found wherever ice occurs. Apparently, animals wintering in the Bering and Chukchi Seas move northward in spring as the ice recedes and southward in autumn as it advances again, whereas those in the Canadian Arctic may reside year-round in the same locality. In western Alaska, the ringed seal is the dominant near-shore seal during months when sea ice is present and is replaced by the harbor seal during ice-free months. A small proportion of the population, mainly juveniles, remains in ice-free areas of the Bering Sea during summer.

*Abundance and trends.* Counts of ringed seals on land-fast ice along the northern coast of Alaska made in 1970 (Burns and Harbo, 1972) indicated that the density of resident animals varies from 5.36 per square mile in the Chukchi Sea between Point Lay and Wainwright, to 1.06 per square mile in the Beaufort Sea between Oliktok and Flaxman Island. Overall, the population in the Bering and Chukchi Seas appears high and is probably stable. Estimates of population size made by the Soviets are difficult to evaluate because they recognize three subspecies with overlapping ranges. The Soviets estimate that the total population of *P. hispida* is 5 to 6 million (Chapskii, 1966); *P. h. hispida* (North Atlantic and Arctic Oceans) at 2,500,000; *P. h. krascheninikovi* (western Bering Sea) at 12,000 (Shustov, 1969); and *P. h. ochotensis* (Okhotsk Sea) at 800,000 to 1,000,000 animals (Fedoseev, 1969, from Bychkov, 1971). The Alaska Department of Fish and Game (1973) estimates the Bering-Chukchi Seas population at about 250,000 ringed seals. The total U.S.-U.S.S.R. harvest is estimated at 12,000 to 16,000 seals annually in the Bering and Chukchi Seas. Almost all of these seals are taken by shore-based hunters because the animals are not numerous in areas where Soviet sealing vessels operate.

*General biology.* The ringed seal is the smallest of the northern seals. The adults of both sexes grow to about 125 cm and 66 kg. A few individuals, usually females, become much larger. The animals undergo marked seasonal changes in weight, being heaviest in mid- to late winter. The pups are born with white coats from March to early April in a birth lair within an ice pressure ridge or under drifted snow. Newborn animals are 55 to 65 cm long and weigh about 4.0 kg. The weight of the pup is tripled during a 4- to 6-week nursing period. Males become sexually mature at 6 to 8 years of age, females at 5 to 7 years. The ringed seal breeds annually, has a 10.5-month period of pregnancy (including delayed implantation), and is probably monogamous. Maximum longevity exceeds 35 years. Ringed seals tend to be solitary but congregate in areas favorable for feeding, along extensive tide cracks in land-fast ice, and during seasonal migrations. The diet of these seals varies considerably, depending on their location and water depth. In western Alaska, this mammal feeds mainly on mysids, amphipods, euphausids, shrimps, saffron cod, polar cod, and sculpin.

These animals commonly have internal parasites, including round worms, acanthocephalans, and anopluran lice.

*Ecological problems.* None known.

*Allocation problems.* None known.

*Current research.* The State of Alaska monitors the Eskimo harvest and conducts some biological research in conjunction with other programs. Canada conducts research on the ringed seal.

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GRAY SEAL

(*Halichoerus grypus*)

*Distribution and migration.* The gray seal inhabits the North Atlantic Ocean, with major populations in eastern Canada, Iceland, and northwestern Europe. Dispersion, particularly by pups, from the Canadian breeding colonies in late spring and summer presumably accounts for most of the gray seals seen scattered along the coast of Maine. The tendency for adults to disperse is far less, although they at times make pronounced local movements. One animal tagged in eastern Canada was recently taken off western Norway.

*Abundance and trends.* The world population is estimated at 50,000 to 60,000 animals, with about two-thirds of these animals in the British Isles (Bonner, 1972). All populations have been increasing until recently, but now appear to be stabilizing (op. cit.). A small colony of 10–15 animals was recently discovered on Muskeget Island, Massachusetts.

*Geneal biology.* The average length of adult males is 2.4 m and of females, 2.0 m. The average weight and length of the newborn pups are 13.6 kg and 0.9 m, respectively. Pups of the Canadian and Baltic populations are born mostly in February, whereas those in Britain are born mostly in September–October. At birth the pups are covered with a white natal coat, which is replaced by one of stiff hair with a distinctive pattern after 3 to 4 weeks. The pups are weaned in about 3 weeks, at which time mating occurs. The adult seals feed chiefly on skates, mackerel, flounders, cod, hake, and herring; and occasionally salmon, smelt, haddock, sea bass, dogfish, squid, and crustaceans.

*Ecological problems.* People occasionally harass the animals and use them for target practice.

*Allocation problems.* In eastern Europe they compete for commercial fishes and destroy fishing gear, and in Canada, the gray seal is an important predator of inshore herring taken commercially.

*Current research.* Research on biology, ecology, and populations continues by Canadian and British Governments and private groups. Some work is also being carried out by the University of Massachusetts on Muskeget Island and by the State of Maine.

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RIBBON SEAL

(*Histriophoca fasciata*)

*Distribution and migration.* Geographically, the ribbon seal is separable into the Okhotsk and Bering-Chukchi Seas populations, and interchanges between these two groups are not know to occur. In the latter group, the center of abundance is in the central Bering Sea. The ribbon seal bears and nurtures its pup on the sea ice. During winter and spring, the entire population is concentrated along the southern edge of the seasonal ice pack. Only a few ribbon seals remain with the ice edge as it retreats northward through Bering Strait. In summer and autumn, ribbon seals are believed to be pelagic, mainly in the ice-free Bering Sea.

*Abundance and trends.* The population of ribbon seals is relatively low and has been markedly reduced by commercial sealers of the Soviet Union during the last 10 years (Alaska Department of Fish and Game, 1973). U.S. citizens harvest very few ribbon seals. The Alaska Department of Fish and Game (1973) estimates that the population probably does not exceed 100,000 animals, and Soviet estimates indicate a population of 80,000 to 90,000. Commercial hunting by the USSR has reduced the population of these seals, but measures have been taken to limit the annual harvest. In Alaska, the harvest is usually less than 250 per year.

*General biology.* Adults of both sexes average 155 cm in length and 80 kg in weight. A very large 23-year-old female obtained in March was carrying a near-term fetus. This seal was 179.7 cm long with a girth of 114.3 cm, a blubber thickness of 6.1 cm, and a weight of 148.2 kg. Pups are born as whitecoats from late March to mid-April and average about 10.0 kg and 80 cm. The pup nurses for about 4 weeks, in which time its weight is tripled. Males become sexually mature between 3 and 5 years of age; females between 2 and 4. The species breeds annually, and pregnancy (included delayed implantation) probably lasts 10.5 months. Maximum longevity is estimated at 26 years. The diet of these seals during late winter and early spring (in the ice edge zone) includes mainly pelagic and demersal fishes, cephalopods, and small crustaceans.

Ribbon seals host anisakid round worms in the stomach and corynosomid acanthocephalans in the intestine.

*Ecological problems.* None known.

*Allocation problems.* None known.

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HARP SEAL

(*Pagophilus groenlandicus*)

*Distribution and migration.* The harp seal occurs in pack ice in the North Atlantic Ocean from Europe to eastern Canada. In the spring, it migrates south for breeding to the White Sea, to the Greenland Sea north of 73° N, and to southern Labrador, northeastern Newfoundland, and the Gulf of St. Lawrence.

*Abundance and trends.* Three breeding stocks of harp seals are known, the eastern (White Sea), central (Norwegian Sea around Jan Mayen Island), and western (Newfoundland). The latter is divided into two substocks, one east of Belle Isle on winter pack ice drifting southward—the "Front," and the other in the southern Gulf of St. Lawrence on winter ice formed *in situ*—the "Gulf." Sergeant (1973) estimates the total eastern Canadian population at 1.3 million. The number of pups born decreased from about 400,000 in 1960 to 300,000 in 1970. The population size in 1970 was less than that giving maximum production, and estimates indicated the 1970 catch was well in excess of the sustainable yield (International Commission for the Northwest Atlantic Fisheries. 1971. Redbook, Part I, Standing Committee on Research and Statistics Proceedings, annual meeting). According to Bychkov (1971), harp seal stocks of the northeastern Atlantic and Arctic Oceans (White Sea, Jan Mayen Island, and Newfoundland populations) numbered 3.0–3.5 million in the mid-20th century. Bychkov (1971) also stated that the White Sea population totaled 3.0–3.5 million animals in 1926–28 and only 400,000 in the 1960's.

*General biology.* The adults grow to about 1.8 m and 180 kg; newborn pups are about 0.6 m long and weigh 4.5 kg. The pups are born from late January to early April, and are nursed for 10–12 days. Molting is complete at 4 weeks. The females mature at age 4–6 years and bear a single pup annually after a gestation of about 7½ months. Maximum life span is about 30 years. Pups feed primarily on small pelagic crustaceans and small fish, and in addition as adults on capelin, herring, and haddock.

*Ecological problems.* One species of helminth affecting the harp seal also is found in the muscles of ground fish, particularly cod, necessitating expensive removal by hand.

*Allocation problems.* The harp seal may eventually conflict with man over capelin stocks as this fishery expands.

*Current research.* Canadian, Danish, Norwegian, and Soviet Government scientists are studying the population of harp seals. At the University of Guelph, scientists are studying the biology of this mammal.

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BEARDED SEAL

(*Erignathus barbatus*)

*Distribution and migration.* The bearded seal is found in the North Pacific region in the Berling, Okhotsk, and northern Japan Sea and is circumpolar in the Arctic Ocean. In winter and spring it is found from the southern edge of the seasonal ice pack, north to permanent ice, wherever areas of broken, moving ice exist. During summer and autumn, it occurs along the edge of the permanent polar ice of the Arctic Ocean. Marked seasonal migrations are associated with the advance and retreat of the seasonal ice. The bearded seal is usually solitary, though very loose aggregations are sometimes observed during the breeding season. It does not normally come ashore.

*Abundance and trends.* All populations seem to be at high levels and relatively stable. A Soviet estimate places the population at 450,000 animals in the East-Siberian, Chukchi, Bering, Okhotsk, and Japan Seas (Bychkov, 1971). The Alaska Department of Fish and Game estimates a population of 300,000 animals in the Bering, Chukchi, East-Siberian, and Beaufort Seas (Alaska Department of Fish and Game, 1973). The combined U.S. and Soviet harvest in the Bering and Chukchi Seas is 8,000 to 10,000 seals per year, well within the biological productivity of this species. Hunting loss, however, is high (op. cit.).

*General biology.* The bearded seal is the largest phocid of the western arctic and subarctic. Some adult females are slightly larger than adult males. Large adults attain a winter weight in excess of 340 kg. From June through September the adults weigh from 215 to 240 kg and average 236 cm in length. The female bears a single pup, usually during late

April or early May, which weighs about 31 kg and is 132 cm long. The pup's weight is tripled by the end of the 12- to 18-day nursing period. Most adult females breed within 2 weeks of weaning their pup. The period of pregnancy is 10.5 months, including 2.5 months of delayed implantation. Some females ovulate at age 3 years, but reproductive maturity is not attained until they are 5 or 6 years old. The males become sexually mature at 6 or 7 years. An estimated 85% of the adult females become pregnant each year. The bearded seal consumes several species of invertebrates, principally crabs, shrimp, clams, and amphipods, and some demersal fishes.

Most bearded seals, other than nursing pups, are heavily parasitized by anisakid round worms in the stomach, acanthocephalans and diphyllobothriid cestodes in the intestine, and anopluran lice on the skin.

*Ecological problems.* The bearded seal is the final host for anisakid worms that infect fishes, but this problem is unimportant in Alaska at present. About 1 percent of these animals harbor *Trichinella spiralis*, the cause of trichinosis in man.

*Allocation problems.* None known. Bearded seals consume commercially important pandalid and crangonid shrimps and lithode crabs; however, they do not compete directly for commercial fishes, nor do they damage fishing gear.

*Current research.* None known.

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### Caribbean Monk Seal

### (*Monachus tropicalis*)

The Caribbean monk seal is classified as endangered in the Red Book of the International Union for the Conservation of Nature. From 17 to 29 March 1973, the Bureau of Sport Fisheries and Wildlife, Department of the Interior, conducted an aerial survey of this species' former habitat in the Gulf of Mexico and Caribbean Sea. The conclusion was that the Caribbean monk seal is now extinct.

It formerly inhabited shores and islands of the Greater Antilles, Bahamas, Yucatan Peninsula, and Florida Keys. It was reported in Jamaican waters as late as 1952. A single pup was born, probably in alternate years. The adults grew to 2.4 m in length. The color was a uniform brownish gray above; the underparts were pale yellow or yellowish white. Monk seals were vulnerable to hunters because they were sluggish, unwary, and not easily alarmed.

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### Hawaiian Monk Seal

### (*Monachus schauinslandi*)

*Distribution and migrations.* The Hawaiian monk seal breeds only on French Frigate Shoals, Laysan Island, Lisianski Island, Pearl and Hermes Reef, and Midway and Kure Atolls of the Leeward Hawaiian Islands. The first four of these islands are within the Hawaiian Islands National Wildlife Refuge (HINWR). Rarely do individuals wander southeastward to the main Hawaiian Islands. The species is not known to have a migratory pattern.

*Abundance and trends.* The total population was estimated at 1,350 in 1958 (Rice, 1960). It is classified as rare by the Office of Rare and Endangered Species, Bureau of Sport Fisheries and Wildlife, and International Union for Conservation of Nature and Natural Resources. Counts in the 1960's and 1970's suggest that the population is declining (Kenyon, 1972).

*General biology.* An adult female measured 2.3 m and her estimated weight was 273 kg. On the average, females outweigh adult males. A typical male is about 2.1 m long and weighs about 173 kg. The newborn pups weigh 16–17 kg. The weights of six yearlings averaged 45 kg. Pups are born from late December to July, with the peak in April and May. Spewings found on haul-out areas included the remains of reef and bottom fishes, eels, and cephalopods.

*Ecological problems.* Harassment of the monk seal by humans and dogs on Midway and Kure Atolls may be causing a problem by preventing these animals from using sheltered dry pupping areas. Sharks are a serious predator.

*Allocation problems.* None known.

*Current research.* The HINW Refuge Manager, Bureau of Sport Fisheries and Wildlife, has a pup tagging and recovery program in progress. The Refuge Manager also makes counts of animals on the beaches of the HINWR, usually in the spring and again in late summer. No studies or observations of the small populations on Midway and Kure, under U.S. Navy and U.S. Coast Guard control, are being made.

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### Crabeater Seal

### (*Lobodon carcinophagus*)

*Distribution and migration.* The species is circumpolar and abundant in pack ice of the southern oceans. It is found as a straggler in New Zealand, Australia, Tasmania, and South America. It moves toward the coasts in summer and away from land in the winter.

*Abundance and trends.* The crabeater seal is the most abundant species of seal in the Antarctic, with population estimates ranging from 2 to 5 million (Scheffer, 1958) to 50–75 million (Erickson, et al., 1971). Laws (in press) believes that the latter estimate is unrealiable, but that earlier estimates were too conservative.

*General biology.* Adult males grow to 260 kg in weight and 2.6 m in length. Some females may be larger than males. Little information is available on breeding habits; mating has not been observed but sperm are present in the testes of males in October and November. Pups are born in the spring (mid-September to early November), and are about 1.4 m long. These seals molt in January and February, while partly fasting. Food is mainly euphausids. Many individuals carry scars, possibly from leopard seal or killer whale attacks.

The species has lice on skin, roundworms in the stomach, and, rarely, tapeworms in the intestine.

*Ecological problems.* None known.

*Allocation problems.* None known.

*Current research.* The University of Minnesota is studying population dynamics of Antarctic seals; the University of Idaho is studying abundance, distribution, and reproductive biology; and the University of Oklahoma is studying anatomy, histology, and neuroanatomy.

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### Ross Seal

*(Ommatophoca rossi)*

*Distribution and migration.* The species is circumpolar in heavy pack ice of the Antarctic Ocean.

*Abundance and trends.* The Ross seal is usually solitary. Scheffer (1958) lists the population at 20,000–50,000 but more recently Hofman et al. (in press) have estimated a population in excess of 100,000.

*General biology.* The adults reach a length of about 2.4 m. The animal is plump, with a short, wide head, a small mouth, and small teeth. The vocalizations of this mammal are striking and account for the common name "singing seal." Little is known of its reproduction and newborn pups have never been seen. The male matures at 3–4 years, and the female at 2–7 years. Breeding probably takes places in November and molting probably in January and February. Food consists primarily of fish and cephalopods. These animals may live up to 12 years.

Roundworms are found in the stomach, tapeworms in the intestine, and lice on the skin.

*Ecological problems.* None known.

*Allocation problems.* None known.

*Current research.* The University of Minnesota is studying the population dynamics of Antarctic seals; the University of Idaho is studying abundance, distribution, and reproductive biology; and the University of Oklahoma is studying anatomy, histology, and neuroanatomy.

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### Leopard Seal

*(Hydrurga leptonyx)*

*Distribution and migration.* Leopard seals are circumpolar in Antarctic pack ice and in southern temperate regions and subantarctic islands in the winter. They are occasionally seen off the southern tips of New Zealand, Australia, South America, and South Africa.

*Abundance and trends.* The leopard seal is a solitary animal. Scheffer (1958) estimated the population at 200–300 thousand. More recently (1972), Laws (in press) estimated the population at 250,000 to 500,000.

*General biology.* The adult males grow to 3.0 m in length and 450 kg in weight; adult females reach 3.3 m in length and 500 kg in weight. Leopard seals have a long slim body, large head, and wide gape. Males are sexually mature at 3–7 years and females at 2–6 years. The mating period is probably in November. Newborn pups are 1.6 m long and weigh 29.5 kg. Lactation lasts about 2 months. The seals molt during January and February. Their food consists of fish, euphausids, squids, penguins, whale carcasses, and pups of other seals.

Leopard seals suffer from diseased teeth, tumors, bony nodules in nasal passages, and stomach carcinomas.

*Ecological problems.* None known.

*Allocation problems.* None known.

*Current research.* The University of Minnesota is studying population dynamics of Antarctic seals; the University of Idaho is studying abundance, distribution, and reproductive biology; and the University of Oklahoma is studying anatomy, histology, and neuroanatomy.

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### Weddell Seal

*(Leptonychotes weddelli)*

*Distribution and migration.* This species is circumpolar in fast ice around Antarctica, occasionally reaching as far north as Uruguay (lat. 35° S). It is littoral in distribution and nonmigratory. Because of its occurrence near scientific stations it is the best known of the Antarctic seals.

*Abundance and trends.* The population was estimated at 800,000 by Scheffer (1958), and Laws (in press) estimates present total population at 250,000 to 500,000.

*General biology.* Adult males grow to 2.7 m in length and females are slightly larger; up to 2.9 m in length. Males reach sexual maturity at 6–8 years and females at 3 years. The average age of breeding females is 9 years. They give birth from September to early November on fast ice, usually close to the Antarctic continent. Pregnancy lasts 9 to 10 months. Newborn pups are 1.5 m long, weigh 29 kg, and have permanent dentition. Lactation lasts 6–7 weeks and pups are weaned at 6 weeks. The females protect their pups and are aggressive toward intruders. This

species feeds primarily on fish and cephalopods.

Wounds inflicted on this mammal heal slowly, and festering sores are common. Kidney stones and uterine fibroids have been found. Weddell seals are heavily infested with tapeworms, trematodes, and roundworms internally, and lice externally. Tooth wear associated with maintaining breathing holes may be a mortality factor.

*Ecological problems.* None known.

*Allocation problems.* None known.

*Current Research.* The University of Minnesota is studying population dynamics of Antarctic seals; the University of Idaho is studying abundance, distribution, and reproductive biology; and the University of Oklahoma is studying anatomy, histology, and neuroanatomy.

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HOODED SEAL

(*Cystophora cristata*)

***Distribution and migration.*** The hooded seal occurs mainly in the east Greenland pack ice from Bear Island and Spitzbergen to Jan Mayen, Iceland, and Denmark Strait. It also occurs off southern Greenland, southeastern Labrador and the Gulf of St. Lawrence. Stragglers appear on the American coast as far south as Cape Kennedy, Florida, along the Canadian Arctic coast as far west as Hershel Island, and on the European coast as far south as the Bay of Biscay, France. Hooded seals prefer deep water and thick, drifting ice floes.

*Abundancse and trends.* Hooded seals of all ages are harvested commercially when the animals are congregated for molting. According to Scheffer (1958), the herds in the middle of the 20th century were estimated at 300,000 to 500,000 and according to Chapskii (1966) 500,000. Sergeant (1965) states that the catch rate of hooded seal has been high. The average annual kill from the Jan Mayen Island herd declined from about 53,000 (1949–53) to about 50,000 (1959–63) (Popov, 1967).

*General biology.* Adult males grow to 2.7–3.0 m and 408 kg; females are slightly smaller. Hooded seals are solitary, but form widely scattered family groups during the breeding season in March. The pups are born from the end of March to the first part of April, are 1.1 m long and weigh 23 kg, and have an exceptionally beautiful silver-gray coat. They are nursed about 2 weeks. Both sexes mature at age 4–6 years and have a maximum life span of about 30 years. The adults mate when the lactation period ends and return to sea, leaving the pups on the ice where they remain an additional 2 weeks before following the adults. Hooded seals feed on redfish, Greenland turbot, octopus, squid, herring, capelin, cod, shrimps, mussles, and starfish, but fast during the breeding period.

*Ecological problems.* None known.

*Allocation problems.* None known.

*Current research.* Research on the hooded seal is carried out by the Fisheries Research Board of Canada, Denmark (Grønlands Fiskeriundersøgelser), Norway (Fiskeridirektoratets Havforsknings Institutt), and the Soviet Union (VNIRO).

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SOUTHERN ELEPHANT SEAL

(*Mirounga leonina*)

***Distribution and migration.*** The southern elephant seal is circumpolar on subantarctic islands, south to the ice edge at lat. 78° S. It breeds on the continental coast of Argentina, and on subantarctic islands.

*Abundance and trends.* The population of the southern elephant seal has been estimated at 600,000±100,000 (Laws, in press). This species was once sought for its oil. It was nearly extinct by 1900, but since that time regulations have allowed the herds to increase. At South Georgia the average annual kill between 1952 and 1964 was 6,000 animals. There has been no commercial sealing there since 1964, although licenses to harvest these animals have been offered (Laws, in press).

*General biology.* The southern elephant seal is the largest pinniped. Males grow to 5.5–6.1 m in length and 3,628 kg in weight; females reach 3.1–3.7 m and 907 kg. Males are sexually mature at 4 years, and hold harems at 5–7 years in utilized populations. The females mature at age 2 years and bear single pups at age 3. In unutilized populations, the females mature at age 3–6 years, but the males do not reach harem status until 12 years old. Most harems contain 20 to 40 females, but up to 100 have been counted. The pups are born in October, about 1 week after the females haul out, are 1.2 m long, weigh 36 kg, and nurse about 23 days. The females mate about 18 days after their pups are born. The females live about 12 years and the males up to 20. The leopard seal and killer whale are natural enemies of the southern elephant seal.

*Ecological problems.* None known.

*Allocation problems.* According to Laws (in press) the southern elephant seal may become threatened because they compete with Soviet fishermen for commercial species of fish.

*Current research.* The University of Minnesota makes incidental observations of this mammal while studying the Antarctic seal species.

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NORTHERN ELEPHANT SEAL

(*Mirounga angustirostris*)

*Distribution and migration.* This species originally occupied rookeries and hauling grounds on the mainland and islands from Cabo San Lazaro, Baja California, northward to Pt. Reyes, just north of San Francisco. Nonbreeding animals range at least as far north as southeastern Alaska.

*Abundance and trends.* By 1890 the population had been reduced to 100 or fewer animals found only on Guadalupe Island, but this number increased to an estimated 15,000 animals by 1960 (Bartholomew and Hubbs, 1960). Peterson and LeBoeuf (1969) estimated a population of about 30,000 in 1969. This species has reoccupied most or all of its historic rookeries and hauling grounds. The first birth of a pup on the Farallon Islands (northern limit of the historic breeding range) was observed on January 21, 1972 by David Ainsley, a biologist from the Pt. Reyes Bird Observatory (San Francisco Chronicle, January 25, 1972).

The California Department of Fish and Game has counted elephant seals during sea lion censuses in early June since 1965 (Carlisle and Aplin, 1971). Carlisle (unpublished California Department of Fish and Game records) has counted *Mirounga* on San Miguel Island each year from 1965 through 1972 except 1968. Recent California counts do not indicate any trend in abundance.

Odell (1972) believes that the San Nicolas Island population is increasing. The largest California population of *Mirounga* is found on San Miguel Island, where 3,137 were counted February 26, 1972 by Johnson and DeLong (pers. comm.).

*General biology.* The adult males usually arrive first on the rookeries in November, followed by the pregnant females in December. Dominant adult males occupy choice locations within the breeding colonies and do most of the mating. The female usually bears a single pup about 7 days after her arrival and weans it about a month later. The female is bred during her last few days ashore. Maximum lengths are about 5 m for adult males and 3.3 m for adult females. Newborn pups are about 1.2 m in length. Little information on the feeding habits of *Mirounga* are available. The stomach of one elephant seal contained seven ratfish, one 66.0 cm California dogfish shark, one swell or puffer shark, three skates, and four squids. The species apparently can feed at considerable depths, as indicated by prey species and the fact that three young *Mirounga* were taken on hooks set in about 100 fathoms.

*Ecological problems.* Oil from the Santa Barbara spill of 28 January 1969 coated about 100 elephant seal pups ashore on one area of San Miguel Island. The pups had been weaned and apparently suffered no ill effects.

*Allocation problems.* None known.

*Current research.* Scientists from the University of California at Santa Cruz, Calif., are studying this species.

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BLACK RIGHT WHALE

(*Balaena glacialis*)

*Distribution and migration.* This right whale inhabits all temperate waters of the world. It migrates between summering grounds in cool temperate waters and wintering grounds in warm temperate waters; the wintering grounds are mostly along continental coasts or around islands.

Three geographically isolated populations are recognized, one in the North Pacific Ocean, another in the North Atlantic Ocean, and a third in the Southern Hemisphere.

In the eastern North Pacific Ocean, the right whale ranges from Bristol Bay and the Gulf of Alaska south to 50° N latitude during the summer, and from Oregon south to central Baja California during the winter.

In the western North Atlantic Ocean, it ranges from Labrador south to the Bay of Fundy during the summer, and Massachusetts south to Florida and Bermuda during the winter.

*Abundance and trends.* The right whale was originally very abundant, but heavy exploitation, mostly during the 19th century, reduced all populations nearly to extinction by the turn of the century. At least some local stocks have increased in recent years. Present numbers are: North Pacific Ocean—about 250 (Wada, 1972); North Atlantic Ocean—no estimate; Southern Hemisphere—about 4,300 (Masaki, 1972).

*General biology.* The black right whale is a heavy-bodied animal up to 18.0 m long and is characterized by lack of a dorsal fin and by a large head with a narrow arched rostrum. It feeds mainly on copepods. The reproductive biology is poorly known. Body length at sexual maturity is about 15.2 m in males and 15.8 m in females. Mating and calving occur in the winter, so the gestation period is probably about 1 year. The female probably bears a calf only once every 2 (or more) years.

*Ecological problems.* None known.

*Allocation problems.* None known.

*Current research.* Research on the black right whale is being carried out by the South African Division of Sea Fisheries and off Argentina by a joint project of the National Geographic Society and the New York Zoological Society.

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BOWHEAD WHALE

(*Balanena mysticetus*)

*Distribution and migration.* The bowhead whale inhabits arctic and subarctic waters in four principal areas: (1) From

Spitzbergen west to east Greenland; (2) in Davis Strait, Baffin Bay, James Bay, and adjacent waters; (3) in the Bering, Chukchi, Beaufort, and East Siberian Seas; and (4) in the Okhotsk Sea. They migrate with ice movements.

*Abundance and trends.* All bowhead whale populations were decimated by the end of the 19th century because of the great value of this species for oil and baleen (Tomilin, 1957). No commercial whaling for bowheads has taken place since about 1915. Eskimos in several arctic coastal villages of Alaska continue to hunt these whales which are an important part in the subsistence economy of the villages. In the last two decades the take of bowhead whales by Eskimos in Alaska has varied between 1 (1959) and 37 (1972) (Maher and Wilimovsky, 1963; Durham, unpublished records). Much of this variation in take is because of variation in hunting conditions, although in recent years an increase in hunting intensity may have taken place. Bowhead whales are taken only occasionally by U.S.S.R. nationals (Zemsky, 1973, pers. comm.). The bowhead whale population of Canada and the Bering, Chukchi, and East Siberian Seas appears to be increasing (Mansfield, 1971; Burns, pers. comm.).

*General biology.* The bowhead whale grows to 18 m in length. Sexual maturity is reached at 11.6 m and 12.2 m in males and females, respectively. Mating probably occurs in early April or earlier. Gestation last 12–13 months, with a single calf (3–4.5 m long) born in April-May. The calf is weaned at 6 months. The reproductive cycle is apparently 2 years. These whales travel singly, in pairs, or threes during the spring. In autumn they are generally scattered, but may occur in groups of up to 50. They feed mainly on euphausids and bottom-dwelling invertebrates.

*Ecological problem.* None known.

*Allocation problem.* Some conflict of interest may exist between people who would like complete protection for bowhead whales and Eskimos who hunt these whales.

*Current research.* The University of Southern California is under contract to the National Marine Fisheries Service (Seattle) to gather biological data on bowhead whales in 1973. In the spring of 1973 a group of scientists from U.S. and Canadian universities attempted to record underwater sounds of the bowhead whale. The Fisheries Research Board of Canada makes annual surveys from planes of bowhead whales in Canadian waters.

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GRAY WHALE

(*Eschrichtius robustus*)

*Distribution and migration.* The gray whale is now restricted to the North Pacific Ocean, although it once occurred in the North Atlantic Ocean.

Two geographically isolated populations are recognized: (1) The eastern Pacific ("California") stock, which spends the summer in the Chukchi, western Beaufort, and northern Bering Seas (and rarely along the coast as far south as central California), and migrates to the west coast of Baja California and the southern Gulf of California for the winter; and (2) the western Pacific Ocean ("Korean") stock, which spends the summer in the northern Sea of Okhotsk and migrates to the southern coast of Korea for the winter.

*Abundance and trends.* Eastern North Pacific Ocean—contrary to earlier published estimates, the original population was almost certainly less than 15,000 (Henderson, 1972). During the late 18th and early 19th centuries the population was greatly reduced. Since complete protection was given the stock in 1947, the population has increased to about 11,000 and has remained stable since 1967 (Rice and Wolman, 1971). In 1972, 181 gray whales were killed in a subsistence fishery on the Chukotski Peninsula in Siberia (Zemsky, 1973, pers. comm.), and in some years one to three gray whales are taken by Eskimos in Alaska.

Western North Pacific Ocean—in 1910, the population probably numbered between 1,000 and 1,500. It now appears to be extinct.

*General biology.* The gray whale is identified by its mottled gray color and low hump in place of a dorsal fin. It feeds on benthic amphipods and other benthic invertebrates on the summering grounds, and fasts during migrations and on wintering grounds. Sexual maturity is attained at an age of 5 to 11 years, at a mean body length of 11.0 m for males and 11.6 m for females. The mating season is in late November and early December while the animals are on their southward migration. The calf is born following a 13-month gestation period after the pregnant females have arrived in certain shallow lagoons on the west coast of Baja California. The female bears a calf only once every 2 or more years. The calves average about 5.0 m long at birth and are weaned 7 months later when they are about 8.0 m long.

*Ecological problems.* The gray whale is now valuable as a tourist attraction, and it supports a rapidly increasing cruise-boat industry, including ½-day cruises off San Diego and Los Angeles, and week-long cruises from these ports to Scammon's Lagoon. These activities have generated a problem of increasing harassment of the whales. In 1972, the Mexican Government declared Scammon's Lagoon a whale refuge, so the activities of the cruise boats are now partly regulated.

*Current research.* Studies on gray whales are being conducted by the National Marine Fisheries Service and the Soviet Union's Far Eastern Institute of Marine Fisheries and Oceanography.

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MINKE WHALE

(*Balaenoptera acutorostrata*)

*Distribution and migration.* The minke whale inhabits all oceans of the world, except in equatorial regions, and ranges into the polar pack ice zones in the Northern and Southern Hemispheres. It makes extensive seasonal migrations between high-latitude summering grounds and low-latitude wintering grounds.

At least three geographically isolated populations are recognized, one in the North Pacific Ocean, another in the North Atlantic Ocean, and a third in the Southern Hemisphere. The affinities of the minke whale stocks in the northern Indian Ocean are unknown.

In the eastern North Pacific Ocean, the minke whale ranges from the Chukchi Sea south to northern Baja California during the summer, and from central California south to the Islas Revillagigedo off central Mexico during the winter.

In the western North Atlantic Ocean, it ranges from Baffin Bay south to Chesapeake Bay during the summer, and from the eastern Gulf of Mexico and northeastern Florida to the Bahamas during the winter.

*Abundance and trends.* The minke whale has long been an important species in the "small whale" fisheries of the world. In 1970, for example, catches were: South Africa—171; Norway (including the entire northern North Atlantic)—2,308; eastern Canada—86; Japan—320; Brazil—701; Soviet Union (Antarctic)—30; South Korea—715. In the 1971/72 season, Japan, for the first time, sent a small factory ship and two catcher boats to the Antarctic specifically for minke whales and 3,000 were killed.

The venture was sufficiently profitable that increased operations are planned. No estimates are available of the abundance of this species in the North Pacific or North Atlantic. In the Southern Hemisphere the present population, which is virtually unexploited, numbers at least 200,000 (International Whaling Commission, 1973).

*General biology.* The minke whale is the smallest member of the genus *Balaenoptera*, not exceeding 10 m in length in the Northern Hemisphere. The northern animals are distinguished by a white band on the flipper; individuals from the Southern Hemisphere average about a meter longer, and usually lack the white flipper band. The minke whale feeds mainly on euphausiids, but also takes some small fishes. In the Northern Hemisphere, it attains sexual maturity at an age of 7 to 8 years and an average body length of 7.0 m in males and 7.9 m in females. The female bears a calf only once every 2 years (rather than annually, as once believed). During the summer, pregnant females migrate to much higher latitudes than do the lactating and immature females.

*Ecological problems.* None known.

*Allocation problems.* None known.

*Current research.* Research on minke whales is being conducted by the Japanese Far Seas Fisheries Research Laboratory, the South African Division of Sea Fisheries, and the Norwegian State Institute for Whale Research.

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## Bryde's Whale

(*Balaenoptera edeni*)

*Distribution and migration.* The Bryde's whale is found in tropical and warm temperate coastal waters around the world. In the western Atlantic Ocean, it ranges from the Gulf of Mexico south to Cabo Frio, Brazil, and in the eastern Atlantic Ocean from Morocco south to the Cape of Good Hope. In the Indian Ocean, it ranges from the Cape of Good Hope north to the Persian Gulf, east to the Gulf of Martaban, Burma, and thence south to Shark Bay, Western Australia. In the western Pacific Ocean, it is distributed from northern Hokkaido, Japan, south to Victoria, Australia, and North Island, New Zealand; in the eastern Pacific Ocean, it ranges from central Baja California, Mexico, south to Iquique, Chile.

At least some of the temperate zone populations (Japan, South Africa) make limited seasonal migrations. The tropical populations may be sedentary.

*Abundance and trends.* The Bryde's whale is of minor importance in the modern whaling industry. Until recently, only a few of these animals were taken by shore stations in Japan, South Africa, and rarely elsewhere. Since 1970, however, increasing numbers have been harvested by Soviet and Japanese pelagic expeditions in the western North Pacific Ocean, as these expeditions have shifted operations more to the south. The population in the western North Pacific Ocean (the only one that has been exploited significantly) numbers between 5,000 and 18,000, and is probably above the level needed for a maximum sustainable yield (Ohsumi, Shimadzu, and Doi, 1971). Estimates of populations elsewhere in the world have not been made.

*General biology.* The Bryde's whale is very similar in appearance to the sei whale, and the two species were formerly confused. The Bryde's whale is slightly smaller—usually less than 13.5 m long; its throat grooves extend posteriorly beyond the umbilicus, and it has a pair of lateral ridges on top of its snout, one on each side of the median ridge. The fringe on its baleen plates is much coarser than that of the sei whale. It feeds mainly on small schooling fishes, and also takes some euphausiids and other crustaceans. Males attain sexual maturity at an average length of 12.2 m and females at 12.5 m. The mating and calving season is usually during the winter, but in some areas—South Africa, for example—they breed year-round. The gestation period is about 1 year. The female does not bear a calf 2 years in succession.

*Ecological problems.* None known.

*Allocation problems.* None known.

*Current research.* Research on the Bryde's whale is being conducted by the South African Division of Sea Fisheries and the Japanese Far Seas Fisheries Research Laboratory.

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## Sei Whale

(*Balaenoptera borealis*)

*Distribution and migration.* The sei whale is nearly world wide in distribution. In the eastern North Pacific, it summers from California to the Gulf of Alaska and Aleutian Islands; in the North Atlantic, from New England and the British Isles to the Arctic Ocean. In winters at low latitudes. In the Southern Hemisphere this species summers in all oceans from 30° S latitude and southward, and in winter it is generally found north of 40° S latitude.

*Abundance and trends.* Information in this section is from the annual reports of the International Whaling Commission (1972, In press) and from recent reports of the Bureau of International Whaling Statistics. Stock sizes available for commercial harvest are estimated to be about 80,000 in the southern oceans and 33,000 to 37,000 in the North Pacific Ocean. Definitive stock estimates of this species in the North Atlantic are not available, though a tentative estimate for the population off Nova Scotia is 1,570. In addition, all stocks contain unknown numbers of sei whales younger than those utilized commercially because a minimum length restriction prevents the taking of these animals and development of population data on this segment of the herd. The sei whale is the second most valuable baleen whale, and populations appear to be near the level of maximum sustainable yield. Catches of sei whales in recent seasons have been:

| Season | North Pacific | North Atlantic | Southern oceans [1] (S. of 40° S) | Southern land stations |
|---|---|---|---|---|
| 1960 | 5,158 | 222 | 5,857 | [2] 824 |
| 1970 | 4,501 | 551 | 6,153 | 138 |
| 1971 | 2,903 | 475 | 5,452 | 446 |

[1] Southern oceans catches are for the seasons 1969/70, 1970/71, 1971/72, respectively.
[2] No information from Brazil and Chile in 1969.

*General biology.* The species resembles the fin whale but is slightly smaller, with less white underneath, and a large dorsal fin. In the far north of the northern hemisphere it feeds mostly on copepods. The diet is much more varied in lower latitudes—including euphausiids, copepods, sauries, anchovies, herring, sardines, and jack mackeral. Sei whales usually travel in small pods of 2–5. They attain sexual maturity at 6–12 years of age, at a body length of about 13.1 m (males) and 13.7 m (females). Females bear calves every 2 or 3 years. The mating and calving season occurs in winter in the respective hemispheres. Gestation lasts 1 year, and the calf is weaned when about 7 months old.

Seven percent of the sei whales taken off California have been infected with a unique disease that causes progressive shedding of the baleen plates and their replacement by an abnormal papilloma-like growth.

*Ecological problems.* None known.

*Allocation problems.* None known.

*Current research.* The National Marine Fisheries Service will share in popu-

lation and biological studies of this species. Other organizations carrying out research on this species are the Japanese Whale Research Institute and Japanese Far Seas Fisheries Research Laboratory (North Pacific and Antarctic), Fisheries Research Board of Canada (North Atlantic), Norwegian State Institute for Whale Research (Antarctic), British National Institute of Oceanography (South Africa and Antarctic), South African Division of Sea Fisheries (South Africa), and Soviet All-Union Research Institute of Marine Fisheries and Oceanography.

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FIN WHALE

(*Balaenoptera physalus*)

*Distribution and migration.* The fin whale is nearly world wide in distribution. In the eastern North Pacific its summers from California into the Chukchi Sea, and in the North Atlantic from Cape Cod and Spain into the Arctic Ocean. The fin whale migrates to more southern latitudes in winter. In the Southern Hemisphere it is generally found at latitude 40°–60° south in summer and from 20°–40° south in winter.

*Abundance and trends.* Information in this section is from the annual reports of the International Whaling Commission (1972, in press) and from the reports of the Bureau of International Whaling Statistics, Sandefjord. Stock sizes available for commercial harvest are estimated at about 80,000 in the Southern Hemisphere, 10,000 to 13,000 in the North Pacific, and about 7,000 in the Northwest Atlantic and possibly in the Northeast Atlantic. In addition, all stocks contain unknown numbers of whales younger than those utilized commercially because a minimum length restriction on the catch prevents the taking of these animals and development of population data on this segment of the herd. Recent catches from the stocks have been:

| Season | North Pacific | North Atlantic | Southern oceans [1] | Southern land stations [2] |
|---|---|---|---|---|
| 1969 | 1,276 | 800 | 3,002 | 224 |
| 1970 | 1,012 | 911 | 2,890 | 132 |
| 1971 | 902 | 663 | 2,683 | 40 |

[1] Southern ocean catches are for the seasons 1969/70, 1970/71, 1971/72, respectively.
[2] No information from Brazil and Chile.

The fin whale is commercially the most valuable baleen whale. Stocks in the North Pacific and southern oceans are below maximum sustainable yield levels.

*General biology.* This species is second in size only to the blue whale; in the Northern Hemisphere it grows to at least 23.2 m and is distinguished by a gray back, white belly and well-developed dorsal fin. Fin whales feed mostly on euphausiids, but often eat fish—especially anchovies in the North Pacific and capelin in the North Atlantic. They usually travel in small pods of 2–5 animals. Fin whales are sexually mature at 6–12 years, and at a body length of about 17.7 m (males) and 18.3 m (females). Females bear calves every 2–3 years. The mating and calving season occurs in winter in respective hemispheres. Gestations last 1 year and the calf is weaned at about age 7 months.

*Ecological problems.* None known.

*Allocation problems.* None known.

*Current research.* The National Marine Fisheries Service plans to share in population and biological studies of this species. Other organizations carrying out research on this species are the Japanese Whales Research Institute and Japanese Far Seas Fisheries Research Laboratory (North Pacific and Antarctic), Fisheries Research Board of Canada (North Atlantic), British National Institute of Oceanography (South Africa and Antarctic), South African Division of Sea Fisheries (South Africa), and Soviet All-Union Research Institute of Marine Fisheries and Oceanography (North Pacific and Antarctic).

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BLUE WHALE

(*Balaenoptera musculus*)

*Distribution and migration.* The blue whale is found throughout all oceans from the equator to the polar pack ice zones in the Northern and Southern Hemispheres. It makes seasonal migrations between rather restricted high-latitude summering grounds and low-latitude wintering grounds.

At least three geographically isolated populations are recognized, one in the North Pacific Ocean, another in the North Atlantic Ocean, and a third in the Southern Hemisphere. Each population is probably comprised of several more or less discrete stocks. The "pygmy blue whale" of the southern Indian Ocean is morphologically distinct from the stocks which spend the summer in Antarctic waters. The affinities of the blue whale populations in the Arabian Sea and Bay of Bengal are unknown.

In the eastern North Pacific Ocean, blue whales range from the Aleutian Islands and Gulf of Alaska south to central California during the summer, and from central Baja California south to southern Sinaloa, Mexico, during the winter.

In the western North Atlantic Ocean, they range from Davis Strait south to the Gulf of St. Lawrence during the summer (the winter range of this stock remains unknown).

*Abundance and trends.* During the first half of the 20th century, the blue whale was one of the most important cetaceans to the whaling industry, but it is now so rare that it will require probably half a century of complete protection to restore the stocks to a significant level. In the North Pacific Ocean the population, which once numbered about 5,000, now contains about 1,500 individuals (Ohsumi and Wada, 1972). This species apparently has been slowly increasing since 1966, the year it was first given complete protection.

The population in the western North Atlantic (off eastern Canada), which originally numbered about 1,100, is now much less (Allen, 1970). Estimates of the eastern North Atlantic population have not been made.

The Southern Hemisphere population originally numbered about 200,000 (Chapman, Allen, and Holt, 1964), but was severely depleted before complete protection was given the stock in 1965. Gulland (1972) states that the most likely recent history of blue whale numbers would be a catchable stock of some 4,000 whales in 1963, which has increased to some 6,000 (at about 4 to 5 percent per year) plus a similar number of blue pygmy whales.

*General biology.* The blue whale is the largest mammal that ever lived on earth, reaching a known length of 29 m and a weight of 136 tons. It is distinguished

from the fin whale by its mottled blue-gray color dorsally and ventrally, its smaller dorsal fin, its broad flat snout, and its black baleen plates. Blue whales feed exclusively on euphausiids during the summer, and fast during the winter. They become sexually mature at an average age of about 10 years, when males of the Antarctic stocks average 22.5 m and females 24.0 m; blue whales of the Northern Hemisphere average about 1 m shorter, whereas the "pygmy" blue whales of the southern Indian Ocean average about 2 m less in length. Every 2 or 3 years during the winter months the female gives birth to a calf after a 12-month gestation period. At birth the calf is about 7 m long; when weaned 8 months later it is about 15 m long.

*Ecological problems.* None known.

*Allocation problems.* None known.

*Current Research.* Observers aboard whaling and research vessels record sightings of blue whales and routinely report them to the International Whaling Commission.

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HUMPBACK WHALE

(*Megaptera novaeangliae*)

*Distribution and migration.* The humpback whale is found in almost all oceans from tropical waters to the edge of, but not into, the polar pack ice zones in the Northern and Southern Hemispheres. It makes extensive seasonal migrations between higher latitude summering grounds and low-latitude wintering grounds—the latter along continental coasts or around islands.

Three geographically isolated populations are recognized, one in the North Pacific Ocean, another in the North Atlantic Ocean, and a third in the Southern Hemisphere. Each population is comprised of several almost entirely discrete stocks.

In the eastern North Pacific Ocean, the humpback whale ranges from the Chukchi Sea south to southern California during the summer, and from southern California south to the Islas Revillagigedo and Jalisco, Mexico, and also around the Hawaiian Islands, during the winter.

In the western North Atlantic Ocean it ranges from Disco Bay in western Greenland south to Massachusetts during the summer, and from Hispaniola and Puerto Rico south to Trinidad during the winter.

*Abundance and trends.* The humpback whale was important, especially to shore stations, during the first half of the 20th century. Now, however, this mammal is so scarce that it will require a half century of complete protection for it to increase to a significant level. A few are killed in subsistence fisheries in Greenland, the Lesser Antilles, and the Tongo Islands. It has a minor value as a tourist attraction in Hawaii and southeastern Alaska. The original population size of the North Pacific Ocean is unknown, but is now severely depleted to about 1,200 individuals (Wada, 1972). The animals have apparently not increased since complete protection was given the species in 1966.

The original population size of the North Atlantic Ocean is unknown, and the western North Atlantic Ocean stock is now reduced to less than 1,000 animals (Allen, 1970). A small increase may have occurred in recent years. Estimates of the eastern North Atlantic Ocean population have not been made.

The original population of the Southern Hemisphere, which probably numbered about 100,000, now contains about 3,000 individuals (Chapman, in press; Masaki, 1972). The stock has apparently not increased since complete protection was given the species in 1964.

*General biology.* The humpback whale is much more heavily bodied than members of the genus *Balaenoptera,* and is characterized by its extremely long flippers. It feeds mainly on euphausiids, but also eats anchovies and sardines when available. The species attains sexual maturity at an age of 6 to 12 years, when males average 11.6 m long and females 11.9 m. The mating and calving season is from October to March in the Northern Hemisphere, and April to September in the Southern Hemisphere. The gestation period is 12 to 13 months and the calf nurses for about 11 months. The female rarely bears a calf 2 years in succession.

The humpback whale is heavily infested with three species of ectocommensal barnacles and with whale lice.

*Ecological problems.* None known.

*Allocation problems.* None at present.

*Current research.* Observers aboard research vessels and foreign whaling ships record sightings of humpback whales and routinely report them to the International Whaling Commission.

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ROUGH-TOOTHED DOLPHIN

(*Steno bredanensis*)

*Distribution and migration.* The rough-toothed dolphin inhabits tropical and warm temperature seas. It ranges in the western Atlantic Ocean from Virginia south. In the North Pacific Ocean it ranges north to southern Japan (35° N) where it is rare, and to the Hawaiian Islands where it is fairly common. It is unknown from the eastern North Pacific except for one stranding near San Francisco.

*Abundance and trends.* The rough-toothed dolphin is uncommon but not rare throughout most of its range. It is seldom caught in the Japanese dolphin fishery (Ohsumi, 1972), and has been recorded on a few occasions in the eastern tropical Pacific tuna fishery (NOAA, 1972).

*General biology.* This dolphin grows to about 2.4 m. Little is known of its biology or habits. Circular scars on its skin suggest that this species feeds on large squid.

*Ecological problems.* None known.

*Allocation problems.* None known.

*Current research.* The Oceanic Institute of Hawaii is studying this species in the wild.

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BOTTLENOSED DOLPHINS

(*Tursiops truncatus*)

*Distribution and migration.* The bottlenosed dolphin is widely distributed in temperate and tropical waters, but strays into much colder latitudes. In the western Atlantic Ocean, it ranges from southern Greenland and Canada to Patagonia, but is best known from New England southward through the West Indies and Caribbean. In the eastern Atlantic, it is found from the northeast Scandinavian coast to South Africa. In the eastern Pacific Ocean, its northern limit is probably Oregon, and it ranges south to Chile. In the western Pacific, it is found north to Japan and south to Australia and New Zealand. Its Pacific range includes the Hawaiian Islands, where it is said to be common. A subspecies, *T. t. aduncus*, may occur in the Indian Ocean and the tropical Indo-Pacific. A closely related form, *T. gilli*, is presently recognized as inhabiting the northern Gulf of California and waters along the west coast of Baja California and southern California. The geographical ranges and characters delimiting these named forms are still poorly defined. They may be a single species. Limited and subjective data suggest that populations are localized within about a 100-mile radius and that this speices does not make long migrations.

*Abundance and trends.* In the early 20th century, from 500 to 1,500 animals were killed annually off North Carolina (Townsend, 1914). A few bottlenosed dolphins are now taken for food in small open-boat pilot whale fisheries in the Lesser Antilles (St. Vincent, St. Lucia, Dominica) and some are harvested by Venezuelan fishermen. Several hundred bottlenosed dolphins have been taken each year off Florida, Mississippi, and Texas for display in marine aquariums and for research. Some of these animals are shipped alive to Hawaii, California, and Europe. Trends are based on subjective data, but it is believed that local populations of the southeastern United States are not now being reduced by these activities (D. K. Caldwell, pers. comm.).

*General biology.* Bottlenosed dolphins are 1.1 m long at birth and grow to 3.6 m in length and 650 kg in weight. Captive animals have become sexually mature at 6 years, but recent evidence suggests that this species normally breeds at about 12 years. Gestation lasts about one year, and calves may nurse for 1.5 to 2 years, although they begin to take solid food at age 6 months. Bleeding apparently occurs throughout the year, but the fact that most of the young are born during a certain time of year suggests that breeding, as well as calving, takes place in the spring and summer. This dolphin is likely to be seen in bays and lagoons, sometimes venturing far up large rivers. These dolphins are usually found close to shore and near islands, but some populations live well beyond the continental shelf. Bottlenosed dolphins are often seen in large loose schools of several hundred animals, which appear to consist of aggregations of small groups of no more than a dozen individuals. Humpback and right whales traveling along the Atlantic coast of Florida are almost always accompanied by bottlenosed dolphins. Bottlenosed dolphins feed on several species of fish, squid, and a few crustaceans. Bottlenosed dolphins have been trained to dive to a depth of about 305 m, from where they have returned within a few minutes. The estimated life span for this species is about 30 years, but it may be longer. Bottlenosed dolphins are extremely social and quick to learn a show routine or experimental procedure. They have been credited with a high order of intelligence, which has not been demonstrated experimentally.

*Ecological problems.* None known.

*Allocation problems.* Bottlenosed dolphins have been accused of harassing fishing efforts by biting fish and shrimp nets and some fishermen attempt to drive them away. Some fishermen consider this dolphin a threat to their activities. Bottlenosed dolphins are occasionally trapped accidentally in commercial fishing gear. In this way, a small number are lost in the eastern tropical Pacific tuna seine fishery. The effect on the population of taking these animals off the southeast United States for display and research is not understood and could become a problem.

*Current research.* Several agencies and institutions conduct or support research on the bottlenosed dolphin. Included are the Office of Naval Research, National Institutes of Health, National Science Foundation, and the American Philosophical Society. The University of Florida concentrates its research on general life history and ecological studies. The Florida State Museum is studying systematics. Research in physiology, echolocation, anatomy, life history and the behavior of captive and wild individuals has been done at the Naval Undersea Centers in San Diego and Hawaii. Studies on vision are being carried out by scientists from the University of Miami. The Dolfinarium at Harderwijk, Netherlands, has recently conducted studies of the physiology and handling of these animals.

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RISSO'S DOLPHIN, GRAMPUS

(*Grampus griseus*)

*Distribution and migration.* The Risso's dolphin ranges through all temperate and tropical seas. In western North America its northern limit is British Columbia, and it is sighted during the winter in central California. In the eastern United States it ranges from Massachusetts south. Strandings in Britain are most common during the summer. The species probably migrates to higher latitudes in warmer months.

*Abundance and trends.* Risso's dolphin was described in 1894 as "abundant" near Monterey Bay, California. (Daugherty, A. E., 1972). The species is uncommon but not rare throughout most of its range. Over 200 of these animals were sighted in one group during 1972 off the Washington coast. (Fiscus, Unpublished field notes, 1972).

*General biology.* Risso's dolphin grows to 3.6–4.0 m. Its skin commonly has long, narrow, white marks believed to be scars caused by others of the same species. Solitary animals or schools of 12 or less are generally observed. This species is frolicsome, and sometimes leaps clear of the water. Known foods are almost exclusively cephalopods.

*Ecological problems.* None known.

*Allocation problems.* None known.

*Current research.* None.

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WHITE-BEAKED DOLPHIN

(*Lagenorhynchus albirostris*)

*Distribution and migration.* The white-beaked dolphin inhabits the coastal waters of the North Atlantic Ocean from the Barents Sea and Davis Strait to France and Massachusetts. It is most common in the North Sea from the east coast of the United Kingdom to the Faroe Islands, and may winter in the southerly parts of the North Atlantic Ocean. It appears in Davis Strait in the spring and summer after the beluga and narwhal migrate north and leaves in autumn sometimes as late as November. It apparently ranges farther north into Arctic waters than its relative the white-sided dolphin.

*Abundance and trends.* This species is one of the more abundant of North Atlantic toothed whales. Schools of as many as 1,500 have been reported from the coast of Norway where it is attracted by herring (Fraser 1949).

Tomlin (1957) reports schools of several hundred and states that this species is taken commercially in Norway, but gives no statistics on the catch. He also mentions that it was once taken commercially in Davis Strait.

*General biology.* This gregarious species grows to 3.0 m; the calves are as

long as 1.2 m when born. The mating period is long, but limited to the warmer half of the year. Most of the calves are born during midsummer. Food is mainly fish such as herring, cod, whiting, and capelin, but also crustaceans and molluscs such as hermit crabs, whelks, and squids.

*Ecological problems.* Strandings of schools of up to 30 animals have been reported.

*Allocation problems.* None known.

*Current research.* None.

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ATLANTIC WHITE-SIDED DOLPHIN

(*Lagenorhynchus acutus*)

*Distribution and migration.* The Atlantic white-sided dolphin ranges the coastal waters of the North Atlantic Ocean from the Barents Sea and Davis Strait south to France and Cape Cod.

*Abundance and trends.* The status of this species is unknown. According to Tomilin (1957), "this dolphin is taken only in summer in the waters of Norway: the animals are trapped in the fjords, which they enter in vast schools pursuing herring. The take may reach 1,500 individuals at a time."

*General biology.* This species grows to 3.0 m. The young are born mostly in midsummer and are about 1.0 m in length. It feeds mostly on pelagic and benthopelagic fish such as mackerel, salmonids, and herring, and some crustaceans and molluscs such as *Pagurus* and *Buccinum*. Schools in excess of 1,000 animals have been reported while they were feeding; groups of 10 to 50 are normally seen.

*Ecological problems.* Stranded schools of up to 30 have been reported.

*Allocation problems.* None known.

*Current research.* None.

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PACIFIC WHITE-SIDED DOLPHIN

(*Lagenorhynchus obliquidens*)

*Distribution and migration.* The Pacific white-sided dolphin ranges the northern North Pacific from the coast of Japan and Baja California northward. It is found year round of California and Washington and in Alaska and Kurile Island waters during the summer, but has not been reported from the Bering Sea. It frequents the waters of the continental shelf and slope but on occasion has been sighted in large schools in offshore waters.

*Abundance and trends.* Norris and Prescott (1961) report the species as common off southern California in inshore waters in winter and spring and offshore in summer and fall. According to sighting reports in the National Marine Fisheries Service files, Seattle, and by Pike and MacAskie (1969), this species may be the most abundant dolphin north of southern California. No estimate of the size of the population along the west coast of North America has been made.

Nishiwaki (1972) estimates the population in Japanese waters to be between 30 and 50 thousand. Klumov (1959) reports that the Pacific white-sided dolphin is one of the two most numerous dolphins found in the late summer and fall in the Kurile Islands area, and forms schools of up to several thousand animals.

A few of these animals are taken for display in ocean aquaria.

*General biology.* This species grows to 2.3 m, and weighs up to 181 kg. A male 1.2 m in length with milk in its stomach was taken off Washington. It probably breeds in late spring to autumn, with a gestation period of 10–12 months. Schools of thousands are seen, often together with common and right-whale dolphins. It is active day and night, frolics, follows ships, dashes across ships' bows, and occasionally jumps clear of the surface. It adapts well to captivity. This dolphin feeds primarily on cephalopods and small fish such as herring, sardine, anchovy, and saury.

*Ecological problems.* None known.

*Allocation problems.* None known.

*Current research.* None.

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SARAWAK DOLPHIN

(*Lagenodelphis hosei*)

*Distribution and migration.* Only a single specimen of the Sarawak dolphin, from Borneo, was known to science until 25 of the mammals were taken in a tuna purse seine in the eastern tropical Pacific. Since then, it has been recorded from several widely separated localities in the Pacific and Indian Oceans: Durban, South Africa; near Sydney, Australia; Tokyo, Japan; and the Central Pacific south of Hawaii.

*Abundance and trends.* The animal is rare in collections and presumably not common in its habitat (Perrin et al., 1973).

*General biology.* Length at birth is approximately 1 m, and the adults are about 2.5 m long. This dolphin feeds on deep living fishes and squids.

*Ecological problems.* None known.

*Allocation problems.* Loss of Sarawak dolphins in the tuna fishery is minor in terms of absolute numbers, but may be significant considering the apparent extreme rarity of the animal. Twenty-nine of thirty-four identified specimens have been taken in tuna seines.

*Current research.* None.

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SPOTTED DOLPHIN

(*Stenella attenuata*)

(*S. frontalis*)

(*S. graffmani*)

(*S. dubia*)

*Distribution and migration.* Knowledge of the spotted dolphins is scanty, and their taxonomy is confused, but two species probably exist. The taxonomy used here is provisional. One form is confined to warm waters of the Atlantic and probably is *Stenella plagiodon* Cope. This species, the Atlantic spotted dolphin, is discussed in a separate status report. The other apparent species occurs in all tropical waters of the world, including the Atlantic Ocean, and has been identified as belonging to the four above-listed nominal species. Taxonomists do not agree on the taxonomy. The two apparent species are different in basic color pattern but both have spots.

The spotted dolphin occurs in the Gulf Stream adjacent to the U.S. east coast and in the Gulf of Mexico. Nothing is known of its migrations. It has not been recorded from the U.S. Pacific Coast, but it is the primary cetacean species involved in the tuna fishery in the eastern tropical Pacific, from Cabo San Lucas to Peru and west to approximately long. 145° W. It occurs around the Hawaiian Islands and in the U.S. Trust Territory. The maximum recorded movement of a single animal is 1,300 miles (2,080 km) in 236 days.

*Abundance and trends.* Population estimates and trends in abundance are not available for these species.

*General biology.* Length at birth of the race involved in the tuna fishery is about 0.8 m. Adults of the various races are 1.6-2.6 m long. Considerable geographic variations exist in external size and shape, coloration, and skeletal structure, with pronounced differences between coastal and offshore subspecies in the eastern Pacific. It feeds on small mesopelagic and epipelagic fishes and squids. In the eastern tropical Pacific, this species commonly associates with the spinner porpoise in mixed aggregations of up to several thousand animals.

*Ecological problems.* None known.

*Allocation problems.* Because of their association with yellowfin tuna, many of these mammals are taken incidentally during tuna harvesting operations by fishermen from Canada, France, Japan, Mexico, Panama, United States, and other countries in coastal and international waters in the eastern tropical Pacific (ETP).

*Current research.* The National Marine Fisheries Service and the tuna industry are assessing the effects of fishing mortality and improving rescue methods and gear to eliminate losses associated with the tuna harvest. Other research includes systematic and ecological studies by P. J. H. van Bree at the Zoological Museum in Amsterdam, W. Dawbin at Sydney University, and E. D. Mitchell at the Arctic Biological Station of the Fisheries Research Board of Canada in Ste. Anne de Bellevue, Quebec.

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ATLANTIC SPOTTED DOLPHIN

(*Stenella plagiodon*)

*Distribution and migration.* The Atlantic spotted dolphin (exact taxonomic position not yet known) is probably confined to tropical and subtropical waters of the Atlantic Ocean. It occurs on the U.S. Gulf coast and off the east coast in Gulf Stream waters, and may be restricted to continental waters, being replaced in the West Indies by some other species in this genus (probably *Stenella frontalis*). Seasonal inshore-offshore migrations occur in Florida waters, and perhaps elsewhere in the Gulf of Mexico, with animals moving close to shore in late spring.

*Abundance and trends.* Population estimates have not been made for this species. The only known fishery for the species has taken 12 or fewer animals per year for display, however, these animals do not easily withstand handling and captivity. Thus, an increased fishery for display animals is not likely.

*General biology.* The newborn are about 0.8 m long, and the adults reach 2.0–2.2 m in length. Little is known of the life history of this species. Except for the annual spring migrations to near shore, this species is considered a mammal of the outer continental shelf or adjacent high seas. Spotted dolphins appear to feed primarily on squid in the wild, but they readily adapt to a fish diet in captivity. Newborn and young animals are not spotted, but progress through a series of color changes until the adults become spotted all over except for the ventral surface near the belly. This species is subject to infestations externally by barnacles and whale lice, internally by trematodes in the stomach, liver, and pancreas, and nematodes in the lungs and stomach. In captivity and in cold weather, these animals easily contract pneumonia.

*Ecological problems.* Little is known about the ecology of this dolphin, but because it normally lives well offshore, it seems likely that it is affected little by man.

*Allocation problems.* None known.

*Current research.* Some information on this species has been gathered incidental to studies by the Office of Naval Research on the bottlenosed dolphin. Most of the recent research has been on various aspects of spund production by this species. However, David K. and Melba C. Caldwell have long been gathering general biological information at the Marine Mammal Center of the Communication Sciences Laboratory of the University of Florida located at Marineland, Florida (near St. Augustine).

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SPINNER DOLPHIN

(*Stenella longirostris*)

*Distribution and migration.* The spinner dolphin inhabits tropical inshore and offshore waters around the world. It has been recorded from the Gulf of Mexico, around the Hawaiian and Line Islands, and U.S. Trust Territory, but not from the U.S. Pacific Coast. It is involved in the U.S. tuna fishery in the eastern tropical Pacific, from Cabo San Lucas to Peru and west to about long. 145° W. Little is known of its migrations. The maximum recorded movement of a single animal is 280 miles (448 km) in 396 days.

*Abundance and trends.* Population estimates and trends in abundance are not available for this species.

*General biology.* Length at birth is approximately 0.8 m, and the adults grow to 1.5–2.2 m Pronounced geographical variations exist in external size and shape, coloration, and skeletal structure. In the eastern tropical Pacific, it commonly associates with the spotted porpoise in mixed aggregations of up to several thousand animals. The spinner dolphin feeds on small pelagic fishes and squids.

*Ecological problems.* None known.

*Allocation problems.* Because of its association with yellowfin tuna, this species is taken incidentally by fishermen from Canada, France, Japan, Mexico, Panama, United States, and other countries in coastal and international waters of the eastern tropical Pacific.

*Current research.* The National Marine Fisheries Service and the tuna fishing industry are assessing the effects of fishing mortality and improving rescue methods and gear to eliminate losses associated with the tuna harvest. Other research includes systematics and ecological studies by P. J. H. van Bree at the Zoological Museum in Amsterdam, W. Dawbin at Sydney University, and E. D. Mitchell at the Arctic Biological Station of the Fisheries Research Board of Canada in Ste. Anne de Bellevue, Quebec; and ethological studies by K. S. Norris at the University of California at Santa Cruz.

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STRIPED DOLPHIN

(*Stenella coeruleoalba*)

*Distribution and migration.* The striped dolphin inhabits temperate and tropical waters around the world, and has been recorded from both U. S. coasts. Nothing is known about the movements of striped dolphins in waters contiguous to the United States.

*Abundance and trends.* Population estimates and information on trends are not available for the U.S. or eastern tropical Pacific populations. The Japanese currently take about 5,000 striped dolphins per year (Kasuya, 1972).

*General biology.* Biological studies have been carried out on the population off Japan. The mean length of the newborn is 1 m, and the gestation period is 12 months long. The mean age at sexual maturity in males and females is 9 years, at 2.2 and 2.1 m, respectively. Lactation lasts about 18 months, and the mean length of the reproductive cycle is about 3 years. Schools of striped dolphins segregate somewhat by age and sex.

*Ecological problems.* None known.

*Allocation problems.* The striped dolphin is involved in the tuna fishery to a very minor extent; schools of this mammal apparently do not usually associate with the tuna.

*Current research.* A federal program of research recently begun by Japan is expected to yield an estimate of population size in the northwestern Pacific Ocean.

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COMMON DOLPHIN, SADDLEBACK DOLPHIN (ATLANTIC COAST), WHITEBELLY PORPOISE (PACIFIC COAST)

(*Delphinus delphis*)

*Distribution and migration.* This species is world wide in distribution in temperate to tropical waters of from 12°–28° C. There may be more than one species, recognizable differences do exist between populations. In the Northwestern Atlantic Ocean, this mammal ranges from Newfoundland to the Caribbean Sea. In the northeastern Pacific Ocean, the primary distribution of this species is from the California-Oregon border to Costa Rica, but one stranded animal was found in British Columbia. Large populations occur off southern California (Santa Barbara to San Diego), the west coast of Baja California, Mexico (Cedros Island to Cape San Lucas), and Costa Rica. A relatively large population also occurs in, and may be resident of, the Gulf of California. In southern California waters *Delphinus* is present throughout the year but is most abundant from August to January. A decrease in herd size during the spring and summer may be due primarily to the animals breaking up into small subgroups of 50 to 200 animals, and a general movement offshore and north.

*Abundance and trends.* The common dolphin is probably the most widespread and abundant delphinid. Herds of several thousand individuals have been reported. This species has been utilized in the Black, Mediterranean, and South China Seas, and off the east coast of Japan. Sleptsov (1940) estimated the Black Sea catch at 110,000 to 120,000 per year. Based on data from aerial surveys, Evans (pers. comm.) estimates a population of 10,000–15,000 in the limited area of the southern California continental borderland. The species has been displayed at Marineland of the Pacific and has been used in experiments and field studies by the National Marine Fisheries Service and the Department of the Navy.

*General biology.* The males grow to 2.6 m and are an average of 14 cm longer than females. The average individual of the northeastern Pacific Ocean is larger than that of the Black and Mediterranean Seas. The largest known specimen from the Black Sea was 212 cm, however, a male 259 cm long was taken from the northeastern Pacific Ocean. Males and females may segregate between mating seasons, especially when the latter are nursing calves or about to bear their young. The gestation period lasts 10–11 months with a post-parturition estrus. The young are 75–85 cm at birth. The young dolphin is weaned at about age 5–6 months (110–120 cm overall length), but may stay with the female up to 1 year. In the northeastern Pacific Ocean, this species appears to have two mating seasons (January–April and August–November), and two calving seasons (March–May and August–October). Herds containing 2,000 to 5,000 dolphins may form, but they appear to be made up of subgroups of 50 to 200 animals.

This species is seldom found inside the 100-fathom line, but it frequents sea mounts, escarpments, and other prominent offshore features. The animal makes most of its dives in excess of 10 fathoms after sunset. The deepest dive recorded is 140 fathoms, but the average dive is to 30 fathoms. During feeding, the animal usually stays under water for 2–3 minutes, but dives of 5 minutes have been recorded. This species is one of the fastest swimming cetaceans and has been clocked at a burst speed of 25–26 knots. Normal cruising speed is about 4–5 knots, with herds moving 40–50 nautical miles in 24 hours. It feeds mainly on anchovy, sprat, pelagic pipefish, and cephalopods in the Black Sea; whiting, horse mackerel, sardine, and hake in the Atlantic Ocean; and anchovy, myctophids, hake, and cephalopods in the northeastern Pacific Ocean.

Skin parasites are rare, but barnacles sometimes attach themselves to the trailing edge of the tail flukes. Remoras are also found on *Delphinus*, especially in tropical waters. Endoparasites include trematodes in the bile ducts, liver, intestine, and stomach; cestodes in the intestine, blubber, and mesentery; nematodes in the intestine, lungs, nasal sacs, and middle ear cavity; and acanthocephalans in the intestine. The brains of 12 stranded specimens contained flukes and their eggs, which in most cases had caused abscesses and lesions.

*Ecological problems.* Large sharks and the killer whale are the only known natural predators.

*Allocation problems.* Because the northern anchovy and squid constitute the bulk of this mammal's diet in the northeastern Pacific Ocean, a substantial increase in the fishery for these resources could have a noticeable effect on the porpoise populations. *Delphinus* is the third most important species of porpoise taken incidentally in the eastern tropical Pacific tuna purse seine fishery. Mexican tuna purse seiners fishing for skipjack in the eastern tropical Pacific and the Gulf of California account for an unknown amount of incidental catch.

*Current research.* The National Marine Fisheries Service and the tuna fishing industry are assessing the effects of fishing mortality and improving rescue methods and gear to eliminate losses associated with the tuna harvest. Studies of behavior, distribution, and abundance have been conducted by the Naval Undersea Center, San Diego, California, since 1968. This research will terminate at the end of FY '73.

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NORTHERN RIGHT WHALE DOLPHIN

(*Lissodelphis borealis*)

*Distribution and migration.* Little is known about the distribution of the northern right whale dolphin other than that it inhabits temperate waters of the North Pacific Ocean.

In the western North Pacific Ocean, the northern right whale dolphin is found from Cape Inubo, Japan, north as far as Etorofu and Paramushir Islands, from where it apparently migrates southward in autumn or winter to near the southern Kurils and is common, at least seasonally, in the northern Sea of Japan.

In the eastern North Pacific, this species has been reported from 30° to 50° north latitudes, though mostly from California. It occurs in the southern California continental borderland only from October or November to about April.

Though it is also oceanic, the right whale dolphin has been observed most frequently along the continental slope and near such features as sea mounts and banks. It has been seen close to the California Channel Islands and the mainland coast near San Diego and Palos Verdes. Two sightings and one specimen from the central Pacific suggest that the species may be continually distributed across the temperate North Pacific.

*Abundance and trends.* Groups of 200 are most common, but herds of an estimated size from 300 to 1,000 off Japan and up to 2,000 off southern California have been seen. Although the species was once thought to be uncommon, aerial surveys have revealed that it is abundant off the Pacific Coast of North America (Leatherwood, pers. comm.). This species is reportedly common in the northern Sea of Japan (Okada and Hanaoka, 1940), where it is harvested.

*General biology.* Newborn animals are about 0.6 m in length and grow to 3.1 m. The species is gregarious and is frequently reported in close association with the white-sided dolphin, with which it shares an extensive common range.

Right whale dolphins may reach speeds in excess of 25 knots in bursts. One entire herd averaged over 15 knots for 30 minutes while attempting escape from a helicopter. When approached, the animals may move away quietly or in a series of low angle leaps, each covering as much as 7 m. Individuals that are widely scattered when approached, bunch together tightly while fleeing from the cause of their disturbance.

Food is primarily squid, but also miscellaneous fishes, including myctophids and engraulids.

Parasites include trematodes and cestodes.

*Ecological problems.* If migrations are food dependent, decimation of food supplies in the southern end of its range could adversely affect the species.

*Allocation problems.* None known.

*Current research.* The only research known is an unfunded examination of all museum materials, collection of beached specimens, and survey of literature being conducted by J. S. Leatherwood, NUC, San Diego, and R. F. Green, Ventura College, Ventura, Calif.

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BROAD-BEAKED DOLPHIN

(*Peponocephala electra*)

*Distribution and migration. Peponocephala* inhabits the tropical Atlantic, Indian, and Pacific Oceans.

*Abundance and trends.* The status of this species is unknown, except that it is apparently rare (Nishiwaki and Norris, 1966).

*General biology.* Unknown.

*Ecological problems.* None known.

*Allocation problems.* None known.

*Current research.* None.

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PYGMY KILLER WHALE

(*Feresa attenuata*)

*Distribution and migration.* The pygmy killer whale probably inhabits most tropical waters.

*Abundance and trends.* The status of this species is unknown except that it is apparently rare (Caldwell and Caldwell, 1971). The species has been captured for exhibit in the oceanariums of Hawaii and Japan.

*General biology.* The adults reach about 2.4 m. In appearance they resemble a small false killer whale. They are aggressive in captivity.

*Ecological problems.* None known.

*Allocation problems.* This species has been reported taken incidentally to a very minor extent in the yellowfin tuna fishery in the eastern tropical Pacific.

*Current Research.* None.

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FALSE KILLER WHALE

(*Pseudorca crassidens*)

*Distribution and migration.* The false killer whale ranges through all temperate and tropical seas. It is an oceanic form, found on the Atlantic side of the United States from North Carolina south, and on the Pacific side from the Aleutian Islands south.

*Abundance and trends.* This species is uncommon throughout most of its range. It is seldom caught in the Japanese small whale fishery but is common on the Pacific side of Honshu (Ohsumi, 1972).

*General biology.* The males grow to 6.1 m and the females to 4.9 m; adult animals weigh up to 1,360 kg. Mating appears to be over a protracted period, with young born at about 1.8 m. False killer whales are found in schools of both sexes and all ages. They have been seen eating dolphinfish (mahi-mahi) off Hawaii.

*Ecological problems.* Schools of up to 835 of these animals have stranded.

*Allocation problems.* The Japanese state that a toothed whale (shachi), which may or may not be the false killer whale, does much damage to their longline tuna industry by feeding on hooked fish.

*Current research.* None.

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COMMON PILOT WHALE, POTHEAD, BLACKFISH

(*Globicephala melaena*)

*Distribution and migration.* This pilot whale inhabits the North Atlantic Ocean south to Virginia and the Mediterranean. It is a schooling mammal and appears regularly off the Canadian and United States coasts. It generally favors pelagic regions, but often moves close to shore in search of food.

*Abundance and trends.* The status of this species is unknown. A total of 3,000 to 4,000 was killed annually in local Newfoundland fisheries up to the early 1950's (Sergeant, 1962), but only a few have been taken in recent years. About 177,000 were taken in the Faroe Islands from 1584 to 1883 (Tomilin, 1957) and several hundred per year are still being harvested there and in Norway.

*General biology.* The adults grow to about 6.5 m; females are usually mature at age 6 to 7 years and males at about age 12. Calves are about 1.8 m long at birth, in July to August, although full-term fetuses have been found year round. Cows probably bear calves every 3 years, the gestation period is about 16 months, and lactation lasts about 2 years. Pilot whales are gregarious, and occur in schools of hundreds and thousands. They have a distinct social organization, however, the sex ratio is not always equal in stranded groups. They are believed polygamous by some, with bachelor males sometimes forming separate schools. They travel in tight schools when not feeding, and disperse into scattered groups when on feeding grounds. Captive pilot whales feed at night and sleep days. They have a top swimming speed of over 25 mph, and a longevity of about 50 years. They feed almost exclusively on squids, but also eat small fish such as clupeids and gadids. Sergeant estimates food intake per year at about 11.5 times the weight of the animal.

*Ecological problems.* Whole schools sometimes strand.

*Allocation problems.* None known.

*Current research.* None.

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SHORT-FINNED PILOT WHALE

(*Globicephala macrorhyncha*)

*Distribution and migration.* In the North Atlantic Ocean, this pilot whale ranges north to New Jersey and Madiera. In the North Pacific Ocean it is found from Japan and the Aleutian Islands south to New Zealand and Peru. It is an oceanic species with a very wide range. Schools of pilot whales appear regularly off U.S. coasts. It generally favors offshore waters, but often moves close to land in search of food. Greatest numbers are seen in the North Atlantic and North Pacific in summer, fewer in winter.

*Abundance and trends.* The status of this species is unknown except that it is fairly abundant around the California Channel Islands (D. W. Rice, unpublished data). Many pilot whales are taken in the Japanese small-whale fishery. This species is also taken in the lesser Antilles.

*General biology.* The adults grow to 4.6–6.7 m. Little work has been done on this species, but indications are that the general biology is similar to *G. melaena*.

*Ecological problems.* Schools of this species often strand.

*Allocation problems.* None known.

*Current research.* The taxonomy of Pacific *Globicephala* is being studied by R. L. Brownell and D. K. Caldwell in the United States, and T. Kasuya and M. Nishiwaki in Japan. The U.S. Navy is studying the behavior and distribution of the pilot whale.

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KILLER WHALE

(*Orcinus orca*)

*Distribution and migration.* The killer whale is worldwide and ranges north and south to polar ice. It is more common in cooler waters, and in more productive coastal areas. The Strait of Georgia in British Columbia, Prince William Sound in Alaska, and Puget Sound in Washington State are areas of concentration. Migratory habits are probably dependent on food supply, and killer whales are most numerous in Puget Sound in November and late summer. In Japan, most of these mammals are taken from April to November, with the greatest number from August to November. In the Norway fishery, killer whales seem dependent on distribution and migration of herring, capelin, and cod.

*Abundance and trends.* Authoritative estimates of the world population are not available. A limited cooperative effort of the Fisheries Research Board of Canada and the Washington State Depart-

ment of Game primarily in the inside waters of Washington and British Columbia gave counts of 459 killer whales in 1971 and 255 in 1972. About 60 individuals have been removed from inside waters of British Columbia and northern Washington State during the past 7 years for display by marine aquariums. An additional nine were killed during U.S. capture operations, mostly during the early years. The number of killer whales killed in Canadian capture operations is not known. The Japanese fishery took 567 killer whales from the Okhotsk Sea to south of Japan from 1948 to 1957. Norwegians harvested 1,417 in the northeastern North Atlantic between 1938 and 1967.

*General biology.* Females grow to 7.0 m and males to 8.2 m. Males weigh up to about 8,000 kg, with about 4,000 kg the apparent limit for females. An adult male dorsal fin may be 1.8 m high, considerably higher than that of the female. Breeding appears to occur year-round, although it may peak in May to July; gestation lasts 13 to 16 months. Newborn calves are about 2.4 m long and weigh about 180 kg. In the Northern Hemisphere births occur mostly in autumn. Killer whales usually are found in groups of about 10 to 100 or even more. The males are probably polygamous. Killer whales hunt successfully in packs, but there are no records of attacks on people. The stomach contents of 364 killer whales taken off Japan from 1948 to 1957 included (in order of occurrence): Fish (mostly cod, flatfish, and sardines), squid, octopus, dolphins, whales, and seals. Salmon constituted 1.6 percent of all stomach contents. Soviets in the Kurils recorded "fish and squid" but no marine mammal remains in 10 animals. Of 10 killer whales examined by the National Marine Fisheries Service, Seattle, 6 adult males had only marine mammal remains except for 1 squid; 1 adult female and 1 immature male had only fish remains.

The most common diseases are those caused by wearing of tooth crowns and denudation of the pulp cavity, which results in abscesses. Other diseases include bony outgrowths and bone tumors. Parasites include nematodes, cestodes, and trematodes. One Puget Sound killer whale stomach contained 5,000 nematodes.

*Ecological problems.* This species has no natural enemies except man. Stranding probably is the greatest nonhuman hazard.

*Allocation problems.* Public interest in killer whales was stimulated by the first live capture in 1964 in British Columbia. Growing public interest is increasing in killer whales as a recreational resource, especially in Puget Sound. The animals are commercially valuable in the United States for display in oceanariums. U.S., Japanese, and Canadian fishermen contend that the whales cause gear damage and interfere with salmon and tuna long-line fisheries. Many consider killer whales an important predator of salmon and herring; others defend them as the natural enemy of other fish eaters, including harbor seals and sea lions. Some sport salmon fishermen claim their presence spoils fishing.

*Current research.* The National Marine Fisheries Service and the Fisheries Research Board of Canada are studying killer whale distribution in western U.S. and Canadian waters.

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## Harbor Porpoise

### (*Phocoena simus* and *Phocoena phocoena*)

*Distribution and migration.* There are four recognized species of harbor porpoise, but only the two found in the waters of the Northern Hemisphere are discussed here. One species, *Phocoena simus*, is apparently restricted in range to the Gulf of California. *P. phocoena* is circumpolar in distribution in ice-free seas, ranging south in the Atlantic Ocean to the Delaware River and the Mediterranean Sea. In the Pacific Ocean it is found south to Japan and southern California, although it is not abundant south of San Francisco.

The harbor porpoise is an inshore species, frequenting coastal waters, the mouths of large rivers, harbors, and bays, and sometimes ascending freshwater streams.

*Abundance and trends.* The harbor porpoise is especially abundant in the waters of Washington (Scheffer and Slipp, 1948) and western Canada (Pike and MacAskie, 1969). Tomlin (1957) reports single catches of 2,000 to 2,500 harbor porpoises at the time they migrate between the Sea of Azov and the Black Sea.

Møhl-Hansen (1954) reporting on biological investigations of the harbor porpoise in Danish waters examined 188 harbor porpoises in 1941–42, 230 in 1942–43, and 212 in 1943–44, so at least those numbers were commercially harvested in Denmark during those years. He also states that these harbor porpoises were from the Baltic Sea populations.

*General biology.* This species grows to 1.8 m, and weighs up to 72 kg. The females are sexually mature at about age 3–4 years. Newborn calves are half the length of the mother. They breed annually during late spring and summer. The gestation period is 10–11 months, and the calves nurse up to 8 months. Harbor porpoises travel in pairs and schools of up to 200 or more, especially on the feeding grounds. This species is less playful than most dolphins or porpoises; they seldom jump out of the water, and usually ignore passing boats. Schools containing all "bachelors" are common; the females stay in groups of mixed sex. Usually they swim just below the sufrace, rising about 4 times per minute to breathe when not feeding. They feed mainly on bottom fishes such as cod, herring fry, flounder, and occasionally on invertebrates such as squids, clams, and crustaceans.

*Ecological problems.* These animals occasionally strand for unknown reasons, and because of their feeding habits, a few tend to get trapped in fishermen's nets.

*Allocation problems.* None known.

*Current research.* None.

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## Dall Porpoise

### (*Phocoenoides dalli*)

*Distribution and migration.* The Dall porpoise inhabits the North Pacific Ocean from Japan and southern California to the Bering and Okhotsk Seas. It appears to migrate twice yearly off the coasts of Japan and California, and may move inshore in winter and offshore in summer. The Dall porpoise is a regular winter visitor to southern California, and has been observed in the Channel Islands area from October to summer. It has been seen off San Francisco Bay from March to October, off Monterey Bay throughout the year, and may be present year round where food is adequate.

*Abundance and trends.* The Dall porpoise is one of the most abundant small cetaceans found in Alaskan inside waters (U.S. Forest Service) and in British Columbia waters (Pike and MacAskie, 1969). It is commonly seen off northern California (W. J. Houck, pers. comm.). Mizue and Yoshida (1965) report an annual accidental catch of more than 10,000 Dall porpoise in the Japanese high seas salmon gillnet fishery in the northern North Pacific and Bering Sea west of 175° W longitude. They also state the Dall porpoise is east of 175° W longitude but that the Japanese fishing fleet does not operate east of the boundary.

The Marine Mammal Division has many records of Dall porpoise ranging from the Bering Sea and the eastern Aleutian Islands south to latitude 34° in California waters (MMD files, Marine mammal observations, 1958–72).

*General biology.* The Dall porpoise grows to about 2.2 m and a weight of about 218 kg. It and the killer whale have the most conspicuous color patterns among cetaceans. Calves are born in the spring and summer, and young are observed in August. These animals are usually found in groups of 2 to 20, but occasionally 200 or more are seen on favorable feeding grounds. It plays in the bow waves of ships, and is among the swiftest of all marine mammals. This mammal consumes squid and such fish as saury, hake, herring, jack mackerel, and bathypelagic and deep-water benthic fish.

*Ecological problems.* None known.

*Allocation problems.* None known.

*Current research.* W. J. Houck is studying *P. dalli* and *P. truei* at Humboldt State College in California, and M. Nishiwaki is studying these species in Japan. G. V. Morejohn is studying feeding habits, migration, behavior, and morphology of the species at the Moss Landing Marine Station, California.

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BELUGA, WHITE WHALE

(*Delphinapterus leucas*)

*Distribution and migration.* The beluga whale inhabits the Arctic Ocean and adjacent seas, including the Okhotsk and Bering Seas, Cook Inlet, Hudson Bay, and Gulf of St. Lawrence. Beluga whales ascend several hundred miles up the larger rivers of Siberia and Alaska. Three races are recognized: *dorofeevi* from the Okhotsk Sea; *marisalbi* in the Barents and White Seas; and *leucas* in the rest of the range. In the Pacific, beluga whales are common along the Alaska coast as far south as Bristol Bay and an apparently separate population is found in Cook Inlet.

*Abundance and trends.* In Alaska beluga whales have been used as a source of muktuk, meat, and oil for both people and dogs by residents of villages on the Bering Sea and Arctic Ocean coasts and along rivers that belugas periodically ascend. In recent years the demand for beluga products has been reduced in the Arctic. Lensink (1961) estimated an annual harvest of 400 to 500 beluga whales in Alaska. In Bristol Bay only a few belugas are now taken, and the estimated annual harvest of the Bering Sea-Arctic Ocean coasts is 150 to 300 (Alaska Department of Fish and Game, 1973). The Cook Inlet, Alaska, population is estimated at 300 to 500. In Bristol Bay the population is estimated at 1,000 to 1,500 and is considered stable. The size of the beluga population in Alaska north of Bristol Bay is unknown, but is much greater than that residing in Bristol Bay (op. cit.). Sergeant (1962) states that from 1948 to 1960 the catch of beluga whales in the Canadian arctic averaged 1,200 annually. In the late 1950's the annual catch of beluga whales averaged 3,000–4,000 in the U.S.S.R., 500–800 in Greenland, and 100–200 from Spitsbergen (Kleinberg et al., 1964).

*General biology.* Males grow to 4.6 m and the females to 4.0 m in the Beaufort Sea, and to 5.2 m and 4.6 m, respectively, in the Soviet arctic. The beluga is polygamous, breeds in the spring, has a gestation period of 13–14 months, and newborn are about 1.5 m in length. Some females are both pregnant and lactating, suggesting that they calve in alternate years. They are gregarious and travel in groups of 2 or 3 to hundreds. Belugas feed from midwater to the bottom, with a diet including fish such as salmon, capelin, cisco, pike, char, cod, squid, crustaceans, and nereid worms. They frequently occur in shallow areas with a bottom of mud, sand, and stones. The beluga produces high-pitched whistles and squeals, ticking and clucking sounds, and have been given the name "sea-canary." Animals break the ice with their backs to reach air for breathing.

Parasites include nematodes in the respiratory organs, ears, circulatory system, intestine, and urogenital system; trematodes are found in the intestine, as well as cestodes and acanthocephalans. Helminths are apparently one cause of mortality.

*Ecological problems.* Known natural enemies include the killer whale and polar bear.

*Allocation problems.* These mammals take salmon at the mouths of large Alaskan rivers, and are important predators of salmon smolt in Bristol Bay, Alaska. Recorded killer whale sounds have been used experimentally to prevent beluga predation in the Kvichak River.

*Current research.* None known.

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NARWHAL

(*Monodon monoceros*)

*Distribution and migration.* The narwhal is the most northern cetacean and occurs in north polar seas, including the entire Arctic Ocean, but is mainly found in the North Atlantic Ocean region. It is most common in northwestern Greenland and the eastern Canadian arctic, particularly Jones and Lancaster Sounds, the north and east coasts of Baffin Island, Repulse Bay, and occasionally in northern Foxe Basin and Hudson Strait. Narwhals also occur near Franz Josef Land and Novaya Zemlya. They are rare in the Laptev, East Siberian, Chukchi, and Beaufort Seas.

*Abundance and trends.* The Canadian population is estimated at about 10,000, with smaller numbers in northwestern Greenland (Mansfield, pers. comm.). Numbers elsewhere are unknown. Extremely rare occurrences in Great Britain (4) and Holland (1) are documented. Narwhals are hunted in Greenland and the eastern Canadian arctic for dog food, muktuk, sinew, and ivory.

*General biology.* Narwhals grow to 4.6 m in length and adult males to 1,550 kg. The young are born in May and June at about 1.5 m in length. Males have a tusk (canine tooth) which is usually the left one and occasionally both. Sometimes females also have a tusk. The tusk grows as a spiraled rod to 2.0 m in length, and distinguishes narwhals from all other whales. Gestation appears to last about 14 months, since well-developed fetuses are present in July and August. Usually only one calf is produced. Narwhals are gregarious, forming schools of up to one or two thousand, made up of small groups of up to about 20 (Mansfield, pers. comm.). Speculations on the tusk function are numerous and the tusk may only be a secondary sexual characteristic. Food of the narwhal consists mainly of cephalopods, polar cod, and Greenland turbot.

Ectoparasitic whale lice occur in cuts, skinfolds, and around the base of the tusk. Endoparasitic nematodes occur occasionally in the stomach, and frequently in basicranial sinuses.

*Ecological problems.* Narwhals are occasionally trapped in large numbers by rapid freeze-up. In such situations, Greenlanders may kill entire groups of these mammals. Although it is not adapted to drift ice areas, the killer whale probably occurs there and may be a natural enemy of the narwhal.

*Allocation problems.* None known.

*Current research.* The narwhal is being studied by the Fisheries Research Board of Canada.

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### Sperm Whale

### (*Physeter catodon*)

*Distribution and migration.* The sperm whale is nearly world wide in distribution except for the pack ice of the polar regions. Females and immature animals are generally found between 40° S and 50° N latitudes. Sperm whales appear to migrate north during the northern summer and south during the northern winter. In the North Pacific, male sperm whales are found as far north as the Bering and Okhotsk Seas; in the North Atlantic they move into Davis Strait and near Spitzbergen.

*Abundance and trends.* Information on this section is from the annual reports of the International Whaling Commission (1972, In press) and from recent reports of the Bureau of International Whaling Statistics. Stocks available for commercial harvest are estimated at about 70,000 males and 184,000 females for the North Pacific and 128,000 males and 295,000 females for the southern oceans. Estimates of the number of immature animals are not available. The Northwest Atlantic has an estimated total stock of all ages of about 22,000. The sperm whale is currently the most important species of the world whaling industry. Stocks in most areas are above maximum sustainable yield levels.

Catches of sperm whales in recent seasons have been:

| Season | North Pacific | Atlantic | Southern oceans, pelagic [1] | Southern land stations |
|---|---|---|---|---|
| 1969 | 11,329 males<br>3,605 females | [2] 640 | 5,390 | 4,011 |
| 1970 | 11,236 males<br>3,579 females | 649 | 5,891 | 4,135 |
| 1971 | 8,295 males<br>2,595 females | 558 | 7,335 | 4,498 |

[1] Southern oceans catches are for the seasons 1969/70 1970/71, 1971/72, respectively.
[2] All catch data except North Pacific include males and females.

*General biology.* The sperm whale's large squarish head is distinctive because it bears a tank-like "case" containing spermaceti. The lower jaw is long and narrow, and has about 25 pairs of teeth. Females reach 11.6 m in body length, males 16.8 m. This species dives to at least about 1,000 m, can remain submerged for about an hour, and feeds mainly on large squid. It also consumes significant quantities of octopuses and demersal and mesopelagic fishes. Females and juveniles of both sexes form schools of 10–50 animals, averaging about 25. Younger, sexually mature males (ca. 11.0–13.4 m, age 15–25 years) form "bachelor" schools usually containing not more than 10 animals. Older males (13.7 m, 22–27 years) are usually solitary except when with schools of females for breeding for about 5 months in the spring and early summer. The females mature sexually at about age 8 to 11 years when body length is about 8.5 to 9.1 m, physically at 25 to 30 years and a body length of 11.0 m. Males are not sexually mature until about 19 years and 11.9 m, and are not "socially" mature until about age 25 years. Growth of males continues until they are 45 to 60 years old, and about 15.5 m long. The female bears a calf (about 4.0 m) once every 3 to 5 years. Gestation lasts 14–15 months, and the calf nurses 1–2 years and is weaned at about 6.7 m long.

*Ecological problems.* None known.

*Allocation problems.* None known.

*Current research.* The National Marine Fisheries Service is studying the life history of the sperm whale. Other organizations carrying out research on this species are the Japanese Whales Research Institute and Japanese Far Seas Fisheries Research Laboratory (North Pacific and Antarctic), Fisheries Research Board of Canada (North Atlantic), British National Institute of Oceanography (South Africa and western South America), South African Division of Sea Fisheries (South Africa), Australian Commonwealth Scientific and Industrial Research Organization (Australia), the University of Chile (Chile), the Marine Institute of Peru (Peru), and the Marine Department of New Zealand (New Zealand).

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### Pygmy Sperm Whale

### (*Kogia breviceps*)

*Distribution and migration.* The pygmy sperm whale occurs in all the warmer seas of the world. In the Pacific Ocean it ranges north to Washington and Japan; in the Atlantic Ocean it ranges north to Nova Scotia and the Netherlands.

*Abundance and trends.* The status of this species is unknown other than the fact that it is apparently rather rare. There are many more records of stranding than there are for *Kogia simus*, the dwarf sperm whale (C. O. Handley, Jr., pers. comm.). This species is occasionally taken in the Japanese small-whale fishery (Yamada, 1954).

*General biology.* Adult pygmy sperm whales are 2.7 to 3.4 m long. Their dorsal fin is low and posterior to the center of the back. This species was long confused with the dwarf sperm whale, and the following composite statement is based on both species. They are usually solitary or in small pods. They feed mostly on squid but also take pelagic crustaceans such as shrimps and giant mysids. Females simultaneously pregnant and lactating have been found, suggesting that they may bear a calf 2 years in succession.

Parasites include tapeworm cysts in the blubber, roundworms in the stomach, and giant kidney worms.

*Ecological problems.* None known.

*Allocation problems.* None known.

*Current research.* None.

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Yamada, M. 1954. Some remarks on the pygmy sperm whale, *Kogia*. Sci. Rep. Whales Res. Inst., 9: 37–58.

### Dwarf Sperm Whale

### (*Kogia simus*)

*Distribution and migration.* The dwarf sperm whale apparently has a discontinuous distribution around the world. It has been found in the seas adjacent to South Africa, India, Ceylon, Japan, Hawaii, South Australia, and the west and east coasts of the United States. On the west coast it has been recorded only

from Cabo San Lazaro, Baja California, and San Luis Obispo County, California. On the east coast it ranges from Cape Henry, Virginia, south and west to Texas.

*Abundance and trends.* The status of this species is unknown other than the fact that it is apparently rather rare over much of its range. However, it strands rather frequently on the southeast coast of the United States and is taken in the Japanese small-whale fishery (Yamada, 1954).

*General biology.* Adult dwarf sperm whales are 2.1 to 2.7 m long. Their dorsal fin is high and near the center of the back. This species was long confused with the pygmy sperm whale, and the following is a composite statement based on both species. They are usually solitary or in small pods. They feed mostly on squid but also take pelagic crustaceans such as shrimps and giant mysids. Females simultaneously pregnant and lactating have been found, suggesting that they may bear a calf 2 years in succession.

Parasites include tapeworm cysts in the blubber, roundworms in the stomach, and giant kidney worms.

*Ecological problems.* None known.

*Allocation problems.* None known

*Current research.* None.

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NORTH SEA BEAKED WHALE

(*Mesoplodon bidens*)

*Distribution and migration.* The North Sea beaked whale ranges mostly from the western Baltic Sea and central Norway south to the Bay of Biscay. It has been recorded in the western North Atlantic Ocean from Newfoundland and Massachusetts. Its migrations are unknown.

*Abundance and trends.* The status of this species is unknown, except that it is apparently rare. (Moore, 1966).

*General biology.* This species is the only one of its genus for which even rudimentary life history data are available. These beaked whales attain a maximum length of 5.5 m for males and 4.9 m for females. Mating and birth usually take place in late winter and spring. The gestation period is about 1 year. At birth the calf is between 1.8 and 2.1 m long, nurses for about 1 year, and at weaning is probably about 3.0 m long.

*Ecological problems.* None known.

*Allocation problems.* None known.

*Current research.* None.

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ANTILLEAN BEAKED WHALE

(*Mesoplodon europaeus*)

*Distribution and migration.* The Antillean beaked whale ranges from Trinidad, Jamaica, and the Gulf of Mexico, north to Long Island, New York. One record for the English Channel has been obtained. Its migrations are unknown.

*Abundance and trends.* The status of this species is unknown, except that it is apparently rare (Moore, 1966).

*General biology.* These whales are known mostly from stranded individuals, which suggest that they are usually solitary. Otherwise, nothing is known of their biology.

*Ecological problems.* None known.

*Allocation problems.* None known.

*Current research.* None.

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TRUE'S BEAKED WHALE

(*Mesoplodon mirus*)

*Distribution and migration.* The True's beaked whale has been found in the western North Atlantic Ocean from Nova Scotia south to northern Florida, and in the eastern North Atlantic Ocean from the Outer Hebrides south along the west coast of Ireland. There is another population off the coast of South Africa. Its migrations are unknown.

*Abundance and trends.* The status of this species is unknown, except that it is apparently rare (Moore, 1966; 1968).

*General biology.* These whales are known mostly from stranded individuals, which suggest that they are usually solitary. Otherwise, nothing is known of their biology.

*Ecological problems.* None known.

*Allocation problems.* None known.

*Current research.* None.

REFERENCES

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BERING SEA BEAKED WHALE

(*Mesoplodon stejnegeri*)

*Distribution and migration.* The Bering Sea beaked whale is endemic to the North Pacific Ocean. It ranges from the Commander and Pribilof Islands, Bristol Bay, and the northern Gulf of Alaska south to the Sea of Japan on the western side and Oregon on the eastern side. Its migrations are unknown.

*Abundance and trends.* The status of this species is unknown, except that it is apparently rare (Moore, 1966; 1968).

*General biology.* These whales are known mostly from stranded individuals, which suggest that they are usually solitary. Otherwise nothing is known of their biology.

*Ecological problems.* None known.

*Allocation problems.* None known.

*Current research.* None.

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ARCH-BEAKED WHALE

(*Mesoplodon carlhubbsi*)

*Distribution and migration.* The arch-beaked whale has been recorded only in the North Pacific Ocean, from the Sanriku coast of Hokkaido on the western side and from British Columbia south to southern California on the eastern side. Its migrations are unknown.

*Abundance and trends.* The status of this species is unknown, except that it is apparently rare (Moore, 1966; 1968).

*General biology.* These whales are known mostly from stranded individuals, which suggest that they are usually solitary. Otherwise, nothing is known of their biology.

*Ecological problems.* None known.

*Allocation problems.* None known.

*Current research.* None.

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### Ginkgo-Toothed Whale

### (*Mesoplodon ginkgodens*)

*Distribution and migration.* The ginkgo-toothed whale has been recorded from Ceylon, in the western North Pacific Ocean from Taiwan to the Sanriku coast of Hokkaido, and in the eastern North Pacific Ocean at Del Mar in southern California. Its migrations are unknown.

*Abundance and trends.* The status of this species is unknown, except that it may not be so rare in the western part of the North Pacific as once thought (Nishiwaki et al., 1972).

*General biology.* These whales are known mostly from stranded individuals, which suggest that they are usually solitary. Otherwise, nothing is known of their biology.

*Ecological problems.* None known.

*Allocation problems.* None known.

*Current research.* None. Present knowledge is based on opportunistic examination of specimens.

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### Dense-Beaked Whale

### (*Mesoplodon densirostris*)

*Distribution and migration.* The dense-beaked whale is widely, but perhaps discontinuously, distributed in tropical and warm temperate waters around the world. In the North Pacific Ocean it has been recorded from Taiwan, Japan, and Midway Island. In the North Atlantic Ocean it has been recorded from Nova Scotia south to the Bahamas on the western side, and from Madeira on the eastern side.

*Abundance and trends.* The status of this species is unknown, except that it is apparently rare (Besharse, 1971; Moore, 1966).

*General biology.* These whales are known mostly from stranded individuals, which suggest that they are usually solitary. Otherwise, nothing is known of their biology.

*Ecological problems.* None known.

*Allocation problems.* None known.

*Current research.* None.

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### Goose-Beaked Whale

### (*Ziphius cavirostris*)

*Distribution and migration.* The goose-beaked whale is found in all oceans except Arctic and Antarctic waters. In the North Pacific Ocean it ranges north to Hokkaido, the Commander and Aleutian Islands, and the Queen Charlotte Islands. In the North Atlantic Ocean it ranges north to Cape Cod, Massachusetts, on the western side and the Shetland and Orkney Islands on the eastern side. Its migrations are not understood.

*Abundance and trends.* The status of this species is unknown. The goose-beaked whale is the most frequently observed ziphiid, at least in the eastern North Pacific Ocean, and throughout its range has been found stranded far more often than any other species of the family (Mitchell, 1968). Between 13 and 16 goose-beaked whales have been taken annually in the Japanese small-whale fishery during the past 5 years (Nishiwaki and Oguro, 1972).

*General biology.* The goose-beaked whale is distinguishable from other ziphiids by its relatively short beak, the dorsal profile of which forms an almost straight line with the steeply sloping forehead, and by its brown coloration; older males have snow-white heads. The maximum body length in both sexes is about 7.0 m. These whales usually travel in tight schools of up to about 10 individuals, but old males are often solitary. Their main foods are squids and deep-water fishes. Sexual maturity is attained at a length of about 5.5 m in both sexes.

*Ecological problems.* None known.

*Allocation problems.* None known.

*Current research.* Research on this species has been conducted incidentally to other studies in Japan by the Whales Research Institute and the Ocean Research Institute.

#### REFERENCES

Mitchell, E. 1968. Northeast Pacific stranding distribution and seasonality of Cuvier's beaked whale *Ziphius cavirostris*. Can. J. Zool., 46: 265–279.

### Giant Bottlenose Whale

### (*Berardius bairdi*)

*Distribution and migration.* The giant bottlenose whale is endemic to the North Pacific Ocean, where it ranges from St. Matthew Island in the Bering Sea south to central Honshu on the western side and southern California on the eastern side. Its migrations are poorly known.

*Abundance and trends.* The status of this species is unknown except that it is uncommon but not rare. According to information taken from the Bureau of International Whaling Statistics, between 100 and 400 giant bottlenose whales have been taken annually in the Japanese small-whale fishery during the past 20 years.

*General biology.* This species is the largest of the beaked whales. Males attain a maximum length of 11.9 m and females 12.8 m. Their long narrow beak, bulging forehead, and size distinguish them from other species of beaked whales in the North Pacific Ocean. They usually travel in tight schools of up to 30 individuals. Their main foods are deep-water fishes and squids. Males attain sexual maturity at a length of about 10.0 m, and females at about 10.3 m. Sexual maturity is not attained earlier than age 3 years, and probably much later. Mating takes place mostly in February, and calves are born in December.

*Ecological problems.* None known.

*Allocation problems.* None known.

*Current research.* Research on this species has been conducted incidentally to other studies in Japan by the Whales Research Institute and the Ocean Research Institute; in California by the National Marine Fisheries Service; and in British Columbia by the Fisheries Research Board of Canada.

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### North Atlantic Bottlenose Whale

### (*Hyperoodon ampullatus*)

*Distribution and migration.* This species of bottlenose whale is endemic to the colder waters of the North Atlantic Ocean. On the western side it ranges from Davis Strait south to Rhode Island; on the eastern side it ranges from Novaya Zemlya south to the Azores and English Channel. It migrates south in the autumn and north in the spring.

*Abundance and trends.* The status of this species is unknown, except that it is fairly common in at least parts of its range. According to records from International Whaling Statistics between 260 and 700 of these animals have been taken annually throughout the North Atlantic Ocean by the Norwegian small-whale fishery. A few individuals are sometimes taken by whalers operating from Nova Scotia and the Faeroe Islands.

*General biology.* The bottlenose whale is easily recognized by a conspicuous beak that is sharply demarked from the high bulging forehead which, in old males, becomes almost vertical and flattened in front and slightly overhangs the base of the beak. Bottlenose whales

are black when young, turn brown when adult, and almost yellow with a white head when very old. Males attain a maximum length of 10.7 m, and females 9.7 m. They usually travel in small herds of 4 to 10, but the adult males are often by themselves. Their food appears to be mainly squids. Females attain sexual maturity when about 6.5 m long. The calves are born from early spring to early summer.

*Ecological problems.* None known.

*Allocation problems.* None known.

*Current research.* This species is being studied by the Statens Institutt for Hvalforskning, Oslo, Norway.

REFERENCES

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CONTRIBUTORS OUTSIDE THE DEPARTMENT OF COMMERCE TO THE STATUS OF STOCKS REPORT

Brooks, James W., Alaska Department of Fish and Game, Subport Building, Juneau, AK 99801.

Brownell, Robert L., Jr., Museo Nacional de Historia Natural, Casilla 399, Montevideo, Uruguay.

Burns, John J., Alaska Department of Fish and Game, 1300 College Road, Fairbanks, AK 99701.

Caldwell, David K., Communication Sciences Laboratory, Route 1, Box 122, St. Augustine, FL 32804.

Caldwell, Melba C., Communications Sciences Labortory, Route 1, Box 122, St. Augustine, Fla 32804.

Carlisle, John G., California State Fisheries Laboratory, Marine Resources Region, 350 Golden Shore, Long Beach, CA 90802.

Chapman, Douglas G., College of Fisheries, University of Washington, Seattle, WA 98195.

Drury, William H., Massachusetts Audobon Society Lincoln, MA 01773.

Durham, Floyd, Department of Biology, University of Southern California, Los Angeles, CA 90007.

Evans, William E., Naval Undersea Research and Development Center, San Diego, CA 92132.

Fay, Francis H., Arctic Health Research Center, U.S. Public Health Service, Fairbanks, AK 99701.

Gates, Doyle E., California Department of Fish and Game, Marine Resources Region, 350 Golden Shore, Long Beach, CA 90802.

Handley, Charles O., Jr., Department of Vertebrate Zoology, Smithsonian Institution, Washington, DC 20560.

Houck, Warren J., Division of Biological Sciences, Humboldt State University, Arcata, CA 95521.

Leatherwood, James S., Marine Life Sciences Laboratory, Naval Undersea Research and Development Center, San Diego, CA 92132.

Mansfield, Arthur W., Arctic Biological Station, Fisheries Research Board of Canada, P.O. Box 400, Ste. Anne de Bellevue, P.Q., Canada.

Mead, James G., Smithsonian Institution, National Museum of Natural History, Washington, DC 20560.

Norris, Kenneth S., University of California at Santa Cruz, Santa Cruz, CA 95060.

Ray, G. Carleton, Department of Pathobiology, Johns Hopkins University, 615 North Wolfe Street, Baltimore, MD 21205.

Scheffer, Victor B., 14806 SE., 54th Street, Bellevue, WA 98006.

Siniff, Don B., Department of Ecology and Behavior, JFB Museum of Natural History, University of Minnesota, Minneapolis, MN 55453.

Vania, John S., Marine Mammal Studies, Alaska Department of Fish and Game, 1018 International Airport Road, Anchorage, AK 99502.

Ximénez, Isaías, SOYP Depto Cientifico y Tecnico del Servicio, Oceanografico y de Pesca, Juan Lindolfo Cuestas 1409, Montevideo, Uruguay.

MARINE MAMMAL LAWS

Each marine mammal of U.S. concern is protected by one or more U.S. laws or acts, and the conservation of some species is at least partially assured by international treaty or law. A summary of the various laws, conventions, and commissions designed and enacted to protect marine mammals follows:

1. *Marine Mammal Protection Act of 1972.* A U.S. federal law that prohibits U.S. citizens from taking, harassing, or importing any marine mammal or its byproducts into the United States, except when authorized to do so by special permit. Indians, Eskimos, and Aleuts of the North Pacific and Arctic Oceans can take marine mammals for subsistence, and for creating and selling handicraft items and clothing as long as the stocks can support the harvest.

2. *Endangered Species Conservation Act.* The purposes of this Act, which became effective June 3, 1970 with respect to whales, is to provide a program for the conservation, protection, restoration, and propagation of selected species that are threatened with extinction. The Act bans the hunting, capturing, killing, or importing of products derived from species protected under the Act.

3. *International Whaling Convention.* The International Whaling Commission (IWC) was established under a convention signed in Washington, D.C. in December 1946. The membership includes all countries that catch significant numbers of whales except Spain, Portugal, Chile, Peru, and Brazil. The IWC is responsible for whale conservation worldwide. Since 1964, the IWC has acted to bring world whaling under control by prohibiting worldwide the taking of some species, sharply reducing the authorized catches of species in certain areas, establishing catch quotas by species, and implementing an international observer plan for policing quotas and regulations at land stations and on factory ships. The IWC appears to be extending its authority to cover all cetaceans and to implement regulations for threatened species. The IWC now regulates the harvest of fin, sei, Bryde's, minke, and sperm whales. A subcommittee of the IWC may be established to improve data collection on small cetaceans and review problems. The gray, bowhead, right, blue, and humpback whales are completely protected, except for some hunting by aboriginals.

4. *International Convention on Trade in Endangered Species of Wild Fauna and Flora.* When this convention becomes effective, it will provide additional protection for the following species: Appendix I—gray, blue, humpback, bowhead, and right whales, northern elephant seal, Ganges River dolphin, Caribbean and Mediterranean monk seals, dugong, and West Indian and South American manatees; Appendix II—southern elephant seal, southern fur seal, Galapagos fur seal, Juan Fernandez fur seal, dugong (Australian), and West African manatee.

5. *Interim Convention on North Pacific Fur Seals.* This Convention prohibits most citizens of Japan, Canada, the U.S.S.R., and the United States from taking northern fur seals. The exceptions are aboriginal Indians, Aleuts, and Eskimos, who may take them only at sea and by primitive methods. The Convention also provides for intensive research on this species by the four countries. The economic utilization of northern fur seals on their breeding grounds is conducted by the respective governments and is regulated on a scientific basis.

6. *International Convention for the Northwest Atlantic Fisheries.* Under terms of a Convention signed in 1949, ICNAF is responsible for the investigation, protection, and conservation of the fisheries of the Northwest Atlantic in order to make possible the maintenance of a maximum sustained catch from these fisheries. The harp seal harvest is regulated by ICNAF, which imposes quotas for the taking of these mammals.

7. *International Convention for the Conservation of Antarctic Seals, 1972.* The purpose of this Convention is to safeguard all species of Antarctic seals and to ensure that, if commercial sealing begins on floating ice of the Southern Ocean, the killing of certain species will be prohibited and the taking of other species will be subject to strict limitations. Measures adopted under the Antarctic Treaty of 1959 provide only for the protection of seals and other animals around the shoreline of the Antarctic Continent, but not on floating ice. The Convention of 1972 may be applicable to any or all of the following seals: southern elephant, leopard, Weddell, crabeater, Ross, and southern fur seals.

8. *Canadian-Norwegian Agreement on Sealing.* On December 22, 1971, these two governments ratified an agreement on sealing and the conservation of seal stocks in the Northwest Atlantic. The

agreement applies to the harp seal, but provision is made for extension to hooded and bearded seals and to the walrus.

9. *Miscellaneous regulations and agreements of some U.S. interest.* a. *Harp seal.* The U.S.S.R. and Norway signed an agreement in 1958 entitled "Preservation of seals in the Greenland Sea." The agreement provides for the regulation of harp seal catches by these two nations. The U.S.S.R., however, has not hunted harp seals since 1965.

b. *Gray seal.* The U.S.S.R. has prohibited (since 1970) the hunting of gray seals for sport and by amateurs, but permits the taking of these animals for subsistence. Canada uses an 1886 law for authority in regulating the take of gray seals. England has prohibited the hunting of gray seals on the Farne Islands since 1932 and on Orkney Island since 1923. Norway has forbidden hunting at Sör Trondelag (since 1923). Finland and Sweden offer bonuses for gray seals taken.

c. *Hooded seal.* Canada and Norway prohibit the taking of hooded seals near Newfoundland before March 10, near Jan Mayen Island before March 13, in Denmark Strait from June 15 to July 15, and in northern waters from March 20 to May 5. The U.S.S.R. and Norway in 1958 agreed to prohibit the harvest of hooded seals near Jan Mayen Island before March 13, and banned hunting in Denmark Strait.

d. *Bearded seal.* The U.S.S.R. has, since 1970, banned the commercial hunting of bearded seals from vessels, and regulates the take of this species by aborigines and the harvest from shore by others.

e. *Ribbon seal.* Since the 1960's, the U.S.S.R. has forbidden the hunting of ribbon seals at sea from March 1 to September 1, and in 1970 stopped hunting by "amateurs."

f. *Ringed seal.* The U.S.S.R. banned sport hunting of *Pusa hispida hispida* beginning in 1970. Sport hunting of another subspecies (apparently accepted by the U.S.S.R. as *P. h. krascheninikovi*) was also banned by the U.S.S.R. in that year, local harvests were regulated, and hunting of the subspecies between March 1 and September 1 was prohibited. The U.S.S.R. has also, since 1970, prevented commercial hunting of *P. h. ochotensis* from vessels, and regulated the take of this subspecies by aborigines and the harvest from shore by others.

g. *Harbor seal—Ice-dwelling populations.* The U.S.S.R. has prohibited sport hunting of these populations of the harbor seal since 1970, protects its rookeries from harassment and pollution, and regulates the harvest.

*Land-dwelling populations.* The U.S.S.R. has prohibited the sport hunting of these populations since 1970, and regulates the take of harbor seals from the White and Barents Seas.

h. *Northern sea lion.* The U.S.S.R. regulates the harvest of northern sea lions and protects its rookeries from harassment.

i. *Walrus.* In 1958, the U.S.S.R. and Norway agreed to ban the hunting of walrus except to satisfy local needs and those of expeditions.

j. *Guadalupe fur seal.* Mexico has safeguarded the breeding grounds of the Guadalupe fur seal on the Guadalupe Islands by making this island a wildlife refuge.

k. *South American fur seal.* The Uruguayan and Argentinian Governments protect the South American fur seal on land and out to 200 miles at sea. In addition, the Uruguayan Government regulates the harvest by protecting all female seals except the 1-year-olds, controlling take of pups by seasonal restrictions, and imposing quotas in some instances.

l. *South African fur seal.* The harvest of South African fur seals is largely a state enterprise in South Africa, however, the system includes one of control and leasing of rookeries to private contractors. The South West African Administration has not entered the harvesting business, but licenses private firms, restricts gear to be used, establishes closed seasons, and places limits on sex and condition of catch.

m. *Narwhal.* Canada allows its Eskimos to take five narwhals annually for personal use and issues permits to capture this mammal for exhibition.

n. *Killer whale.* Canada allows this species to be taken under a permit system.

## PART III—APPENDICES

Appendix A—Interim Rules and Regulations: FEDERAL REGISTER reference 37 FR 28177

Appendix B—FEDERAL REGISTER Notices: FEDERAL REGISTER references, 38 FR 2340; 38 FR 7987; 38 FR 8610; 38 FR 10032; 38 FR 10484; 38 FR 12145; and 38 FR 16088

Appendix C—Public Display Requirements

Appendix D—Coordinated Pribilof Islands-Bering Sea Research Proposal

### APPENDIX C

#### PUBLIC DISPLAY REQUIREMENTS

1. *Advance notification.* The Holder shall notify the Director by telegram sufficiently in advance of each collecting trip so as to enable him to arrange for an official or officials of the Service or any other person(s) duly designated by the Director to accompany the collecting crew if the Director so desires. Where possible such notice shall be given at least two weeks in advance.

2. *The methods of transportation of living marine mammals.* a. Except in the case of a marine mammal being transported in connection with the taking operation, the Holder shall transport no marine mammal until it has fasted for 12 hours.

b. The Holder shall employ a duly certificated common carrier by air, water, rail, or road in the transportation of any marine mammal, except that the Holder may use a private vehicle for such transportation if such vehicle is operated by Holder's personnel and the provisions of this subsection are complied with in the course of the transportation involved.

c. The Holder shall be responsible for the transportation of the marine mammal from the capture site to the Holder's facilities and shall insure that the provisions of this subsection are complied with in the course of this transportation.

d. The cargo space of any airplane, railroad car, or truck in which a mammal is to be transported shall be constructed and maintained so as to prevent the ingress of the vehicle's exhaust gases or other noxious fumes. The interior of the animal cargo space shall be kept physically clean. The ambient temperature shall be sufficiently regulated by heating or cooling to protect the animals from extremes of temperature, to provide for their health, and to prevent their discomfort.

e. The primary enclosures, such as compartments, transport cages, stretchers, or slings shall be well constructed, well ventilated, and designed to protect the health and assure the safety of the animals. Such devices shall be made and positioned in such a manner that (1) each animal in the vehicle has access to air for normal breathing, (2) the openings of the devices are easily accessible at all times for emergency removal of the animals, and (3) the animals are afforded adequate protection from the elements.

f. Primary enclosures for shipping marine mammals shall be watertight and of adequate size so that the animal is supported in a manner allowing even distribution of weight over as large an area as possible. Padding with foam rubber or polyfoam to prevent pressure necrosis is essential. Animals shall be kept moist over the entire body surface to prevent drying of the skin and overheating.

g. All aspects of the transportation plans must be found satisfactory by a duly license doctor of veterinary medicine.

3. *The methods of care and maintenance of living marine mammals*—a. *Facilities, general*—(1) *Structural strength.* The facility must be constructed of such material and of such strength as appropriate for the animals involved. The housing facilities shall be structurally sound and shall be maintained in good repair to protect the animals from injury and to contain the animals in a comfortable fashion.

(2) *Water and power.* Reliable and adequate electric power, if required to comply with other provisions of this subpart, and adequate circulating water, sufficient to meet USPHS standards for human bathing areas, and standards of salinity and temperature, shall be available on the premises. Controlled chlorine injection shall not exceed 0.4 p.p.m. and shall be monitored at least every 24 hours.

(3) *Storage.* Supplies of food shall be stored in facilities which adequately protect such supplies against deterioration, molding, or contamination by vermin. Refrigeration shall be provided for supplies of perishable food.

(4) *Waste disposal.* Provisions shall be made for the removal and disposal of animal and food wastes, dead animals, trash, and debris. Disposal facilities shall be so provided and operated as to minimize vermin infestation, odors, and disease hazards. The disposal facilities and any disposal of animal and food wastes, dead animals, trash, and debris shall comply with applicable Federal, State, and local laws and regulations relating to pollution control or the protection of the environment.

(5) *Washroom and sinks.* Facilities such as washrooms, basins, showers, or sinks, shall be provided to maintain cleanliness among animal caretakers.

b. *Facilities, indoor*—(1) *Ambient temperatures.* Temperatures of air and water in indoor housing facilities shall be sufficiently regulated by heating or cooling to protect the animals from the extremes of temperature, to provide for their health, and to prevent their discomfort. The ambient temperature shall not be allowed to fall below nor rise above temperatures compatible with the

health and comfort of the animal. Insofar as possible, water temperature shall be maintained at or near the natural temperature of the water in the wild from which the animal was taken.

(2) *Ventilation.* Indoor housing facilities shall be adequately ventilated by natural and/or mechanical means to provide for the health and to prevent discomfort of the animals at all times. Such facilities shall be provided with fresh air by means of windows, doors, vents, fans, and/or air-conditioning and shall be ventilated so as to minimize drafts, odors, and moisture condensation.

(3) *Lighting.* Indoor housing facilities shall have ample lighting, by natural or artificial means, or both, of good quality, distribution, and duration as appropriate for the species involved. Such lighting shall be uniformly distributed and of sufficient intensity to permit routine inspection and cleaning. Lighting of primary enclosures shall be designed to protect the animals from excessive illumination.

(4) *Drainage.* A suitable sanitary method shall be provided to rapidly eliminate excess water from indoor housing facilities. Drains shall be properly constructed and kept in good repair to avoid foul odors and installed so as to prevent any backup of sewage. The method of drainage shall comply with applicable Federal, State, and local laws and regulations relating to pollution control and/or the protection of the environment.

c. *Facilities, outdoor*—(1) *Shelter from sunlight.* When sunlight is likely to cause overheating or discomfort of the animals, sufficient shade by natural or artificial means shall be provided to allow all animals kept outdoors to protect themselves from sunlight.

(2) *Shelter from inclement weather.* Natural or artificial shelter appropriate to the local climatic conditions for the species concerned shall be provided for all animals kept outdoors to afford them protection and to prevent discomfort. Individual animals shall be acclimated before they are exposed to the extremes of the individual climate.

(3) *Drainage.* A suitable sanitary method shall be provided to rapidly eliminate excess water. Drains shall be properly constructed and kept in good repair to avoid foul odors and installed so as to prevent any backup of sewage. The method of drainage shall comply with applicable Federal, State, and local laws and regulations relating to pollution control and/or the protection of the environment.

d. *Space requirements.* Enclosures shall be constructed and maintained so as to provide sufficient space to allow each animal to make normal postural and social adjustments with adequate freedom of movement. Inadequate space may be indicated by evidence of malnutrition, poor condition, debility, stress, or abnormal behavior patterns. The minimum size of enclosures for cetaceans shall be a diameter of not less than twice the length of the animal, and a depth of not less than half the length of the animal. The adequacy of the space for all animals shall be satisfactory to the Director.

e. *Feeding.* (1) The food shall be wholesome, palatable, free from contamination, and of sufficient quantity and nutritive value to maintain all animals in good health. The diet shall be prepared with consideration for the age, species, condition, size, and type of animal. Insofar as possible the animal's natural food in the wild shall be used.

Considering the marked propensity of fresh fish to develop deficiencies and toxic properties, proper handling and storage are required and the use of pasteurized, more stable and balanced rations, as they become available, are encouraged. Animals shall be fed at least once a day except as dictated by hibernation, normal fasts, veterinary treatment, or other professionally accepted practices.

(2) Food receptacles shall be kept clean and sanitary at all times. Adequate measures shall be taken to thaw frozen fish in manner to prevent contamination and minimize deterioration and loss of soluble nutrients.

f. *Water.* If fresh seawater or artificial seawater is not accessible to the animals at all times, it must be provided as often as necessary for the health and comfort of the animal. The frequency of need for seawater shall be dictated by considerations of age, species, condition, size, and type of the animal on the basis of generally acceptable veterinary standards. Salinity where required shall be maintained at 15 to 36 parts per thousand.

g. *Sanitation*—(1) *Cleaning of enclosures.* Excreta shall be removed from primary enclosures as often as necessary to prevent contamination of the animals contained therein, to minimize disease hazards, and to reduce odors.

(2) *Sanitation of enclosures.* Whenever an animal in the facility is discovered with infectious or transmissible diseases, the cages, rooms, and hard-surfaced pens and pools shall be sanitized either by washing them with hot water (180° F. at source) and soap or detergent, as in a mechanical washer, or by washing all soiled surfaces with a detergent solution followed by a safe and effective disinfectant, or by cleaning all soiled surfaces with saturated live steam under pressure. Pens and pools using gravels, sand, or dirt, shall be sanitized when necessary as directed by the attending veterinarian.

(3) *Housekeeping.* Premises (buildings and grounds) shall be kept clean and in good repair in order to protect the animals from injury and to facilitate the prescribed husbandry practices set forth in this subpart. Accumulations of trash shall be placed in designated areas and cleared as necessary to protect the health of the animals.

(4) *Pest control.* A safe and effective program for the control of insects, ectoparasites, and avian and mammalian pests shall be established and maintained.

h. *Employees.* A sufficient number of adequately trained employees shall be utilized to maintain the professionally acceptable level of husbandry practices set forth in this subpart. Such practices shall be under a supervisor who has background in animal care. A doctor of veterinary medicine shall be on the staff of the Holder or otherwise generally available to the Holder when needed.

i. *Separation.* Animals housed in the same primary enclosure must be compatible. Animals shall not be housed near animals that interfere with their health or cause them discomfort. Socially dependent animals should not be needlessly deprived of the company of other compatible animals.

7. *Requirements with regard to reports and rights of inspection*—a. *Reports.* Within 90 days following October 20, 1973, and annually thereafter, the Holder shall submit a report to the Director covering the Holder's performance of the activities authorized by this exemption. Such report shall be in such form and provide such substantive coverage as hereafter shall be required by the Director.

The Holder shall submit such other reports as the Director may hereafter require.

b. *Inspection.* Upon request by the Director, the Holder shall permit any employee(s) of the National Marine Fisheries Service or any other person(s) duly designated by the Director, to inspect the Holder's records and facilities insofar as such records and facilities pertain to activities authorized by this exemption, relate to species covered by this exemption, or pertain to the Director's responsibilities under the Act.

8. *Additional terms and conditions to be prescribed.* Additional reasonable terms and conditions may hereafter be prescribed by the Director.

9. *General conditions.* a. No marine mammal authorized to be taken or imported hereunder, as the case may be, shall be taken by the Holder or any other person, in violation of the law of any country having jurisdiction over the taking.

b. Except as otherwise agreed to by the State involved, no marine mammal authorized to be taken hereunder shall be taken in waters under the jurisdiction of a State unless the method of taking and subsequent transportation conforms with the laws and regulations of that State which were in force and effect on December 20, 1972.

c. The Holder shall neither take nor import any mammal which is pregnant, a lactating female, or is an unweaned young mammal.

d. Any marine mammal taken or imported pursuant to the terms hereof may not be displayed at any facility of the Holder other than the facility for which the exemption was sought, unless specific permission is requested and obtained from the Director. However, the Holder may hold the mammals at another facility acceptable to the Director in the manner required hereunder.

e. In the event any marine mammal is killed or injured during the course of taking, the Holder shall notify the Director as soon as possible but no later than 30 days after the event. For the purpose of this exemption, any marine mammal killed during the taking process or transportation after taking shall be considered as having been taken and the number of live animals of the kind permitted to be taken or imported shall be reduced accordingly unless the Director determines that the death was due to causes beyond the control of the Holder, in which case the Holder shall be entitled to take an additional animal.

Furthermore, if the Holder determines within 30 days after the taking of any marine mammal that such mammal is unacceptable for his purposes, then he shall be permitted to take an additional mammal; *Provided,* The unacceptable mammal is disposed of in a manner satisfactory to the Director: *And provided further,* That in the case of death the Director determines that such death was due to causes beyond the control of the Holder. The foregoing replacement privilege shall not apply in any case in which the Director does not determine that the status of the stock to which the animal in question belongs will not be threatened by any further taking.

f. No marine mammal may be imported unless the Director determines that the methods of taking, holding, and transporting marine mammals in the country of origin are consistent with the provisions and policies of the Act.

g. All marine mammals must be taken in a humane manner. In the event the Director determines that any method of taking authorized herein or otherwise is not humane, taking by such method shall immediately cease and taking shall not resume until an acceptable method of taking has been prescribed by the Director. Any inhumane taking shall subject the Holder to the penalties of the Act, including revocation of this Letter of Exemption.

h. This exemption does not authorize the Holder or any other person to take marine mammals in the territorial waters of any country without the consent of such country. The Holder is responsible for securing such consent and complying with appropriate laws of that country.

i. The Holder is authorized to conduct scientific research on any marine mammal taken hereunder provided such scientific re-

search reasonably can be expected not to cause death or permanent injury to the animal and is approved in advance by the Director.

j. The Holder agrees to abide by any reasonable condition with respect to the maintenance and care of captive marine mammals recommended by the Marine Mammal Commission within a year of its formation.

k. Any display program in which any of the marine mammals taken or imported hereunder are to participate shall be designed so as not to fatigue or overwork the mammals. A duly licensed veterinarian shall certify to the Director that any display programs involving any mammals taken or imported pursuant to this Letter of Exemption will not unduly fatigue or injure such mammals.

l. All personnel of the Holder, including veterinarians, requiring State or Federal licenses to practice their profession shall be, and so long as employed by the Holder in that capacity, remain duly licensed under the appropriate law.

m. The provisions of this Letter of Exemption may be amended upon reasonable notice by the Director.

n. The Holder shall be responsible for the activities of any individual relating to the taking, transportation or maintenance and care of any marine mammal authorized to be taken or imported hereunder.

Under the terms of the Regulations, a violation of any of the terms and conditions of this Letter of Exemption shall subject the Holder to penalties provided in the Act.

o. The Act and regulations prescribe that a reasonable fee will be charged for this Letter of Exemption. You will be advised within 60 days of the established fee.

j. *Veterinary care.* (1) Programs of disease prevention and parasite control, euthanasia, and adequate veterinary care shall be established and maintained under the supervision of a veterinarian. The pest control program shall be reviewed by the veterinarian for the safe use of materials and methods.

(2) Animals shall be observed every day by the person in charge of the care of the animals or by someone working under this direct supervision. Sick, diseased, stressed, injured, or lame animals shall be provided with veterinary care or humanely destroyed as specifically authorized by a licensed veterinarian.

(3) In the event of the humane destruction of an animal pursuant to subsection j(2) above, the Holder shall perform an autopsy on the animal and, within seven days of the death of such animal, shall notify the appropriate regional office of the National Marine Fisheries Service of the death and send to such office a copy of the autopsy report.

(4) Any pregnant animal shall receive proper veterinary attention. All births involving any animal taken under this exemption shall be reported to the Director.

4. *Sale or disposition of mammals or progeny.* The Holder shall not sell or otherwise dispose of (1) any mammal the taking or importation of which is authorized by this exemption, or the progeny of any such mammal, or (2) any mammal in his possession or control on the date of the issuance of this exemption which is of the same species as any mammal the taking or importation of which is authorized by this exemption, or the progeny of such a mammal, except with the approval of the Director and subject to such terms and conditions as the Director may prescribe. All animals subject to this paragraph shall be marked or otherwise identified in a manner satisfactory to the Director.

5. *Period of validity.* The exemption granted herewith is valid for the period beginning with the date of its issuance and ending at midnight, Eastern Standard Time, on October 20, 1973. The Holder shall neither take nor import into the United States any mammals the taking or importing of which is authorized by this exemption after the expiration of the above period.

6. *Transferability and assignability.* The Holder shall not transfer or assign the exemption granted herein to any other person, as person is defined in Section 3(10) of the Act. This exemption is of no force and effect if transferred or assigned to any other such person.

## APPENDIX D

### COORDINATED PRIBILOF ISLANDS-BERING SEA RESEARCH PROPOSAL

*Introduction.* The fur seals of the Pribilof Islands have been studied by U.S. scientists with varying degrees of effort since 1867 when the Pribiloff Islands became a part of the United States. Since 1956, the population has been studied intensively in an effort to fulfill the following overall objectives of the Interim Convention on the Conservation of North Pacific Fur Seals:

1. "What measures may be necessary to make possible the maximum sustainable productivity of the fur seal resources so that the fur seal populations can be brought to and maintained at the levels which will provide the greatest harvest year after year;" and

2. "What the relationship is between fur seals and other living marine resources, and whether fur seals have detrimental effects on other living marine resoures substantially exploited by any of the Parties and, if so, to what extent."

The need for coordinated land-pelagic studies was pointed out at the 1972 meeting of the North Pacific Fur Seal Commission. Each delegation was called upon "to be prepared at their next meeting to submit plans for achieving more effective coordination of land and pelagic research to resolve the primary questions posed by the Interim Convention."

Although we now know much about the fur seal, the factors which act to control population size are not fully understood, and the relationship of these mammals to their environment and to other living marine resources has received little consideration. This proposal for a coordinated land and pelagic research effort is intended to provide additional knowledge concerning the primary questions posed by the Convention.

*Statement of the problem.* Management procedures set in motion in 1956 have not resulted in the predicted number of harvestable animals. By 1962 the total population was reduced to 1.2 million animals with an annual pup production of 300,000 to 400,000. From such an annual production a harvestable population of 55,000 to 60,000 males and 10,000 to 30,000 females was anticipated. This has not materialized. The average harvestable total of males has been 43,000 vs. the expected 55,000. A similar situation was evolving for females and in 1969 all harvest of females was stopped. Since our attempt to further manipulate the fur seal population has not succeeded, the problem is to identify the principal factors which control this population.

Management of the fur seal population has been based on the premise that by the mid-1950's the herd had exceeded the level that would provide maximum yield. In practice, management is limited to changing the utilization rate of males and females and thus to regulating abundance and the sex ratio. Beginning in 1956, therefore, females were killed with the objective of reducing the population to a level which would produce about 400,000 pups annually. The expected result was that the total harvest would increase and then stabilize with an estimated sustained yield of 55,000 to 60,000 males and 10,000 to 30,000 females.

Estimates of the number of pups born based on shearing and sampling show that the population of approximately 1.2 million animals has been near the desired level since 1962. During this recent period the number of pups born annually has been between 300,000 and 400,000. The average annual harvest of males from 1965 through 1972, the years when year classes since 1962 have contributed most or all of the harvest, was about 43,000. This harvest is considerably lower than expected from historical data. For instance, we estimate that the number of pups born reached 300,000 in 1929 and increased to slightly over 400,000 in 1933. Thus the number of pups born annually from 1929 to 1933 was similar to the number born annually since 1962. Males from year classes 1929–1933 were harvested primarily during the period 1932 through 1937 when the average annual take was 53,600, compared with 43,000 for recent year classes when similar numbers of pups were born. Even considering the shortcomings of these calculations, it is difficult to reach but one conclusion; namely, that the number of males available for harvest from recent year classes has decreased, compared to year classes of similar size in the early 1930's.

The number of males taken from a year class is believed to be a reasonably accurate index of the total number available because the harvesting effort has changed little since the 1930's. Minor modifications made since 1956 probably have increased the utilization rate slightly, which means that the difference in the number of males available during the two periods was even greater than is indicated by the average harvest figures.

The reasons for the disparity between actual and expected harvests are not known, but a decrease in the survival rate through age 2 years is believed to be the most likely cause of the smaller total harvest. It seems unlikely that the foregoing deviations from "normal" harvests are the result of random fluctuations in survival. The total Pribilof Islands harvest for males has exceeded 50,000 only twice since 1962 and has been less than 40,000 for 3 of the last 4 years. Survival rates will fluctuate randomly, but to be consistently low for such a long period seems improbable.

Individually or combined, several factors could be causing a decline in the survival rate. The availability of food probably has decreased in recent years because of the tremendous increase in the harvest of certain fishes and invertebrates from the Bering Sea and North Pacific within the past 2 decades. Some of the species taken are preferred items in the diet of fur seals. Research and management activities could also be factors because they may disrupt nursing cycles and lessen the intake of food by the pups before they are weaned, as well as increase the amount of energy used. Relatively long term changes in the ocean environment, disease, and pollution are additional factors that may affect survival rates.

Because harvesting is an unnatural cause of mortality, it is also possible that after several generations the gene pool of the population has been modified to the extent that survival or behavior has been altered. If change in the gene pool has occurred, its consequences might be impossible to appraise. With a better understanding of behavior, however, we can perhaps design a harvest that will resemble random mortality, which in turn would have no selective effect on the gene pool.

If the survival rates is lower now than during the early 1930's when the population was at a similar level, then it is uncertain if the relation of survival and abundance calculated from data collected from the 1920's through the mid-1950's is applicable. Therefore, changes in management necessary for

obtaining maximum sustainable yields from the fur seal population are not obvious; in fact, it is possible that the significant mortality factors now operating on the seal population are not density related.

The success of future management of the fur seal herd will depend considerably on our understanding of how survival changes with changes in abundance (survival-abundance relationship), the relationship of fur seals to other living marine resources, and on our ability to predict these relationships. To date, we are unable to confidently describe either of these relationships, and because of their complexity, we may never obtain irrefutable evidence on which to base an understanding. However, every reasonable opportunity to obtain relevant data should be attempted.

In summary, the approach to studying this problem is three pronged: (1) The relationship between survival and abundance is not understood, especially in view of the returns from recent year classes; (2) the relationship of fur seals to other living marine resources is also not understood; and (3) the effect of management and research activities on the fur seal population is not known.

OBJECTIVES

A. Determine how survival changes with changes in abundance of the fur seal population.

B. Determine the relationship of fur seals to major living marine resources.

C. Compare the biological and behavioral characteristics of a harvested and unharvested population.

Because of their complexity, the first two objectives probably will never be attained to the extent that the relationships will be understood precisely. However, sufficient information can be obtained for making predictions with the accuracy and confidence needed for application to resource management. The third objective appears to be less complex, and useful results should accumulate within a relatively short time span.

RESEARCH PROPOSAL

*The General Plan.* Research on wild animal populations is complicated by uncontrollable factors that affect the results. This situation has existed with respect to studies of the fur seal and has been a serious obstacle of evaluating the effects of recent management practices on the population. The establishment of a "control" area (one on which the animals are not harvested) will partially solve the problem. Commercial harvesting on St. George Island will be halted for a sufficient period for the fur seals to resemble, as near as possible, a "natural" population. Probably 15 years will be required; but it would be unwise to establish a fixed period at this time.

The land research plan will primarily emphasize comparative studies of harvested and unharvested populations. Subpopulations on St. George Island will be used, at least partially, as "controls" in an attempt to identify and measure the effects of management. For example, the major change that will occur on the control areas is a change in the sex ratio among adult animals. As the sex ratio changes, results of quantitative and observational studies on the control area will be compared to those from areas being harvested to determine the optimum sex ratio.

The control areas will also provide the opportunity to obtain knowledge from a "natural" population. If the causes of mortality of the unharvested population can be identified as the population approaches the maximum levels, those that are density related can be recognized. The "natural" population will also serve as a standard against which changes in the harvested population can be compared.

Another important value of control areas will be the knowledge gained from studying seals on undisturbed hauling grounds. To date, it has not been possible to describe the basic hauling-out pattern of young males or to identify factors that may affect this behavior.

Studies of fur seals in their pelagic environment will be intensified in the Bering Sea and closely coordinated with studies on land. Major feeding areas will be located and prey species identified. The behavior of lactating females on land and at sea and the behavior and distribution of young males in both environments will receive special attention. Birds and northern sea lions will be collected and principal food determined, if found in feeding areas of fur seals.

The abundance and distribution of major prey species of fur seals in the Bering Sea will be studied to provide additional data for evaluating the relationship of fur seals to other living marine resources. These studies will include monitoring changes in abundance of major prey species and analysis of fishery statistics.

Initially, considerable effort will be spent improving and testing such methods and equipment as marking, telemetry, sonic tags, and aerial photography.

*Research activities.* The land and pelagic studies will be discussed in more detail under the following four categories: (A) Abundance, Distribution, and Composition of the Fur Seal Population; (B) Reproduction and Survival; (C) Behavior and Activity Patterns; and (D), Identification, Abundance and Distribution of Major Prey Species.

Research in the four categories is designed to:

Determine the changes in population abundance and the maximum level of an unharvested population.

Describe the composition of the unharvested population as it changes; for example, the sex ratio of adults, number of pups, and the ratio of territorial to nonterritorial males.

Describe changes in rookery area and density of seals as changes in population abundance and composition occur.

Observe behavioral changes or changes in activity, especially of adult males and females, as density and sex ratio change.

Determine changes in survival rates and causes of mortality with changes in population abundance and composition.

Determine changes in reproductive rates with changes in population abundance and composition.

Determine distribution, food, and feeding behavior of fur seals in the Bering Sea.

Monitor abundance and distribution of Bering Sea stocks of fishes and invertebrates utilized by fur seals and other marine mammals.

A. *Abundance, distribution, and composition of the fur seal population.* The only segment of the population that can be estimated with confidence is the number of pups born. The accuracy of these estimates which will be made as in the past by shearing and sampling pups, will be checked at some areas by making complete counts. The total number of pups born will be estimated every fifth year. Estimates will be made for approximately 25 percent of the rookeries during intervening years.

Adult-sized males will be counted on all rookeries each year about June 20, and on about 25 percent of the rookeries in mid-July. From the counts in July the proportion of territorial, nonterritorial and harem males will be estimated.

Aerial photography will be tested to determine if a reliable index of the number of adult females can be developed, and if this method can replace the present practice of counting adult males on land. Photographs will delineate areas occupied by harems and areas used as hauling grounds.

The distribution of fur seals in the Bering Sea will be determined from sightings and collections taken by scientists aboard vessels. Pelagic collections will be made in the Bering Sea from July through November for about 3 years. Special attention will be given to areas known to be most heavily subjected to commercial fishing.

Specific information that will be collected will include:

1. Estimates of the number of pups born.
2. Counts of adult males, territorial and nonterritorial.
3. Land area occupied by fur seals.
4. Age, sex, and body measurements of animals collected at sea.

B. *Reproduction and survival.* Quantitative information relating to reproduction (age specific pregnancy and ovulation rates) will be based on the examination of females collected pelagically in the North Pacific Ocean, on the rookeries, and in captivity. Unless sufficient samples of females are obtained, pelagic collections from April through June will not provide valid data on pregnancy and ovulation rates for comparison between islands.

Mature females collected on land late in the season may be useful for this research because they will already be bred and will most probably be found on the rookery on which they were born. In addition, observations of behavior on rookery areas will be useful for interpreting this reproductive data. Examination of females of known reproductive history held in captivity will provide knowledge that will further improve the interpretation of conditions observed among collected samples of females. Reproductive physiology will also be studied.

Estimating survival rates with sufficient accuracy and precision to make meaningful comparisons between harvested and uhharvested populations may not be possible except for pups on land. If the population increases on St. George Island, comparisons at different population levels should be possible. Survival rates of pups on land will be calculated from estimates of the number born and counts of dead pups on land. The survival rates of other animals will be estimated from mark-recapture data and counts of dead animals on land.

Specific information to be collected will include:

1. Reproductive condition of females collected at sea and on land.
2. Observations and specimens of females of known reproductive history.
3. Marking and recapture of males at age 0, 1, 2, and 3 years.
4. Counts of individually marked animals for a period of years.
5. Age composition of the commercial harvest (St. Paul Island only).
6. Number, age, sex, and, where possible, causes of death among animals on land.
7. Weight and other body measurements of young males in the harvest (St. Paul Island only) and of pups in autumn.

C. *Behavior and activity patterns.* Behavioral studies using individually identifiable animals will begin immediately. Freeze branding, radio tagging, and other methods of marking will be used to provide recognizable animals. Adult females, pups, adult males, and young males will be studied on rookeries and on hauling grounds.

Behavioral and activity studies will provide information valuable for interpreting the results of other studies and for improving or designing new techniques. The significance of human disturbance as a mortality factor will be measured from observations of mother and pup reactions, especially with

respect to nursing cycles. The time spent on land and at sea feeding will be determined. Sonic and radio tags will be applied to lactating females to study feeding behavior at sea. Observations of the daily activity patterns of adult territorial males at different population densities and ratios of territorial to nonterritorial males will be useful in determining the effects on the population of changes in sex ratio. Observations of young males on hauling grounds will improve estimates of the magnitude of escapement of males and may result in improved management practices. We will determine if females traditionally found on hauling grounds beginning in late July have living pups. The interactions between northern sea lions and fur seals on a rookery will be observed to determine the probable effect on the fur seal population of the rookery.

Specific information to be collected will include:

1. Behavior and activity patterns of adult males, for example, time spent establishing and defending territory.
2. Length of nursing-feeding cycle of lactating females.
3. Distance traveled to feeding areas and time spent feeding by lactating females.
4. Activity of pups such as time spent nursing and average number of nursing periods prior to leaving the island.
5. Activity patterns of young males and adult females on hauling grounds.
6. Changes in fur seal activity patterns when disrupted by research or management activities.
7. Interaction between fur seals and northern sea lions on fur seal rookery areas.

D. *Identification, abundance, and distribution of prey species.* These studies will provide data that will be helpful in describing the relationship between the availability of food resources and the productivity of fur seals and identify some of the species that may compete with fur seals for food. An essential first step will be to identify the most important food species of fur seals and to determine their relative importance in different areas within the range of fur seals by examining the stomach contents of fur seals collected in the Bering Sea. The results will be compared with those developed from fur seals collected in the early 1960's. Northern sea lions and birds will also be collected in areas where fur seals are found to determine the major food species taken by each. The frequency of occurrence and the volume of prey species found in the stomachs of collected animals, and observations of feeding animals, will provide estimates of consumption and possible competition with the commercial fishery. Areas of intense commercial fishing will receive special attention. Chemical analysis of food species and contents of the alimentary tract will yield additional information on the role these predators play in the cycling of nutrients.

Concurrent analyses will be undertaken of statistics on catches of fish and shellfish and fishing effort expended by all nations in the Bering Sea. These analyses will provide a historical base for examining the general relationship between the productivity of the fur seal population and the availability of key, forage species. The primary source of data will be from the Japanese fishery in the eastern Bering Sea, which in 1970–71 accounted for 84 percent of the combined harvest by all nations. Statistics on Japan's catches and fishing effort will be analyzed by small statistical blocks measuring ½° latitude by 1° longitude to determine within and between-year changes in availability of forage species. A prerequisite to this analysis will be the development of procedures for standardizing fishing effort to account for improvements which have occurred in gear, detection equipment and tactics.

The initial analysis of fisheries statistics will include all the important target species in the eastern Bering Sea. Once species are identified as important fur seal food, it will be possible to focus analysis on them at relevant areas and seasons.

The period covered by this analysis of commercial fishing statistics will be from 1954; the beginning of Japan's contemporary fishery in the Bering Sea. Greatest detail will be for the period since 1964 when records on Japan's fishery are the most complete.

The effects of the abundance of forage species on the productivity of the fur seal population will also be examined by monitoring changes in availability of fish and shellfish from chartered research vessels and correlating the results with those from studies of the fur seal population. Surveys from research vessels will focus on species and areas identified as especially important from studies of the feeding habits of fur seals. Survey areas and times will be scheduled to correspond with known foraging migrations of fur seals, and thus will provide synoptic information on the availability of key forage species which are not now targets of commercial fisheries or are outside the operating range of the fleets. Such baseline information will be extremely useful in assessing the impact of any future commercial catch of these species on the availability of food for fur seals.

Specific information to be collected will include:

1. Location of major feeding areas.
2. Identification of stomach contents and chemical analysis of food species and contents of alimentary tract.
3. Presence or absence of fish concentrations in areas containing fur seals.
4. Environmental and oceanographic conditions in areas containing concentrations of fur seals.

SELECTION OF A CONTROL AREA

The Pribilof Islands have 21 fur seal rookeries: 14 on St. Paul Island, RDB 6 on St. George Island, RDB and 1 on Sea Lion Rock. Some of these rookeries are isolated, whereas others are in close proximity to each other. The 21 rookeries can be conveniently grouped into 9 subpopulation units, 5 on St. Paul Island and 4 on St. George Island. Associated with each subpopulation unit are one or more hauling grounds from which male seals are harvested annually. The degree of "homing" to the unit of birth among young males determines how much the utilization rate can be changed by not harvesting seals on a hauling ground, an important consideration in selecting a control area. The adaptability of subpopulations as units for study is further enhanced by the fact that maturing seals display good fidelity to the rookery-hauling ground complex of birth. In other words, the "homing instinct" is pronounced in fur seals in general and increases with age. By age 5 years, less than 30 percent of the animals hauled out on land are found outside the subpopulation unit of birth.

Analysis of tag recovery data obtained from harvested males shows that the degree of homing to the island of birth is considerably higher than that to the rookery of birth. For example, the degree of homing among age 2 males varies from 25 to about 40 percent to the subpopulation units on St. George Island but is about 60 percent to the island. The latter figure increases to 85 percent by age 5 years. Comparable homing figures for St. Paul Island 2-year-olds are from 27 to 61 percent for subpopulation units and over 80 percent to the island. Nearly 100 percent of the males "home" to St. Paul by age 5 years. Of the units on St. Paul Island, Northeast Point has the highest degree of homing, with values comparable to those for all of St. George Island. The homing tendency of females is considerably greater than that of males, regardless of the unit or island of birth, or age. Thus, the designation of Northeast Point Rookery or an entire island as a control area will result in maximum change in utilization rate.

Several other factors must also be considered in selecting a research control area. An area that can be readily divided into discrete sampling units will allow replication of studies and will permit studies that are not compatible to be carried out on separate areas. The sampling units should not be too large, yet should be of sufficient size to provide representative data. Large areas require more effort to obtain data, which in some cases can never be complete. For example, areas of a size suitable for making complete counts of the number of pups born have a distinct advantage. Access and topography determine suitability for collecting some kinds of data and have little affect on other collections. The amount of pretreatment data that is available is also a factor but, with the exception of three small sampling units on St. Paul Island, essentially similar data are available for all subpopulations.

Considering all preceding factors, St. George Island is the most desirable as a research control area. The island contains approximately 20 percent of the total Pribilof Island fur seal population, or slightly less than that of Northeast Point on St. Paul Island, and has the second highest degree of homing. The fur seals form four physically discrete subpopulation units which will allow research studies which are not compatible to be carried out on separate units and will also allow replication of studies. The subpopulations are relatively small, containing from about 8,000 to 20,000 pups. It is possible to make a complete count of pups on all units, and access to the rookeries and hauling grounds is as good or better than to the units on St. Paul Island. Topography of the St. George units poses no particular problem with respect to proposed research.

Stopping the commercial harvest of fur seals on St. George Island will reduce the utilization of males born there to an estimated rate of less than 30 percent through age 5, assuming that their homing tendency does not change. Because of progressive increases in homing tendency at ages 3, 4 and 5, little effect on the utilization rate of males born on St. Paul Island is expected. The expected reduction in the harvest is 10 to 20 percent.

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