Bering Sea Ecoregion Strategic Action Plan

Part II

First Iteration
December 2004

WWF

The Nature Conservancy
SAVING THE LAST GREAT PLACES ON EARTH

Part II. Other Resources for Bering Sea Ecoregion Strategic Action Plan- First Iteration

The following documents were compiled to support the first iteration of the Bering Sea Strategic Action Plan (Part I), which is meant to function as a stand-alone document. Copies of the Strategic Action Plan can be obtained by contacting the TNC or WWF Alaska field offices.

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Part II: Other Resources for Bering Sea Strategic Action Plan- First Iteration

1. SUMMARIES OF PREVIOUS BERING SEA PLANS

1.1 Summary of Alaskan Plans

Bering Sea Ecoregion Project - Working together for the Future - Final Report. June 2000. State of Alaska Division of Governmental Coordination.

The Bering Sea Ecosystem Project began in response to concerns by area residents about their observations of changes to the condition of the ecosystem. DGC conducted nearly 100 interviews, held workshops in five coastal communities, and sponsored meetings with state and federal agencies and organizations. Project staff developed seven recommendations after an analysis of the issues, concerns and suggestions raised during the interviews and meetings:

- Continue collaboration among coastal districts to address coastal concerns in the Bering Sea region.
- Continue collaboration among agencies and organizations involved with Bering Sea management programs.
- Develop means to consider how inland activities affect Bering Sea resources on an ongoing basis.
- Standardize mapping and data gathering, and ensure a wide distribution of this information.
- Develop models for incorporating local and traditional knowledge into policy development and implementation.
- Improve coordination for research design, data collection, and reporting.
- Enhance the ability for communities to respond to ecosystem changes.

The report contains:

- An analysis of agency responsibilities, jurisdictions and authorities;
- A description of what agencies and organizations are doing;
- An identification and analysis of issues important to Bering Sea stakeholders;
- An analysis of ocean initiatives in other states that may be appropriate for Alaska; and
- Initial recommendations identified by stakeholders to address important issues.

Ecoregion-Based Conservation in the Bering Sea – Identifying Important Areas for Biodiversity Conservation. 1999. World Wildlife Fund and The Nature Conservancy.

This document outlines the results of an international expert's workshop held in Girdwood, Alaska in March 1999. The goal of the workshop was to identify priority areas for biodiversity conservation in the Bering Sea. The report provides:

- An overview of the ecoregion-based conservation approach, as defined by WWF and TNC;
- A description of the process used in the Girdwood workshop to identify key areas for biodiversity in the ecoregion;
- A discussion of threats to Bering Sea biodiversity (identifying four critical threats: mismanagement of fisheries, global climate change, alien species introductions and pollution);
- Maps outlining the areas important for each major taxon group of Bering Sea species;
- A map presenting the results of collective discussions about priority areas for biodiversity conservation; and
- Detailed descriptions of these priority conservation areas.

The report is intended to serve as a conceptual framework around which a variety of conservation programs can be built. A brief and preliminary discussion of conservation strategies recommends consideration of marine safety areas and marine protected areas as tools to promote biodiversity conservation.

North Pacific Fishery Management Council. 2002. Responsible Fisheries Management into the 21st Century. Anchorage, AK: NPFMC. 23pp.

This document is a brief overview of some of the actions carried out by the NPFMC. This summary serves as a reminder of those actions and the council's priorities:

- Closure of 30,000 square nautical miles of Bering Sea to bottom trawling year-round. The report shows a map of the areas that comprise the closure: Pribilof Islands Habitat Conservation Area, Nearshore Bristol Bay Closure Area (draw a straight line from Cape Newenham south to Cape Lieskof), and the Red King Crab Savings Area (a square area, a little smaller than the PIHCA, west and adjacent to the NBBCA).
- Fishery closures in nearshore areas to reduce interactions with Steller sea lions at their rookeries and habitats, restrictions on fishing of sea lion prey species, and prohibition of shooting sea lions.
- The Council is considering protections for coral habitats.
- Comprehensive seabird bycatch reduction program, including mandatory seabird avoidance measures to reduce the incidental take of seabirds in hook-and-line fisheries. The Council has also proposed additional regulations to reduce incidental capture (p. 13).

- Bycatch reduction through limits that close fisheries when reached, gear restrictions

Center of Marine Conservation. 1998. Ecosystem-based management in the Bering Sea. Proceedings from the Alaska Seas Marine Conservation Biology Workshop, October 6-7, 1997, Anchorage, AK. Washington, D.C.: CMC. 102 pp.

CMC made 13 recommendations in three general areas of focus: Information Exchange, Research and Management:

- Information Exchange and Cooperation:
  - Incorporate Native, local, and Russian knowledge of the Bering Sea
- Research:
  - Identify US and Russian data to determine data gaps and to synthesize existing information.
  - Attendees stated that "monitoring and developing a better understanding regarding fluctuations in plankton biomass in the Bering Sea could lead to improved predictive power with regard to changes in the upper trophic levels, including targeted fish species."
- Management: Management recommendations focused on efforts that NPFMC and NMFS should undertake. NPFMC should:
  - Consider ecosystem effects when managing fisheries;
  - Develop a management-based experiment to disperse the pollock fishery in time and space in the Aleutians; and
  - Consider other measures to protect areas of high productivity or foraging activity, such as establishing marine protected areas or restricting harmful fishing gear; and move away from single-species management and aid diversification of fishing technology.
  - NMFS should complete a Supplemental EIS on the spatial and temporal impacts of fishery removals on fish species and upper trophic level species and the impacts of fishing gear on benthic habitats.
  - Concern about trawling impacts on benthic habitat and the potential consequences on higher trophic levels had also led to a suggestion that a carefully designed and monitored management-based experimentation could clarify the real extent of such impacts and means of mitigation.

The report also had two cross-cutting recommendations: a multi-disciplinary team should establish common goals for long-term management and devise mechanisms to achieve those goals; and the Russian and US governments should reach an international agreement including collaborative research and management measures.

Report of the Bering Sea Ecosystem Workshop, December 4-5, 1997, Anchorage, AK. Workshop presented by NMFS-NOAA, ADFG, and DOI.

Draft Bering Sea Ecosystem Research Plan. April 1998.

Report of the Bering Sea Ecosystem Workshop, June 2-3, 1998. Anchorage, AK. Workshop presented by NMFS-NOAA, ADFG, and DOI.

Four research-related recommendations came out of the first workshop, leading to the Draft Bering Sea Ecosystem Research Plan. Two recommendations were about improving sharing of information between the agencies. The third was to include traditional knowledge in research and environmental monitoring programs. The last recommendation was to develop a Bering Sea Ecosystem Science Plan. The first report lists data gaps and future research needs. The second workshop was an opportunity for continued discussion on Bering Sea ecosystem science.

Bering Sea Task Force. 1999. Report to Governor Tony Knowles (draft 3-5-99)

Recommendations:

- Create a North Pacific Research Board (broadly representative, with a scientific and technical advisory board, overlaps with existing bodies like EVOS, exempted from FACA)
- Establish a secure, stable, long-term funding source for North Pacific and Bering Sea and related research
- NPRB should develop and maintain a comprehensive and coordinated research plan for the North Pacific and Bering Sea
- NPRB should establish a comprehensive system for gathering, keeping, and communicating information
- NPRB should promote means for improved communication and coordination among research programs

National Research Council. 199?. Bering Sea Ecosystem

Recommendations:

- Adopt a broader ecosystem perspective for research and management.
- Adopt an experimental or adaptive approach to management.
- Conduct research on the structure of the Bering Sea ecosystem, including nature and causes of pollock population dynamics over the past 50 years.
- Research how well Bering Sea management and institutions are structured to address problems and provide solutions.
- Improve coordination of management institutions.
- Develop a research program to better understand Bering Sea ecosystem.
- Broaden the distribution of fishing effort in time and space, especially for pollock.

Bering Sea Coalition. 1999. Wisdomkeepers of the North. Conference Final Report. March 16-20, 1999.

Includes general and specific recommendations based on 6 teams:
- Traditional knowledge and wisdom
- Global warming, contaminants, human health in the Bering Sea
- Transboundary issues and perspectives
- Pockets of hope – Solutions from around the world
- Personal healing, community wellness, health and stewardship
- Partnerships and Alliances.

Specific action steps for conference follow-up included:
- Creation of the Bering Sea Council of Elders;
- Seek funding for Bering Sea Coalition; and
- Provide updated information on the BSC website, etc.

MMPA Bering Sea Ecosystem Studies. Draft Proposed study plan by the Alaska Fisheries Science Center – Jan 1995

High priority items in the research plan include:
- Identify major perturbations and influences.
- Identify habitat of special biological significance – document effects of disturbance caused by human activities.
- Gather climate information, especially regarding wind driven events.
- Gather physical oceanographic information, especially local processes (upwelling, eddies, tides), larger system influences (e.g., major currents).
- Determine species distributions, especially areas for reproduction and feeding for fish, birds, and mammals; population structure; and population demographics.
- Investigate predator-prey relationships, especially relationship between natural predation and fisheries, fisheries as predators, overlap w/ biological predators, and relationship between marine mammals and birds and their prey species.
- Collect socioeconomic data.
- Develop models to integrate biology and physical oceanography with fisheries events.

1.2 Summary of Russian Plans

Biodiversity Hotspot List and Recommendations for the Far East. July 1998. Friends of the Earth- Japan, Siberia Hotspot Project. Author: Josh Newell. (Text available online at http://forests.org/archive/europe/signupbi.htm).

This document is the resolution from the conference on "Biodiversity Conservation in the Russian Far East: Priority Territories ('Hotspots') and Strategies for their Protection," which was held in Yakutsk, Russia from June 16-19, 1998. This conference was a follow-up to the first 'Hotspots" conference organized by Friends of the Earth-Japan in Vladivostok in 1995. The purpose of the Yakutsk conference was to update the List of Hotspots for the Russian Far East (RFE) and to develop specific protection strategies.

The list of Conference Resolutions makes specific recommendations including on developing new protected areas, on forest use, on marine resource management, on foreign investment policy, and on legal issues. Among key recommendations are that:

This document also identifies sixty key priority territories ('Hotspots') in the Russian Far East (RFE) and is the result of roundtables, attended by NGOs, government, and academics, in all ten administrative subdivisions of the RFE during 1997 and 1998.

Papers Presented at the Regional Scientific Conference on: "Protecting the Biodiversity of Kamchatka and Surrounding Seas" Conducted within the Framework of the Sacred Earth Network program, "Nature Conservation Initiatives on Kamchatka," in conjunction with the Earth Day celebration in 2000. April 11-12, 2000.

Assessments and recommendations made at the conference are related to: Kamchatka's biodiversity values; theoretical and methodological aspects of biodiversity conservation; the challenges posed to biodiversity conservation on Kamchatka by anthropogenic activities; and the particularities of biodiversity conservation of Kamchatka's marine coastal ecosystems.

Resolution from the First Citizens' Russian-American Conference on: "Problems in Protecting Biological Resources of the Bering Sea" April 5-7, 2001. Petropavlovsk-Kamchatsky, Russia.
Available on line at: tka.ru/np/magazin/magazin01eng.htm.

- This document outlines the results of a conference at which representatives of NGOs, fishing enterprises, scientific institutes, and government agencies of Russia and the US presented papers. Participants discussed issues involving the overall evaluation of the situation and primary problems of protecting biological resources in the Bering Sea.

The Conference participants recommended:

- Provision of new opportunities for the participation of Russian and American fishers and the public in decision-making about problems of the Bering Sea;
- Development of new forms and methods for public participation in fighting poaching;

- Greater support for defining subsistence fishing in such as way as to provide for the livelihoods of the local population;
- Prohibition of driftnets and bottom gill-nets in large-scale industrial fisheries;
- Implementation of measures that decrease the negative influence of fishing gear on harvest targets, other organisms, and habitat; such measures may include the outfitting of fishing boats with apparatus to locate and raise lost fishing gear;
- Protection of jobs in traditional areas for fishermen and mammal hunters, or to create creation of new jobs benefiting local communities including thorough development of fish processing and small-boat fisheries;
- Legislation supporting priority rights of native peoples to use aquatic biological resources for subsistence in keeping with sound conservation principles;
- Completion of an Environmental Impact Assessment of commercial fisheries, particularly in those areas where traditional harvesting of resources occurs by native peoples;
- Creation of coastal and marine territories of traditional natural resource use;
- Mapping of biologically important areas of the Bering Sea with the goal of creating a network of protected areas with varying management regimes (including no-take zones, subsistence areas, fishing areas, and other categories) for the protection of biological diversity and the resource potential of the region;
- Strengthening management in existing marine and coastal protected areas in the Bering Sea;
- Applying internationally recognized criteria for areas sensitive to oil pollution to fisheries management regulations;
- To carry out regular Russian-American public conferences about the problems of biological resources in the Bering Sea;
- Creation of functional informational centers that can provide the fishing community, government organizations, and the public with accurate and objective information about the condition of biological resources, problems in fisheries management, and ecological risks associated with other industrial activity such as oil development;
- Development of an interdisciplinary program of joint Russian-American study and regulation of the fishing industry in the aquatic areas of the Bering Sea; and
- Preparation of an international Convention on Fisheries Conservation in the Bering Sea.

Papers Presented at the Second Regional Scientific Conference on: "Protecting the Biodiversity of Kamchatka and Surrounding Seas." April 2001. Petropavlovsk-Kamchatsky.

Assessments and recommendations made at the conference are related to: Kamchatka's biodiversity values; theoretical and methodological aspects of biodiversity conservation; the challenges posed to biodiversity conservation on Kamchatka by anthropogenic activities; biodiversity conservation of Kamchatka's marine coastal ecosystems; the functioning of the peninsula's strictly protected nature areas; and biodiversity conservation in surrounding territories and marine areas.

Papers Presented at the Third Regional Scientific Conference on: "Protecting the Biodiversity of Kamchatka and Surrounding Seas." November 27-28, 2002. Petropavlovsk-Kamchatsky.

The overall goal of this conference was to analyze aspects of biodiversity conservation on Kamchatka and surrounding marine areas, including: current conditions, extent of knowledge and study, challenges, and the identification of strategies in the face of growing anthropogenic and technological activities.

Assessments and recommendations made at the conference are related to: Kamchatka's biodiversity values; theoretical and methodological aspects of biodiversity conservation; the challenges posed to biodiversity conservation on Kamchatka by anthropogenic activities; biodiversity conservation of Kamchatka's marine coastal ecosystems; the functioning of the peninsula's strictly protected nature areas; and biodiversity conservation in surrounding territories and marine areas.

Conference recommendations were:

- To regularly conduct scientific and scientific-practical events in order to discuss and resolve the theoretical and methodological challenges of biodiversity conservation, as well as to develop recommendations for biodiversity conservation of Kamchatka and surrounding seas;
- To raise awareness among authorities on the federal and regional level about the necessity of improving the system for managing nature conservation and use;
- That specialists from regional Committees for Natural Resources, together with scientists from local institutes, develop a unified approach for preparing and reviewing documents related to the creation of strictly protected nature areas in the region;
- To raise awareness among local officials about the intolerability of extracting oil and gas resources on the Okhotsk and Bering Sea shelves, which highly bio-productive;
- To raise awareness among local authorities about the problem of poaching on the peninsula and in surrounding marine areas;
- To prepare, publish, and distribute materials about biodiversity conservation, nature conservation, and sustainable nature use;
- To raise awareness among local authorities about the importance of adopting legislation about the protection of rare, little studied, and endangered species of flora and fauna that are found on the peninsula and in surrounding marine areas; and to finance work to prepare and publish a "Red Data Book" for Kamchatka; and
- To expand activities to raise awareness and understanding among various levels of society about nature conservation.

Papers Presented at the Fourth Regional Scientific Conference on: "Protecting the Biodiversity of Kamchatka and Surrounding Seas." November 17-18, 2003. Petropavlovsk-Kamchatsky.

The overall goal of this conference was to analyze aspects of biodiversity conservation on Kamchatka and surrounding marine areas, including: current conditions, extent of knowledge and study, challenges, and the identification of strategies in the face of growing anthropogenic and technological activities.

Seventy three papers were delivered by 108 authors representing 32 various institutes, universities, protected nature areas, and nature conservation organizations in Russia, Japan, the USA, and Great Britain. These materials and participants' recommendations were compiled in a publication.

Sixth North Pacific Rim Fisheries Conference. May 22-24, 2002. Vladivostok.

The 6th international fishery conference, attended by representatives from Russia, China, S. Korea, Vietnam, USA and Canada, was held in Vladivostok on May 22-24. The principal goal of the conference was to improve understanding of national fishery policies and scientific approach to problems existing in the fishing sector.

The conference was attended by Yury Moskaltsov, State Fisheries Committee vice chairman, who said that the most urgent problem in the Sea of Okhotsk and Bering Sea is conservation of pollock stocks for sustained fisheries. Also in attendance was Dr. William Hogarth, Assistant Administrator of the National Marine Fisheries Service (NOAA Fisheries) of the United States.

In the opinion by the Association of Far East Fish Industrialists, one of key issues for the industry's survival is revision of governmental policies in the distribution of quotas for aquatic bioresources. Quota auctions should be replaced by distribution through self-regulated organizations, believe fish producers. In accordance with a bill prepared by the Ministry of Economic Development, such organizations will be associations, unions and other fishermen's noncommercial organizations.

Research on the Marine Bioresources of Kamchatka and the Northwestern Pacific Ocean. A Compilation of Scientific Work. KamchatNIRO. Petropavlovsk-Kamchatsky. 2000. 203 pages.

This compilation presents the results of scientific research by scientists at the Kamchatka Scientific Research Institute for Fisheries and Oceanography. Research topics include various fish and invertebrate species inhabiting Kamchatka and its coastal waters. The research examines community structures, population differentiation, physiology, hydrology, and parasitology. The research would be of interest to ichthyologists, hydrobiologists, ecologists, parasitologists, biology students, fishery scientists and staff, and people more generally interested in the protection and reproduction of the biological resources of the northwestern Pacific Ocean.

Trawling in the Mist: Industrial Fisheries in the Russian Part of the Bering Sea. TRAFFIC-Europe, WWF, and IUCN. Alexey Vaisman. ***November 2001.*** **88pp.**

This publication reports on TRAFFIC's investigation into the fishing industry of the Russian part of the Bering Sea. The investigation was conducted with the aims of exploring: the evolution of commercial fisheries in the region; the legislative and enforcement structure governing fisheries; key target fisheries, including catch and trade levels over time; and illegal practice and factors conducive to this.

Recommendations (primarily in relation to the large fleets of the industrial fishery of the Russian part of the Bering Sea.):

Fisheries management

The Russian Government should take action to ensure:

- improved fisheries information, including species-specific surveys of fish stocks and the transmission of up-to-date catch data to the UN Food and Agriculture Organization (FAO);
- improved management of stocks, in such a way that a precautionary approach to the management of industrial fisheries in the Bering Sea is adopted and the criteria for quota allocations are made transparent to stakeholders;
- the identification and creation of protected areas in key habitats for important fishery stocks
- improved regulation of fishing gears, specifically by extending regulations to require the prohibition of all non-selective and destructive gear;
- that governance over fishing and trade in the Russian EEZ of the Bering Sea is strengthened;
- that social and community considerations are addressed, by requiring that people living adjacent to the Bering Sea be involved in decision-making affecting the resources on which they rely, and that their economic and community interests be balanced against the needs of industrial fisheries; and
- improved financing, through channeling fines for fisheries infractions, money from quota sales and other forms of fisheries income into reforms necessary in the fishing industry .

Enforcement

The Russian Government should ensure that fisheries law enforcement is strengthened by:

- clarifying roles of, and improving co-ordination between, enforcement agencies ;
- improving the system of observers, by creating and coordinating a network of observers with new operating conditions, to reduce opportunities for corruption inherent in the current system;
- expanding observer coverage to include Russian vessels and possibly to Customs duties, where applicable;
- improving equipment, including satellite vessel monitoring systems; and
- adjusting financial incentives and disincentives, including increasing penalties and considering a bonus system for enforcement staff.

International co-operation

At an international level, actions should be taken so that:

- interaction between Customs agencies of countries trading in Bering Sea marine resources is improved;
- all nations involved in trade in Bering Sea fishery products apply the most precise category code available of the Harmonized Commodity Description and Coding System;
- the implications of closure of the Donut Hole to Alaska Pollock fishing on marine resources in the western Bering Sea are examined under the Convention on the Conservation and Management of Pollack Resources in the Central Bering Sea; and
- the importance of bilateral US-Russian decision-making is emphasized.

Awareness

Actions to increase awareness of the issues surrounding the conservation of marine resources in the western Bering Sea should include:

- a conference bringing together industry, regulatory agencies and environmental groups;
- dissemination of information on the levels of threat to fish stocks to interested parties, with the aim of involving non-governmental groups, including industry, in funding or lobbying; and
- consideration of the use of economic incentives for the promotion of sustainable fisheries through certification or other trade mechanisms.

2. STAKEHOLDER ANALYSIS

2.1 Alaskan Stakeholders

Non-Governmental Conservation Organizations (Alaska Focused)

Alaska Audubon
715 L Street, Suite 200
Anchorage, Alaska 99501
Phone: (907) 276-7034
Fax: (907) 276-5069

Audubon Alaska strives to conserve nationally and internationally significant wildlife populations and their habitats, especially on public lands and waters in Alaska; Enhance public awareness and understanding of the ecological relationships of the natural world; and build a culture of conservation and environmental ethic in Alaska that contributes to a healthy, sustainable economy while at the same time fostering a quality of life in harmony with our natural environment.
Current Bering Sea Ecoregion activities include:

- Identification of "Important Bird Areas" (IBA's)
- Education programs ("Bird Academy") in coastal Alaskan communities

Alaska Community Action on Toxics
505 West Northern Lights Blvd, Suite 205
Anchorage, Alaska 99503
Phone: (907) 222-7714
Fax: (907) 222-7715
Email: info@AKAction.net

To protect the environment and human health from the toxic effects of contamination from industry and the military. We believe everyone has the right to clean air, clean water and toxic-free food.

Alaska Conservation Foundation - Alaska Ocean Program
308 G Street, Suite 219
Anchorage, AK 99501
info@alaskaoceans.net
(907) 929-355
Alaska Ocean Program is an independent program of the Alaska Conservation Foundation dedicated to conservation and management of Alaska's important and valuable marine resources.

Alaska Marine Conservation Council
PO Box 101145
Anchorage, AK 99510
Phone: (907) 277-5357

Fax: (907) 277-5975
amcc@akmarine.org

The Alaska Marine Conservation Council (AMCC) is a community-based organization of people who care about the health and future of Alaska's oceans and coastal communities. Our members are fishermen, subsistence harvesters, marine scientists, small business owners and families. Our way of life, livelihoods and economies depend on healthy marine ecosystems.
Current Bering Sea Ecoregion activities include:

- Fisheries bycatch reduction
- Reauthorization of Magnuson-Stevens Act, and other fisheries policy related work
- Marine Habitat protection
- Broad outreach to coastal communities throughout Alaska on fisheries and marine conservation issues

Center for Biological Diversity
Main Office
P.O. Box 710
Tucson AZ 85702-0710
Phone: (520) 623-5252
Fax: (520) 623-9797
Email: center@biologicaldiversity.org

Alaska Office
P.O. Box 6157
Sitka, AK 99835
Phone: (907) 747-1463
Fax: (907) 747-8873

At the Center they believe that the health and vigor of human societies and the integrity and wildness of the natural environment are closely linked. Beyond their extraordinary intrinsic value, animals and plants, in their distinctness and variety, offer irreplaceable emotional and physical benefits to our lives and play an integral part in culture. Their loss, which parallels the loss of diversity within and among human civilizations, impoverishes us beyond repair.

Earthjustice
National Headquarters
426 17th Street, 6th Floor
Oakland, CA 94612-2820
Phone: 510/550-6700
Fax: 510/550-6740
eajus@earthjustice.org

Earthjustice is a non-profit public interest law firm dedicated to protecting the magnificent places, natural resources, and wildlife of this earth and to defending the right of all people to a healthy environment. We bring about far-reaching change by enforcing and strengthening environmental laws on behalf of hundreds of organizations and communities.

Environmental Defense Fund (SSL and groundfish focus)
257 Park Avenue South
New York, NY 10010
Telephone: (212) 505-2100
Fax: (212) 505-2375
members@environmentaldefense.org

Environmental Defense is dedicated to protecting the environmental rights of all people, including future generations. Among these rights are clean air, clean water, healthy food and flourishing ecosystems.

The Nature Conservancy in Alaska
715 L Street, Suite 100
Anchorage, AK 99501
Phone: (907) 276-3133

Preserve the plants, animals and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive.

National Resources Defense Council
40 West 20th Street
New York, NY 10011
Telephone: (212) 727-2700
Fax: (212) 727-1773

U.S.'s most effective environmental action organization. They use law, science and the support of more than 1 million members and online activists to protect the planet's wildlife and wild places and to ensure a safe and healthy environment for all living things.

Oceana
175 South Franklin Street
Suite 418
Juneau, Alaska 99801 USA
Phone: (907) 586-4050
Fax: (907) 586-4944
Email: northpacific@oceana.org

Campaign teams of marine scientists, economists, lawyers and advocates seek specific policy outcomes to stop the collapse of fish stocks, marine mammal populations and other sea life.

Current Bering Sea Ecoregion activities include broad work on marine policy issues in the North Pacific Ocean involving:

- Reduction of bycatch
- Marine habitat protection
- Reauthorization of the Magnuson-Stevens Act

The Ocean Conservancy
Alaska Regional Office
425 G Street, Suite 400
Anchorage, AK 99501
Phone: 907-258-9922
Fax: 907-258-9933

Through science-based advocacy, research, and public education, The Ocean Conservancy informs, inspires, and empowers people to speak and act for the oceans. In all its work, The Ocean Conservancy strives to be the world's foremost advocate for the oceans.
Current Bering Sea Ecoregion activities include broad work on marine policy issues in the North Pacific Ocean involving:

- Reduction of bycatch
- Marine habitat protection
- Reauthorization of the Magnuson-Stevens Act

Trustees for Alaska
1026 W. 4th Ave., Suite 201
Anchorage, AK 99501
Phone:(907) 276-4244 Fax: (907) 276-7110
Email: ecolaw@trustees.org

Public interest law firm whose mission is to provide legal counsel to sustain and protect Alaska's natural environment.

Conservation Non-Governmental Organizations (International Focused)

Greenpeace International
Ottho Heldringstraat 5
1066 AZ Amsterdam
The Netherlands
Phone: 31 20 5148150
Fax: 31 20 5148151
Email: supporter.services@int.greenpeace.org

Greenpeace is an independent, campaigning organization that uses non-violent, creative confrontation to expose global environmental problems, and force solutions for a green and peaceful future. Greenpeace's goal is to ensure the ability of the Earth to nurture life in all its diversity.

International Bering Sea Forum
C/o Pacific Environment
311 California Street, Suite 650
San Francisco, CA 94104-2608
Ph: +1 415/399-8850
Email: info@pacificenvironment.org

International Bering Sea Forum is an independent body of scientists, indigenous leaders, environmentalists, and family fishermen committed to sustainable management of the Bering Sea. The Forum is an independent, non-governmental body.

WWF-United States
1250 24th Street, NW
Washington, DC 20037
Phone: (202) 293-4800
Fax: (202) 293-9211

WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature, by conserving the world's biological diversity, ensuring that the use of renewable natural resources is sustainable, and promoting the reduction of pollution and wasteful consumption.

AK Native Conservation Non-Governmental Organizations

Alaska Inter-Tribal Council
431 West 7th Avenue, Suite 201
Anchorage, AK 99501
Phone:
Fax: (907) 563-9337
Email: dgoldsmith@aitc.org

The Alaska Inter-Tribal Council, as a statewide consortium of First Nations, which share a common bond with unique cultures, language, spirituality, and traditional values, declare our intent to proactively advocate for, protect, defend, and enhance our inherent rights, as self-determining tribal sovereigns.

Alaska Federation of Natives (AFN)
1577 C Street, Suite 300
Anchorage, AK 99501
Phone 907.274.3611
Fax 907.276.7989

The mission of AFN is to enhance and promote the cultural, economic and political voice of the entire Alaska Native community.

Aleut International Association
Protect the natural resources and the environment of the region surrounding the Aleut homelands vital to the Aleut way of life.

Alaska Native Science Commission
429 L Street
Anchorage, Alaska 99501
Main Number: (907) 258-ANSC (2672)
Fax Number: (907) 258-2652
General Email: info@aknsc.org

The goals of the Alaska Native Science Commission are to: facilitate the inclusion of local and traditional knowledge into research and science, participate in and influence priorities for research, seek participation of Alaska Natives at all levels of science. Provide a mechanism for community feedback on results and other scientific activities. Promote science to Native youth, encourage Native people to enter scientific disciplines, and ensure that Native people share in the economic benefits derived from their intellectual property.

First Alaskans Institute
606 E Street, Suite 200
Anchorage, AK 99501
Phone: 907-677-1700
Website: www.firstalaskans.org

The First Alaskans Institute will help develop the capacities of Alaska Native Peoples and their communities to meet the social, economic and educational challenges of the future, while fostering positive relationships among all segments of our society.

Native American Fish & Wildlife Society
131 West 6th Avenue
Suite 3
Anchorage, Alaska 99501
Phone: (907) 222-6005
Fax: (907) 222-6082
Email: aknafws@alaska.net

National nonprofit dedicated to the protection, preservation, enhancement, and prudent use of Native American fish and wildlife resources. Committed to furthering the role of Alaska Natives in resource management.

Pribilof Island Stewardship Program
Karin Holser
P.O. Box 938
St. George Island, Alaska 99591
(907) 859-2233
kholser1@yahoo.com

Current Bering Sea Ecoregion activities include:

- Education and stewardship on St. George and St. Paul Islands
- Sponsorship of research projects on marine mammals around the Pribilof Islands

Rural CAP
P.O. Box 200908
Anchorage, Alaska 99520
Phone: 1-907-279-2511
Fax: 1-907-278-2309

Protect and improve the quality of life for low-income Alaskans through education, training, decent and affordable housing and advocacy.

AK Regional Native Corporations

Aleut Corporation
4000 Old Seward Hwy, Suite 300
Anchorage, AK 99503
Phone: (907) 561-4300
Fax: (907) 563-4328

Aleutian Pribilof Islands Association, Inc.
201 East 3rd Avenue
Anchorage, AK 99501
Phone: (907) 276-2700
Fax: (907) 279-4351
E-mail: apiai@apiai.org

To promote self-sufficiency and independence of the Unangax by advocacy, training, technical assistance, and economic enhancement and to assist in meeting health, safety, and well-being of each Unangax community; and To promote, strengthen, and preserve the Unangax cultural heritage.
Current Bering Sea Ecoregion activities include:

- Rat prevention
- Investigating contaminants in subsistence foods

Association of Village Council Presidents (AVCP)
P.O. Box 219
101 Main Street
Bethel, AK 99559
Phone: (907) 543-7300
Fax: (907) 543-3596

The Association of Village Council Presidents provides Human Development, Social Services, and other culturally relevant programs for the people to promote self-determination, protection, and enhancement of our culture and traditions through a working partnership with member villages of the Yukon-Kuskokwim Delta.

Bristol Bay Native Association
Box 310
Dillingham, AK 99576
Phone: (907) 842-5257
Fax: (907) 842-5932

Dedicated to the betterment of the Native people of the Bristol Bay area.

Calista Corp
301 Calista Court, Suite A
Anchorage, Alaska 99518-3028
Phone: (907) 279-5516
Fax: (907) 272-5060
E-mail: calista@calistacorp.com

Calista's mission is to continue growth and profits through teamwork, professionalism and innovation while respecting cultural values.

Kawerak, Inc.
PO Box 948, Nome, AK 99762
Phone: 907 443 5231
Fax: 907 443 4452

Kaweraks mission is to assist, promote and provide programs and services to improve the social, economic, educational, cultural and governmental self-sufficiency for the betterment of the Native people within the region; to preserve the traditional culture, languages and values.

Manillaq Association
P.O. Box 256, #733 2nd Avenue
Kotzebue, AK 99752
1-800-478-3312

They are committed to individual responsibility for health and quality care through tribal self-governance.

NANA Regional Corporation
P.O. Box 49
Kotzebue, Alaska 99752
P (907) 442-3301
P (800) 478-3301 (Toll Free in AK)
F (907) 442-2866
info@nana.com

NANA's mission is to be an Iñupiaq Corporation that enables our people to continue living productively in traditional and modern worlds.

Elected Officials/ Tribal Governments

Ted Stevens
United States Senate
522 Hart Senate Office Building
Washington, D.C. 20510
Phone: (202) 224-3004
Fax: (202) 224-2354 FAX

Lisa Murkowski
322 Hart Senate Office Building
Washington, D.C. 20510
Phone; (202) 224-6665
Web Form: murkowski.senate.gov/contact.html

Don Young
Alaska-At Large, Republican
2111 Rayburn HOB
Washington, DC 20515-0201
Phone: (202) 225-5765

Frank Murkowski
Office of the Governor
Box 110001
Juneau, AK 99811
Phone (907)465-3500
Fax: (907) 465-3532

St. George Traditional Council
Anthony B. Merculief
P.O. Box 970

St. George Island, Alaska 99591
Phone: (907) 859-2249
Tribal Ecosystem Office Phone: (907) 859-2205

Tribal Ecosystem Office is widely involved in environmental protection, comanagement of marine mammals, and engages in research on wildlife populations around the Islands.

Tribal Government of St. Paul
Richard Zaharof, President
P.O. Box 86
St. Paul Island, Alaska 99660
Phone: (907) 546-3200
Email: rzacharof@tdxak.com
Tribal Ecosystem Office: (907) 546-3229

Tribal Ecosystem Office is widely involved in environmental protection, comanagement of marine mammals, and engages in research on wildlife populations around the Islands.

Other leaders
Vera Alexander
Tony Knowles
Ed Rasmusson
Robin Samuelson
Clem Tillion
Fran Ulmer

US Federal Agencies and Refuges

U.S. Fish and Wildlife Service (USFWS)
Alaska Regional Office
1011 East Tudor Road
Anchorage, AK
Phone: (907) 786-3309
Fax: (907) 786-3495

Working with others to conserve, protect and enhance fish, wildlife and plants and their habitats for the continuing benefit of Americans.

Alaska Maritime National Wildlife Refuge
95 Sterling Highway, Suite 1
Homer, Alaska 99603-8021
Phone: (907)235-6546
Fax: (907)235-7783
E-Mail: akmaritime@fws.gov

Current Bering Sea Ecoregion activities include:

- Seabird research and monitoring in Bering Sea
- Rat and other invasive species prevention/ eradication

Endangered Species
1011 East Tudor Road; MS 361
Anchorage, AK 99503
Phone: (907) 786-3520
Fax: (907) 786-3350
E-mail: ak_fisheries@fws.gov

Izembek National Wildlife Refuge
1 Izembek Street
P.O. Box 127
Cold Bay, Alaska 99571
Phone: (907) 532-2445
Email: izembek@fws.gov

Migratory Birds
1011 East Tudor Road: MS 201
Anchorage, Alaska 99503
Phone: (907) 786-3443
Fax: (907) 786-3641
E-mail: ak_mbm@fws.gov

Current Bering Sea Ecoregion activities include:

- Seabird research and monitoring in the Bering Sea
- Primarily responsible for management of migratory bird populations in the US Bering Sea

Togiak National Wildlife Refuge
6 Main Street
Dillingham, Alaska 99675

Yukon Delta National Wildlife Refuge
State Highway, Box 36
Bethel, Alaska 99559
Phone: (907) 543-3151
Email: yukondelta@fws.gov

NOAA/ National Marine Fisheries Service (NMFS)
Alaska Region
PO Box 21668
Juneau, Alaska 99802-1668
Phone: (907) 586-7221
Fax: (907) 586-7249

Email: alaska.webmaster@noaa.gov

Stewardship of living marine resources through science-based conservation and management and promotion of healthy ecosystems.

Protected Resources Division
NMFS Alaska Region
Protected Resources Division
222 W. 7th Ave., #43
Anchorage, AK 99513-7577

National Marine Mammal Lab (NMML)
7600 Sand Point Way N.E. F/AKC3
Seattle, WA 98115-6349
Phone: (206) 526-4045
Fax: (206) 526-6615

Responsible for conducting research on marine mammals important to the mission of the NMFS and NOAA.

Alaska Fisheries Science Center
Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
7600 Sand Point Way N.E., Building 4
Seattle, Washington 98115
Phone: 206 526-4000
Fax: 206 526-4004

Generates the scientific information necessary for the conservation, management, and utilization of the region's living marine resources.

Division of Sustainable Fisheries
Their goal is to manage the recreational and commercial fisheries of our region to provide a sustainable harvest that provides the greatest overall benefit to the nation.

Environmental Protection Agency (EPA)
U.S. EPA, Region 10
1200 Sixth Avenue
Seattle, WA 98101
Phone: (800) 424-4EPA or (206) 553-1200

The mission of the Environmental Protection Agency is to protect human health and the environment. Since 1970, EPA has been working for a cleaner, healthier environment for the American people.

U.S. Coast Guard (USCG)
Coast Guard Headquarters
Commandant, U.S. Coast Guard,
2100 Second Street, SW,
Washington, DC 20593

U.S. Geological Survey- Biological Resources Division
Federal source for science about the Earth, its natural and living resources, natural hazards and the environment.

Its mission is to protect the public, the environment, and U.S. economic interests – in the nation's ports and waterways, along the coast, on international waters, or in any maritime region as required to support national security.

National Parks Service (NPS) - Bering Straits
The National park Service preserves the natural and cultural resources of the national park system for the enjoyment, education, and inspiration of this and future generations.

State of Alaska

Alaska Department of Fish and Game (ADFG)
Commissioner Kevin Duffy
PO Box 25526
Juneau, Alaska 99802-5526
Phone:(907) 465-4100
Fax: (907) 465-2332
Mission is to protect, maintain and improve fish, game and aquatic plant resources of Alaska.

ADFG Board of Fisheries
Conserve and develop the fishery resources of Alaska by making allocative and management decisions.

ADFG Subsistence Division
Provides comprehensive information on the customary and traditional use of wild resources in Alaska.

Department of Natural Resources (DNR)
Goal to contribute to Alaska's economic health and quality of life by protecting and maintaining the state's resources, and encouraging wise development of these resources by making them available for public use.

Alaska Boroughs

Aleutians East Borough
3380 "C" St., Suite 205
Anchorage, AK 99503
907-274-7555
Fax: 907-276-7569
aebanc@gci.net

Aleutians West Borough

Lake & Peninsula Borough

Bristol Bay Borough
P.O. Box 189
Naknek, AK 99633
Phone: 907-246-4224
Fax: 907-246-6633

Northwest Arctic Borough
P.O. Box 1110
Kotzebue, AK 99752
(907)442-2500
(800)478-1110
Fax: (907)442-2930

North Slope Borough
Box 69, Barrow, AK 99723
907.852.2611 (ext. 200) Phone
907.852.0337 Fax
Margaret Opie, Special Assistant
margaret.opie@north-slope.org

Alaska Native Co-management Groups

Nanuq Commission
Charles Johnson, Executive Director
Phone: (907) 443-5074

Russian and Alaskan Native marine mammal hunters and the USFWS working together to conserve polar bears.

Alaska Eskimo Whaling Commission
Their purposes are to preserve and enhance a vital marine resource, the bowhead whale, including the protection of its habitat, to protect Eskimo subsistence bowhead whaling, to protect and enhance the Eskimo culture, traditions, and activities associated with

bowhead whales and subsistence bowhead whaling, and to undertake research and educational activities related to bowhead whales

Alaska Native Harbor Seal Commission
800 E. Dimond Blvd., Suite 3-590
Anchorage, Alaska 99515
(907) 345-0555
Toll Free 1-888-424-5882
Fax: (907) 345-0566

The mission of the commission is to strengthen and increase the role of Alaska Natives in resource policy and decisions affecting the harbor seals and their uses.

Economic Development Organizations

Southwest Alaska Municipal Council (SWAMC)
3300 Arctic Blvd., Suite 203
Anchorage, AK 99503
Phone: (907) 562-7380
Fax: (907) 562-0438

Helps promote economic opportunities to improve the quality of life and influence long-term responsible development of the region's people, businesses and communities.

Alaska Industrial Development and Export Authority
813 West Northern Lights Blvd.
Anchorage, AK 99503
(907) 269-3000
Fax (907) 269-3044
Toll Free (Alaska Only) 888-300-8534

Their mission is to encourage economic growth and diversification in Alaska.

Alaska Fisheries Development Foundation
900 W. 5th Ave., Suite 400
Anchorage, Alaska 99501
Phone: (907) 276-7315 Phone
Fax: (907) 276-7311 Fax
Email: information@afdf.org

Alaska Seafood Marketing Institute
311 N. Franklin Street
Suite 200
Juneau, AK 99801-1147

(800) 478-2903
(907) 465-5560
Fax: (907) 465-5572
Email: Info@AlaskaSeafood.org

The mission statement of the Alaska Seafood Marketing Institute is to increase the worldwide consumption of Alaska Seafood and promote the quality and superiority of Alaska seafood products.

Local Fishing Associations

Atka Fishermans Association
PO Box 47037
Atka, AK 99547
Phone: (907) 839-2249
Fax: (907) 839-2234

Bristol Bay Driftnetters Association
725 Christensen Drive
Anchorage, AK 99501
Phone: (907) 279-6519
Fax: (907) 258-6688
Email: bsfa@alaska.net

St. George Fishermans Association
Dennis Lekanof, President
Box 933
St. George Island, Alaska 99591
(970) 859-2727
Email: bigred76@starbrand.net

Regional (or larger) Fishing Associations

Alaska Crab Coalition
3901 Leary Way NW # 6
Seattle, WA 98107
Phone: (206) 547-7560

American Factory Trawlers Association
4039 21st Avenue, Suite 400
Seattle, WA 98199

At-Sea Processors Association
Anchorage
Art Nelson, Director of Alaska Operations
Trevor McCabe, Special Counsel
431 West 7th Avenue, Suite 201
Anchorage, AK 99501
Phone: (907) 276-8252
Email: apa@atsea.org

Seattle
Paul MacGregor, General Counsel
4039 21st West, Suite 400
Seattle WA 98199
Phone: (206) 285-5139
Email; apa@atsea.org

Working with fishery managers, scientists, environmentalists, and others to improve and implement conservation measures in the North Pacific.

Groundfish Forum
4241 21st Ave. W., Suite 200
Seattle, WA 98199
Phone: (206) 213-5270
Fax: (206) 213-5272

The Groundfish Forum was created to craft meaningful solutions to problems such as discards, incidental catches, and impact on habitat. Our solutions must be effective, while maintaining the efficiency and economic margins of our industry to the greatest degree possible. Another part of the Groundfish Forum mission is to inform state and local government officials of the contributions made by the H&G fleet to the economies of Alaska and the Pacific Northwest.

Marine Conservation Alliance
P.O. Box 20676
Juneau, AK 99802
Phone: 907-523-0731
Fax: (907) 523-0732

Promote conservation and sustainable use of fishery resources for present and future generations based on sound science.
Current Bering Sea Ecoregion activities include:
- Marine debris removal from beaches

North Pacific Fisheries Management Council
605 West 4th, Suite 306
Anchorage, Alaska 99501-2252

Phone: (907) 271-2809
Fax: (907) 271-2817

Has primary responsibility for overseeing management of the region's fisheries.

North Pacific Longline Association
4209 21st Avenue West, Suite 310
Seattle, WA 98199
(206) 282-4639.

Pacific Seafood Processors Association
Seattle
1900 W. Emerson Pl., #205
Seattle, WA 98119
Phone: (206) 281-1667
Email: info@pspafish.net

Juneau
222 Seward Street, #200
Juneau, AK 99801
Phone: (907) 586-6366

Established to foster a better understanding of the importance of the seafood industry and its value to the regional and national economies.

United Catcher Boats
Brent Paine
email: bpaine@ucba.org

Represents catcher vessel interests in Washington D.C. and at regional Fishery Management Council meetings.

United Fishermen of Alaska
211 Fourth Street Suite 110
Juneau Alaska, 99801
Phone 907.586.2820
Fax 907.463.2545

Their mission is to promote and protect the common interest of Alaska's commercial fishing industry, as a vital component of Alaska's social and economic well-being.

Western Alaska Fisheries Development Association

Yukon River Drainage Fisheries Association
725 Christensen Drive, Suite 3-B

Anchorage, AK 99501
Phone: (907) 272-3125,
Fax: (907) 272-3142
1-877-99-YUKON (98566)

Their mission is to establish communications between all user groups: subsistence, commercial, personal use, and sport, the management agencies to include all state and federal agencies that have jurisdiction over any activity that will affect the fish stocks in the Yukon River drainage whether it be direct or indirect. And to take whatever actions are necessary to insure that all fish stocks in the Yukon River drainage are managed in such a manner as to provide for a stable and healthy fishery in the future.

CDQ organizations

Aleutian Pribilof Island Community Development Association
P.O. Box 208
Unalaska, Alaska 99685
Phone: (907) 581-5960
Fax: (907) 581-5963
Email: apicda_unak@ansi.net

Their purpose is to develop stable local economies based upon the fishing industry in each of its communities.

Bristol Bay Economic Development Corporation
P.O. Box 1464
Dillingham, AK 99576
Phone: (907) 842-4370
Fax: (907) 842-4336
Toll Free: 800-478-4370

Their mission is the purpose of the Bristol Bay Economic Development Corporation to promote economic growth and opportunities for residents of its' member communities through sustainable use of the Bering Sea resources.

Central Bering Sea Fisherman's Association
P. O. Box 288
Saint Paul, Alaska 99660
Phone: (907) 546-2597
Fax: (907) 546-2450
Email: cbsfa@cbsfa.com

To become a viable, self-sustaining independent fisheries development organization that, on behalf of the local fishermen, and the Aleut Community of Saint Paul as a whole, and in cooperation with other Bering Sea Coastal communities and CDQ groups will ensure key participation in fishery related development in the region while exercising proper resource stewardship.

Coastal Villages Region Fund
711 H. Street, Suite 200
Anchorage, AK 99501
(907) 278-5151
(907) 278-5150 FAX
(888) 795-5151

Their mission is to improve the social conditions of the Coastal Villages region by creating human resource programs that provide entry-level employment and advancement, a wide range of training programs, scholarships, internships, and apprenticeships that will be self sustaining over time. To enter into the Bering Sea and Aleutian Islands groundfish and crab fisheries as an active participant. To develop the fisheries resources of the Coastal Villages region to the maximum extent economically feasible, given the limited nature of the local resources and their relatively low value.

Norton Sound Economic Development Corporation
420 L Street, Suite 310
Anchorage, AK 99501
Phone 1-800-650-2248
Fax 1-907-274-2249

They participate in and encourage the clean harvest of all Bering Sea fisheries to promote and provide economic development through education, training, and financial assistance to member communities and Western Alaska, while protecting subsistence resources.

Yukon Delta Fisheries Development Association
318 Calista Ct. Suite C
Anchorage, Alaska 99518
ph: (907) 644-0326
fax: (907) 644-0327

Their mission is create a self-sustaining independent fishing company which will create income and employment opportunities for Yukon Delta residents.

Research Entities

Alaska Sea Grant
University of Alaska Fairbanks
PO Box 755040

Fairbanks, AK 99775-5040

Phone: (907) 474-7086
Fax: (907) 474-6285
Email: fygrant@uaf.edu

Bristol Bay Science and Research Institute
P.O. Box 1464
Dillingham, AK 99576
Phone: (907) 842-4370
Fax: (907) 842-4336
Toll Free: 800-478-4370

BBSRI is an independent research institute established by BBEDC in 1999 to undertake scientific research and educational programs that will lead to a greater understanding of the fish stocks, fisheries, and the environments of the Bristol Bay region

National Science Foundation
Bering Sea Ecosystem Study
4201 Wilson Boulevard
Arlington, Virginia 22230
Tel: 703-292-5111
FIRS: 800-877-8339
TDD: 800-281-8749

North Pacific Research Board
1007 West 3rd Avenue, Suite 100
Anchorage, AK 99501
Phone: (907) 644-6700
Fax: (907) 644-6780

North Pacific Research Board is to understand the dynamics of the North Pacific marine ecosystem and use of the resources; the ability to manage and protect the healthy, sustainable fish and wildlife populations that comprise the ecologically diverse marine ecosystems of the North Pacific, and provide long-term, sustained benefits to local communities and the nation; and the ability to forecast and respond to effects of changes, through integration of various research activities, including long-term monitoring.

National Research Council
The National Academies
500 Fifth Street, NW
Washington, DC 20001
1-202-334-2000

The National Research Council has become the principal operating agency of both the National Academy of Sciences and the National Academy of Engineering in providing services to the government, the public and the scientific and engineering communities.

Ocean Studies Board
The National Academies
500 5th Street, NW
Keck Building Rm. K-752
Washington, D.C. 20001
Telephone: 202-334-2714
Facsimile: 202-334-2885

United States Arctic Research Commission
Virginia Office:
4350 N. Fairfax Drive
Suite 510
Arlington, Virginia 22203
Phone: 703.525.0111
Fax: 703.525.0114
Email: info@arctic.gov

Alaska
420 L Street
Suite 315
Anchorage, Alaska 99501
Phone: 907.271.4575
Fax: 907.271.4578
Email: info@arctic.gov

The United States Arctic Research Commission was established by the Arctic Research and Policy Act of 1984. Their Commission's principal duties are (1) to establish the national policy, priorities, and goals necessary to construct a federal program plan for basic and applied scientific research with respect to the Arctic; (2) to promote Arctic research, to recommend Arctic research policy, and to communicate our research and policy recommendations to the President and the Congress; (3) to work with the National Science Foundation as the lead agency responsible for implementing the Arctic research policy and to support cooperation and collaboration throughout the Federal Government; (4) to give guidance to the Interagency Arctic Research Policy Committee (IARPC) to develop national Arctic research projects and a five-year plan to implement those projects; and (5) to interact with Arctic residents, international Arctic research programs and organizations and local institutions including regional governments in order to obtain the broadest possible view of Arctic research needs

University of Alaska Fairbanks
School of Fisheries and Ocean Sciences
University of Alaska Fairbanks

Fairbanks, AK 99775-7220
Phone: (907) 474-7824
Fax: (907) 474-7204
E-mail: info@sfos.uaf.edu (use for general inquiries)

Other International Efforts

Arctic Council
The Arctic Council Secretariat
Ministry for Foreign Affairs of Iceland
Raudararstigur 25
IS-150 Reykjavik
Iceland
Tel. + 354 545 9900
Fax. + 354 562 2373
E-mail: bk@mfa.is

The Arctic Council is a regional forum for sustainable development, mandated to address all three of its main pillars: the environmental, social and economic.

Arctic Monitoring and Assessment Programme
Secretariat
Strømsveien 96
P.O. Box 8100 Dep.
N-0032 Oslo
Norway
Tel. +47 23 24 16 32
Fax +47 22 67 67 06
amap@amap.no

Conservation of Arctic Flora and Fauna
Rannsoknarhusinu
Nordurslod
603 Akureyri
Iceland
Tel: +354 462 3350
Fax: +354 462 3390
Email: caff@caff.is
Website: http://www.caff.is

International Pacific Halibut Commission
P.O. Box 95009
Seattle, WA 98145-2009
Voice: (206) 634-1838

Fax: (206) 632-2983

International Whaling Commission
The Red House,
135 Station Road,
Impington,
Cambridge,
Cambridgeshire CB4 9NP, UK.
Tel: +44 (0) 1223 233 971
Fax: +44 (0) 1223 232 876
Email: secretariat@iwcoffice.org - for general enquiries

The main duty of the IWC is to keep under review and revise as necessary the measures laid down in the Schedule to the Convention which govern the conduct of whaling throughout the world. In addition, the Commission encourages, co-ordinates and funds whale research, publishes the results of scientific research and promotes studies into related matters such as the humaneness of the killing operations.

Inuit Circumpolar Conference
Alaska Office
401 E. Northern Lights Blvd. #203
Anchorage, Alaska 99503
Tel: (907) 274-9058
Fax: (907) 274-3861
E-mail: inuit@icc.alaska.com

North Pacific Anadromous Fish Commission
North Pacific Anadromous Fish Commission (NPAFC)
Suite 502, 889 West Pender Street
Vancouver, B.C.
V6C 3B2
Canada
Telephone: 604-775-5550
Facsimile: 604-775-5577
e-mail: secretariat@npafc.org
URL: http://www.npafc.org

To promote the conservation of anadromous stocks in the waters of the North Pacific Ocean and its adjacent seas.

The Northern Forum
Office of the Secretariat
716 W 4th Avenue,
Suite 100
Anchorage, Alaska 99501
USA

p: +1 907 561 3280
f: +1 907 561 6645
NForum@northernforum.org

To improve the quality of life of Northern peoples by providing Northern regional leaders a means to share their knowledge and experience in addressing common challenges; and to support sustainable development and the implementation of cooperative socio-economic initiatives among Northern regions and through international fora.

Pacific Envrionment
311 California Street, Suite 650
San Francisco, California 94104
Phone: (415) 399-8850
Fax: (415) 399-8860
Email: info@pacificenvironment.org

Mission: Protecting the living environment of the Pacific Rim (see also "International Bering Sea Forum")
Current Bering Sea Ecoregion activities include:

- Defending endangered marine species
- Stopping the harmful effects of underwater oil and gas extraction
- Protecting threatened habitat
- Opposing the worst industrial fishing methods

Protection of Arctic Marine Environment
Hafnarstraeti 97
600 Akureyri
Iceland
Tel : +354 461 1355
Fax: +354 462 3390
Email: pame@pame.is

The Wild Salmon Center
Jean Vollum Natural Capital Center
721 NW Ninth Ave, Suite 290
Portland, OR 97209
Tel: (503) 222-1804
Fax: (503) 222-1805
E-mail: info@wildsalmoncenter.org

Their mission is to identify, understand and protect the best remaining wild salmon ecosystems of the Pacific Rim, including the Russian Far East.

2.2 Russian Stakeholders

Non-Governmental Conservation Organizations

Chukotka Ecological Union "Kaira Club"
Gennady Smirnov, Chairman (and International Bering Sea Forum Member)
Ulitsa Otke 41-29
PO Box 83
Anadyr, Chukotka 689000
Tel: +7 (427-22) 46-76-1
Fax: +7 (427-22) 20-58-7
Email: gsmirnov-2003@yandex.ru; karia_new@mail.ru
Website: http://www.kaira.seu.ru

The main goals of the "Kaira Club" are to: initiate and unite voluntary public activities to protect nature; to organize and conduct public environmental assessment and public environmental monitoring; to deliver environmental education to the public; to preserve traditional nature use practices; and to develop a network of strictly protected nature areas. Kiara Club performs ecological monitoring of coastal walrus rookeries in Anadyr Bay with the Chukotka Branch of TINRO (the Pacific Research Centre for Marine Fisheries and Oceanography) and with the Regional Fisheries Inspectorate. Funded from 1996-2002 by USFWS, WWF-US, USGS.

City Association of Indigenous Minority Peoples of Anadyr, Chukotka
Nikolai Ettyne, Chairman (and International Bering Sea Forum Member)
Anadyr, Chukotsky Autonomous Okrug, Russia
Tel (work): +7 (427-22) 2-65-84; Fax: +7 (427-22) 2-65-84
Email: aliot@anadyr.ru

Association of Traditional Marine Mammal Hunters of Chukotka
Polyarnaya 20-14, Anadyr, Chukotka A.O, Russia 689000
phone/fax: +7-(42722) 2-2531
e-mail: ezdor@anadyr.ru; atmmhc@yandex.ru
689315, Lorino, Gagarina 14-5;
phone/fax: +7-(42736) 9-3355

The main goals of the Association are: preservation of traditional marine hunting as the basis of indigenous peoples' traditional subsistence; preservation of marine mammal populations and marine biodiversity; representation of marine hunters' interests at international, national and regional levels; participation in the rational distribution of marine mammal quotas between members of the Association; preservation of traditional marine hunting from commercialization; coordination of sea-food products' marketing according to the requirements of international conventions; coordination of research programs on marine hunting; and collection of native peoples' traditional knowledge.

The Association of Indigenous People of Chukotka
Irina Vasilievna, President
Ulitsa Lenina 48-1
Anadyr, Chukotka, Russia 689000
Email: public@anadyr.ru
Tel: +7 (42722) 2-08-87; Fax**:** +7 (42722) 2-04-52

Society of Eskimos of Chukotka "Yupik"
Lyudmila Ainana, Representative
Mikhail Bragin, Deputy Representative
Ulitsa Eskimosskaya 18-27
Provevideniya, Chukotka Autonomous Region
Tel: (through the operator) 2-29-46

Wild Fish and Biodiversity Fund
Vychaslav Zvyagintsev and Oleg Pustovit
Ulitsa Ryabikova 38, Office 24
Elizovo, Russia, 683000
Tel/Fax: +7 (415-31) 2-10-60, (41-52) 111-879
Email: chief_wf@mail.kamchatka.ru, chief_wf@elrus.kamchatka.ru

Kamchatka League of Independent Experts
Olga Andreevna Chernyagina, President
Ulitsa Partizanskaya 56
Petropavlovsk-Kamchatsky Russia, 683000
Tel. +7 (4152) 120996; Fax +7 (4152) 120747
Email: defens@mail.kamchatka.ru
Internet: http://klie.ru/Engl/eliga.htm

The nongovernmental organization Kamchatka League of Independent Experts serves as a resource center for other regional NGO's. It has recently conducted a public environmental impact assessment of the project Natural Gas Supply of the Kamchatka Oblast; is conducting 3 scientific conferences "Conservation of Biological Diversity in Kamchatka and Coastal Waters", and organized media and expert trips to gas pipe-line construction site.

Ethno-Ecological Information Center in Kamchatka "Lach" (Russian Association of Indigenous People of the North, Siberia, and Far East)
Nina Zaporotskaya, Director (and International Bering Sea Forum Member)
Ulitsa Koroleva, 11, Office 2
Petropavlovsk-Kamchatsky, Russia, 683009
Tel/Fax: +7 (4152) 190-132, 53-291
Email: lach@mail.iks.ru

Kamchatka Regional Association of Public Associations of Native Small-Numbered Peoples of the North

Dmitry Berezhkov, President
Ulitsa Koroleva 11 Office 2
Petropavlovsk-Kamchatsky, Russia 683009
Tel. +7 (4152) 190-132
Email: kamchadal2000@yandex.ru

Union of Public Organizations (Communities) of Native Small-Numbered People of the North of Kamchatka Region "YaYaR"
Liudmila Grigorievna Ignatenko, Head
Ulitsa 60 let Oktyabrya 1-17
Razdol'niy, Elizovsky District, Kamchatka Region, Russia, 684020
Tel. +7 (41531) 37216;
Email: yupik@elrus.kamchatka.su

ANO Resource Center "PILOT"
Dmitry Panov, Director
Ulitsa Sovietskaya, 35, office 139
Petropavlovsk-Kamchatsky, Russia 683024
Tel.: +7 (4152) 123 432
Email: pilot@mail.kamchatka.ru

Aleut Association "Ansarko"
Svetlana Vozhikova
Ulitsa 50 Lyet Oktyabrya
Nikolskoye, Aleutsky District, Kamchatskaya Oblast
Russia 684014
Email: aleut@svyaz.kamchatka.ru
Tel: +7 (415-47) 3-61, 1-12; Fax: +7 (415-47) 1-99

"Aborigine of Kamchatka" Information Center
Valentina Uspenskaya
Ulitsa Pogranichnaya 19, Office 400 b
Petropavlovsk Kamchatsky, Russia 683040
Tel: (4152) 12-66-39
E-mail: aborigen@mail.iks.ru

Northern Pacific Fund
Sergei Vakhrin
Fax: +7 (415-2)-16-92-96
Tel: +7 (415-2)-16-91-50 or 16-91-51
E-mail: info@npacific.kamchatka.ru
Internet: http://npacific.kamchatka.ru/

The Northern Pacific Fund was established in 1991 (initially as the Kamchatka Salmon Protection Fund, and later, in 1996, with its present name) to conduct a broad informational campaign to focus the world's attention on the importance of protecting fish resources in the Russian Far East.

Municipal Enterprise of the Commander Islands
Ivan Vozhikov, Commercial Fisher/ Fur Seal Hunter
Nikolskoye, Kamchatskaya Oblast, Commander Islands, Russia

Aleutsky Municipal Formation
Alexader Yevstifeev
Ulitsa Gagarina 3-7
Nikolskoye, Kamchatka Region, Russia
Tel: +7 (415) 47-22172
Email: iz-strana@mtu-net.ru

Inter-regional Public Organization of Hunters & Fishermen's Association "Krechet"
40, Pushkin Str., Khabarovsk, Russia 680000
Tel. +7 (4212) 32-79-33, 39-34-34; Fax: +7 (4212) 30-61-09.
Email: krechet@en.khv.ru

Works to unite individual fishermen and hunters, involved in salmon and herring fishing, the fur trade, and hunters' supply. Develops sustainable fishing projects the in Shantar Islands. Interested in ecotourism development.

Khabarovsky Krai Environmental Public Organization ECODAL
Irina Borgdan, Chairman
71, Volochaevskaya Str., Khabarovsk, Russia 680030
Tel.: (4212) 23-81-61
E-mail: ecodal@clinic.kht.ru

Works to develop environmental legislation and juridical defense of nature. Actively involved in environmental assessment of oil pipeline and drilling issues; defends indigenous people rights, offers legislative support to protected areas.

Kamchatka Itelmen Council "Tkhsanom"
Oleg Zaporotsky, President
Ulitsa 50 let Oktyabrya 26-10
Kovran, Tigilsky District, Koryaksky Autonomous Region, Russia, 688621
Tel. +7 (41539) 26629
Email: zprco@palana.ru

Association of Indigenous Minority Peoples of the North (KMNS) Olyutorsky District
Albina Yailgina, Chair (and International Bering Sea Forum Member)
Ulitsa Zarechkaya 11-1, Tilichiki, Koryak Autonomous Okrug, Russia 688800
Tel: +7 (244) 52 500
Email: yailgina@mail.iks.ru

Magadan Center for the Environment
Timofei Ilyich Savchenko, Executive Director
PO Box 0/10
Magadan, Russia, 685000
Tel. +7 (4132)2 21289
Email: mace@online.magadan.su
Distributes a journal, implements ecological monitoring, and hosts seminars.

Teamwork
Olga Moskvina, Coordinator
Ulitsa Proletarskaya 12, Office 151
Magadan 684000
Tel: +7 (41322) 2-97-95, 2-20-40
Email: ivmark@kolyma.ru

Bureau for Regional Outreach Campaigns (BROK)
Anatoly Lebedev, Chair
Ulitsa Pologaya 22
Vladivostok, Russia 690091
Tel/Fax +7 4232 405132
Email: swan1@vladivostok.ru
Internet: http://broc.arsvest.ru

BROK is a team of journalists and activists who work to protect nature. It is a part of the "Living Sea" coalition, which works to involve the public in resolving issues related to the sustainable use of marine bioresources in the Russian Far East. BROK initiates media campaigns about the conservation and sustainable use of the Bering Sea's bioresources (as well as about other issues concerning the North Pacific), with particular attention to the interests of coastal indigenous communities.

World Wildlife Fund- RFE
Konstantin Zgurovsky, Marine Program Coordinator (and International Bering Sea Forum Member)
ul. Pologaya, 68, 411
Vladivostok, Russia 690091
Tel: +7 (4232) 429-085; Fax: +7 (4232) 406-657; Tel/fax: +7 (4232) 406-651/2/3
Email: kzgurovsky@wwfrfe.ru, kozgur2002@yahoo.com

"Zov Taiga" Center for Nature Protection
Vasily Solkin, Director
Ulitsa Radio 7
Vladivostok, Russia 690042
Tel: +7(4232) 320-666
Email: editor@zovtaigi.ru
Internet: http://www.zovtaigi.ru

It is a member of “Living Sea” coalition. Publishes the “Zov Taiga” journal and produces a local TV program on the environment. Winner of many awards for their films and publications. Participates in different activities and campaigns.

ISAR Russian Far East
Svetlanskaya 197, k. 79, Vladivostok, Russia, 690091.
Tel: +7 (4232) 20-53-15; 26-96-06.
Email: isarrfe@vlad.ru
Internet: http://www.isarrfe.ru

It is a lead organization of the “Living Sea” coalition. It plays active role in local public initiatives development, arranges and takes part in public campaign. Publishes environmental posters, leaflets, and the magazine “Listya na ladonyakh”

Ecopatrol
Galina Styetskaya
Tel: +7 (4232) 27-76-30
Email: mermaid888@mail.ru
Involved primarily in production of environmental and anti-poaching TV programs.
Participates in anti-poaching raids.

Sakhalin Environment Watch
Kommunisticheskiy Prospekt, 27a,
Office 301
693 007 Yuzhno-Sakhalinsk
watch@dsc.ru
Internet: http://www.sakhalin.environment.ru/

The organization’s mission is to protect and defend nature and the environment of the Sakhalin Region. Its primary goals are: to realize social ecological control, to defend the rights and legal interests of citizens in the sphere of environmental protection; and to organize and conduct public ecological assessment. Its primary directions are to protect forests and to increase ecological safety given the exploration and extraction of oil and gas on the shelf.

Regional Governments

Chukotka Regional Administration
20 Ulitsa Beringa
Anadyr, Chukotka Autonomous Region
Russia 689000
Tel: +7 (42722) 2-90-13; Fax: +7 (42722) 2-29-19; Telex: 354128 UTES RU
Website: http://www.chukotka.org

Governor

Roman Abramovich
Tel: +7 (42722) 2-90-00, 2-90-40; Fax: +7 (42722) 2-27-25

First Deputy Governor
Andrei Gorodilov
Tel: 2-47-55, 2-45-89, 2-90-29; Fax: 2-04-26

Director of International Affairs
Natalia Fogina
Tel: +7 (42722) 2-90-49; Fax: (7-42722) 2-29-19

Chukotka Autonomous Region Fisheries Committee
Ulitsa Otke 44
Anadyr, Chukotka Autonomous Region
Russia,689000
Tel/Fax:+7(42722)2-68-02,2-68-23
Chair: Aleksandr Moskalenko

Chukotka Autonomous Region Fisheries Committee
Igor Mikhno, Vice Chairman (and International Bering Sea Forum Member)
Kursovoy Prospekt 4
Moscow, Russia 119054
Tel: +7 (095) 502-9730; Fax: +7 (095) 937-6580
Email: igorm@chao.sibneft.ru, fishchao@yandex.ru

Chukotoka Autonomous Region Committee for Environmental Protection
Ulitsa Kurkutskovo 34
Anadyr, Chukotka Autonomous Region
Russia, 689000
Tel: +7 (42722) 2-22-81, 2-48-10; Fax: +7 (42722) 2-48-10
Director: Vladimir Shelukhin

Kamchatka Regional Administration
Governor's Office
Ulitsa Ploschad Lenina 1
Petropavlovsk-Kamchatsky, Russia 683040
Tel: +7 (4152) 112-091
Fax: +7 (4152) 273843
Governor: Mikhail Mashkovtsov

Foreign Economic Relations Department
Ulitsa Ploschad Lenina 1
Petropavlovsk-Kamchatsky, Russia 683040

Tel: +7 (4152)112-355, 112-092, 120-822 (tourism)
Fax: +7 (4152) 112-355
Email: kra@svyaz.kamchatka.su
Head: Alexandr Potievsky

Kamchatka Region Fisheries Department
Ulitsa Ploschad Lenina 1, Office 220
Petropavlovsk-Kamchatsky, Russia 683040
Tel/Fax: +7 (4152)12-10-37
Email: info@fishdep.iks.ru
Internet: http://www.fishdep.petropavlovsk.ru/

Kamchatka Region, City of Petropavlovsk-Kamchatsky
State Environmental Conservation Committee of Kamchatka Region
Mail: Russia 683031, Petropavlovsk-Kamchatsky, Pr. Karla Marksa, 29/1
Chairman Tel: +7 (41522) 5-12-22, 5-22-77
Deputy Chairman Tel: 5-06-22, 5-26-46
Fax: +7 (41522) 5-22-77
E-Mail: rcnp@nature.kamchatka.su

Kommandorsky Islands Government
Vladimir Phomin, Chief Fishing Inspector
50 Let Oktyabrya 25-11
Nikolskoye, Aleut Region, Kamchatks Russia
Tel: +7 (41524) 722-187
Email: phominvv@vilkan.ru

Federal Fisheries Management Structures

State Agency for Fishery (SAF) of the Ministry for Agriculture
Rozhdestvensky Boulevard, 12, Moscow, 103031, Russia
Tel: +7 (095) 928 23 20 (Info), (095) 921 07 23 (Chairman), (095) 925 22 76, 928 13 08 (First Vice-Chairman), (095) 928 55 27.
Fax +7 (095) 928 19 04 or 921 69 95
Email: harbour@fishcom.ru
Committee Director: Ilyasov
Deputy Director for Science: Podolyan

Areas of responsibility: The Federal Fisheries Committee is the leading administrative body for fisheries performing the state control of fisheries. It issues or approves all administrative decisions related to marine capture fisheries in Russia's territorial sea, EEZ, the EEZs of other states and the High Seas and controls allocation of quotas for particular marine stocks outside the territorial sea and the internal marine waters.

Russian Federal Directorate for Protection and Replenishment of Aquatic Bioresources (Glavrybvod)
Grigory Konstantinovich Kovalev, Director
Verchnyaya Krasnoselskaya, 17, Moscow
Tel: +7 (095) 264 92 43

Areas of responsibility: Issuing and approval of specific fishery regulation documents, updates and amendments to them, approval of management decisions for most important stocks in marine capture fisheries, supervising issuing fishing permits, collecting statistical data (note: the latter is controversial, Glavrybvod definitely collects statistics but, for internal purposes; there was a case when Glavrybvod refused to provide catch data arguing that VNIRO (see below) is responsible for gathering catch statistics that are intended to be officially submitted to the State Committee for Statistics and FAO). Glavrybvod also coordinates all activities related to fish stocks replenishment and the development of salmon and sturgeon hatchery facilities.

Regional Fisheries Management Structures

Northeast Fish Inspection (Sevvostrybvod, SVRV) of the GKR
Alexander Gennadyevich Jeltyshev, Director
Mikhail Ravilievich Korolev, Deputy Director
Ulitsa Koroleva 58 , Petropavlovsk-Kamchatsky, Russia, 683049
Tel: +7 (4152) 1190 72; Fax: +7 4152 1190 83
Email: sevvostrybvod@rybvod.kamchatka.ru

Areas of responsibility: Responsible for issuing permission to fish, execution of proper fishing regulations, spawning grounds, marine mammals' rookery protection, satellite monitoring of fishing activity and fleet movements.

Kamchatsky Center for Communication & Satellite Monitoring (KCSM)
Viktor Yuryevich Reznikov, General Director
Klyuchevskaya Ulitsa 38, Petropavlovsk Kamchatsky, Russia 683003
Tel. +7 (4152) 11-13-44.
Website: http://www.kccm.ru

Area of responsibility: Area- all Russian Far East region, about 4000 sq. miles, 2000-2500 are monitored, in "Rybolovstvo" system, capable of monitoring 4000 vessels simultaneously, provide communication for fleet, control movement of vessels, collect information on vessels and process data.

Russian Fishery and Oceanography Research Institutes

Russian Federal Research Institute for Fishery & Oceanography (VNIRO)

Boris Nikolaevich Kotenev, Director
Verkhnyaya Krasnoselskaya Ulitsa 17, Moscow, Russia 107140
Tel: +7 (095) 264 93 87; Fax +7 (095) 264 91 87;
Email: yuz@vniro.ru (Deputy Director Yulia Zaitseva)

Areas of responsibility: Coordination of stock assessment, preparation of the Total Allowable Catch proposal, catches statistics for FAO.

Pacific Research Centre for Marine Fisheries and Oceanography (TINRO)
Lev Nikolaevich Bocharov, Director
4, Shevchenko per. Vladivostok, GSP, 690950
Tel: +7 (4232) 400921; Fax +7 (4232) 300751; Email: tinro@tinro.ru
Other key people – Blinov Yuri Grigoryevich, First Deputy Director, Pozdnyakov Sergei Efimovich, Deputy Director;
Areas of responsibility: Coordination of stock assessment of the TINRO branches, Stock assessment, preparation of the Total Allowable Catch (TAC) proposal.

Kamchatka Branch of TINRO
Alexander Paramonovich Antonov, Director
Naberezhnaya str. 18, Petropavlovsk-Kamchatsky, Russia 683000
Tel.: (+7 4152) 11-27-01; 21-06-11

Areas of responsibility: Surveys of living resources of western and eastern Kamchatka shelf, preparation of TAC proposals for TINRO.

Chukotka Branch of TINRO
Vladimir Georgievich Myasnikov, Director
56 Otke Str. Anadyr, 689000, Russia
Tel.: +7 (2722) 26662; Fax: +7 42722 26761, Email: tinro@anadyr.ru.

Areas of responsibility: Surveys of living resources of western and eastern Chukotka preparation of TAC proposals for TINRO.

Ministry for Natural Resources of the Russian Federation (MPR)
Minister Vitaly Grigorievich Atryukhov
Address: Bolshay Gruzinskaya Ultisa 4/6, Moscow, Russia 123995.
Contact information: Tel: +7 (095) 254-48-00. Fax: +7 (095) 254-43-10, 254-66-10.
Email: admin@mnr.gov.ru. Website: www.mnr.gov.ru

Department for Protection of Biological Diversity and Strictly Protected Natural Areas
Amirkhan Magomedovich Amirkhanov, Director
Kedrova, 8, Moscow, Russia
Tel.: +7 (095) 124-04-71
Vsevolod Borisovich Stepanitsky (Protected Areas)
Tel: +7 095 1255688; Fax: 1256302

Areas of responsibility: Measures for protection of marine mammals included in the Red Data Book of the Russian Federation (Polar Bear, Gray and Bowhead whales, Baleen whales, Steller Sea Lion, endangered seabirds), supervision and coordination of management and enforcement of offshore parts of the strictly protected natural areas, including the Commander Islands Biosphere Strictly Protected Reserve (Zapovednik), Kronotsky Biosphere Zapovednik, Koryak Zapovednik, Wrangel Island Zapovednik, Yuzhno-Kamchtaskiy Reserve (Zakaznik).

Federal Service for control of exploitation of natural resources and environmental defense (FSCD)
Boris Nikolaevich Kornev, Director
Pyatnitskaya 59/19, Moscow
Tel: (+7 095) 953-57-59, 230-87-29

Areas of responsibilities: General management and monitoring of Russian environment.

Department for State control of Infrastructure Units at Sea and the Coastal Zone
Konstantin Vladimirovich Shevlyagin, Deputy Director of FSCD, Director of Department
Pyatnitskaya 59/19, Moscow
Tel: +7 (095) 230-87-37

Areas of responsibility: control for construction of different units at sea.

Department for State Ecological Expertise (Ecological Expert Review)
Natalia Ivanovna Onischenko, Director
Bolshay Gruzinskaya Ultisa 4/6, Moscow, Russia 123995
Tel: +7 (095) 254-38-72

Areas of responsibility: Conducting panel review of the annual proposal for Total Allowable Catch.

Special Marine Inspections System

Kamchatka Special Marine Inspection of MPR
Sergey Vitalyevich Panyaev, Director
Sergey Mikhailovich Donigevich, Deputy Director
Ulitsa K. Marksa 29/1, Petropavlovsk Kamchatsky, Russia 683031
Tel: +7 (415 2) 52939, 52921

Areas of responsibility: Work regarding the Law on Animal World (1995), Law on Specially protected Areas (1995), USSR Red Book of Rare and Endangered Plants (1988), USSR Red Book of Rare and Endangered Animals (1996), Water Code (1995), Instructions on Ecological Justification of Economic Activity (1995), Law on Environmental Impact Assessment (1995). It works on base of model regulations approved by order of the State Committee for Environment Protection 25th 1999, # 466.

Enforcement of environmental regulations at sea, including fisheries in territorial waters of the Kamchatka area.

Koryak Special Marine Inspection of MPR
Gennadyi Nikolaevich Komogorov, Director
Leninskaya Ulitsa 18a, Office 404. Petropavlovsk Kamchatsky.
Tel: +7 (415 2) 125201

Areas of responsibility: Enforcement of marine environment regulation in the Koryak Okrug territorial waters of the Russian Federation.

Border Service of the Federal Security Service
Vladimir Egorovich Pronichev, Director
Other key persons: Vice-admiral Viktor Mikhailovich Serdjanin
Myasnitskaya Ulitsa 1, Moscow, Russia 101000.
Tel.: + 7 (095) 2240-19-73; Fax: (095) 923-55-34; Webpage: http://www.fps.ru

Areas of responsibility: Enforcement of marine fishery regulation in the EEZ and the territorial sea of the Russian Federation. It works on base of Decree of the Russian President, dated 29th of August 1997, # 950.

Northeast Regional Division of the Border Service (SVRPU) of Federal Security Service (FSB)
General-Lieutenant Valery Vladimirovich Putov
Other key people: Colonel Pavel Anatolyevich Ivankov, Head of the Analytical Control and Fishery Condition Forecasting Center,
1/1 Karla Marksa Str., Petropavlovsk-Kamchatsky.
Tel.: +7 (415-22) 33434
Email: mail@svru.petropavlovsk.ru

Areas of responsibility: 17000 km border line and 7000000 square miles aquatic territory to control. Technical capacity: In Chukotka area – 1 plane AN 72-1; 3 helicopters MI 26, one is operating, 5 vessels.

Kamchatka State Marine Inspection of the SVRPU
Vladimir Mikhailovich Grabov
Ulitsa Korfskaya 8, Petropavlovsk Kamchatsky,
Tel.: +7 (415-2) 119100, 119101

Technical capacity: About 200 inspectors, at sea usually 20-100 inspectors, onboard foreign and Russian vessels. About 5 vessels in service.

Research Organizations and Institutes

North-East Interdisciplinary Scientific Research Institute
Far Eastern Branch Russian Academy of Sciences
16 Portovaya St.
Magadan, Russia 685000
Tel/Fax: +7(41322)-30051

Institute for Biological Problems of the North
Far East Branch, Russian Academy of Science
Aleksandr Andreev, Assistant Director
Ulitsa Luksa 12-12
Magadan, Russia 685030
Tel: +7 (41322) 505-35
Email: alexandrea@mail.ru

Kamchatka Science Center
Piipa Bulvar 9
Petropavlovsk-Kamchatsky, Russia 683006
Teletype: 244213 VOLCAN; Fax: +7 (41522) 54723
Email: volcan@kcs.iks.ru
Internet: http://www.kcs.iks.ru/index_eng.html

Shirshov Institute of Oceanography, Russian Academy of Science
Mikhail Flint, Deputy Director of Biological Department
36 Nakhimovsky Prospekt
Moscow, Russia 117851
Tel: + (095) 124-8515
Email: m_flint@orc.ru

Kamchatka Institute of Ecology and Natural Resource Use
Robert Moiseev, Director
Ulitsa Partizanskaya 6
Petropavlovsk-Kamchatsky, Russia 683000
Tel: +7 (41522) 94-752
Email: defens@mail.kamchatks.ru, kftig@kcs.iks.ru, terra@kamchatka.ru
Internet: http://www.terrakamchatka.org

The primary activities of the Kamchatka Institute of Ecology and Natural Resources Use are: to study the structural-functional organization, dynamics, and productivity of terrestrial and water ecosystems; to develop scientific foundations for sustainable nature use in the northwestern Pacific Ocean; and to develop methods for the ecological-economic evaluation of anthropogenic activities.

Kamchatka State Pedagogical University
Tatiana Borisova, Senior Instructor (and International Bering Sea Forum Member)
Ulitsa Larina, 32, 30
Petropavlovsk-Kamchatskiy, Kamchatskaya Oblast, Russia 683002

Tel: +7 (4152) 197-095
Email: tany-borisova@yandex.ru; borisova@mail.kamchatka.ru

Kamchatka Branch Pacific Institute of Geography

Robert Moiseev (International Bering Sea Forum Member)
Petropavlovsk-Kamchatskiy, Kamchatskaya Oblast, Russia 683000
Email: mtr@mail.kamchatka.ru

Nature Reserves

Komandorsky Zapovednik

Director: Nikolai Pavlov
29/1 Prospekt Karla Marksa, Office 213
Petropavlovsk Kamchatsky, Kamchatskaya Oblast, Russia 683006
Tel: +7 (415-22) 554-182-01-07
Email: gpz_komandorskiy@mail.iks.ru, komand_zapovednik@rambler.ru

Komandorsky Zapovednik was created in 1993 to protect: marine mammal rookeries (fur seals, sea otter, sea lions, and others, totaling as many as 300,000 individuals); the highly productive northern Pacific marine ecosystem; a unique population of Arctic fox; nesting bird species for which the Commanders is the western part of their range (Aleutian tern, Rock Sandpiper, and others). A special goal is to protect the historical-architectural monuments of the 18th and 19th centuries.

Koryaksky Zapovednik

Director Aleksandr Bakushin
8 Ulitsa Naberezhnaya
Tilichiki, Olyutorsky District, Koryaksky Autonomous Okrug, Russia 684800
Tel: +7 (415-44) 5-23-38, 5-20-74; Email: koryak@mail.iks.ru

Koryaksky Zapovednik was created in 1995 to protect: a territory important to waterfowl for mass migration and nesting; the coastal and marine ecosystems of the southern Bering Sea, with their large colonies of sea birds; and also northern Kamchatka's entire complex of ecosystems.

Kronotsky Zapovednik

Director: Valery Komarov
48 Ulitsa Ryabikova
Elizovo, Kamchatskaya Oblast, Russia 684010
Tel: +7 (415-31) 6-17-54; Email: zapoved@elrus.kamchatka.su

Kronotsky Zapovednik was created in 1934 to protect the unique and diverse landscapes of Kamchatka and also to protect marine mammal rookeries and bird colonies of the Pacific coast.

Lebediny Federal Zakaznik
Director: Vladimir Koval
15 Ulitsa Berezkina, Apt. 8
Markovo, Anadyrsky District, Chukotsky Autonomous Okrug
Lebediny Federal Zakaznik was created in 1984 to: protect, restore, and reproduce animals and birds that are of commercial, scientific, and cultural importance; to protect rare and endangered animal species. Primary species targeted for conservation are: the Brent goose, Snow goose, Lesser White-fronted Goose, Emperor goose, Ivory gull, White-tailed eagle, Gyrfalcon, Peale's Peregrine Falcon, and Mute swan.

Wrangel Island Zapovednik
Director: Leonid Bovye
4/1 Ulitsa Obrucheva
Building 2, Apartment 14
Pevek, Chaunsky District, Chukotsky Autonomous Okrug, Russia 686830
Tel: +7 (427-37) 243-92; Email: wisnr@chrues.chukotka.ru

Wrangel Island Zapovednik was created in 1976 to: protect and study the typical and unique ecosystems of the island part of the Arctic; to protect and study species such as the polar bear, walrus, Russia's only nesting population of Snow goose, and many other species of Beringian flora and fauna, with high levels of endemism. In 1974, musk oxen were introduced to the island.

Yuzhno-Kamchatsky Federal Zakaznik
48 Ulitsa Ryabikova
Elizovo, Kamchatskaya Oblast, Russia 684010
Tel: +7 (415-31) 6-17-54; Email: zapoved@elrus.kamchatka.su

Yuzhno-Kamchatsky Federal Zakaznik was created in 1983 to protect and restore animal species and their habitats including: the sea otter, the snow sheep, black-cappped marmot, Stellar's Sea-Eagle, Peale's Peregrine Falcon, and Gyrfalcon. The zakaznik also protects rare and endemic plant species.

3. Biological Features Information

3.1 Seabirds (Kittiwakes, Murres and Cormorants)

The following resources on Bering Sea Ecoregion seabirds were compiled for the first iteration of this Strategic Action Plan for the Bering Sea:

- Life History, Population Status, Threats to and Research Needs for Bering Sea Ecoregion Seabirds (Denise Woods, WWF Bering Sea Ecoregion Program)
- Documentation for Viability Table (E5S Planning Tool)
- Conceptual Model Developed to Identify Key Ecological Attributes and Threats for Bering Sea Ecoregion Seabirds (Randy Hagenstein, TNC Alaska; Evie Witten and Denise Woods, WWF Bering Sea Ecoregion Program) (Figure A1)
- Threats to Bering Sea Ecoregion Seabirds (Table A1)

The following experts were consulted with regard to Bering Sea Ecoregion seabirds:

Greg Balogh
U.S. Fish and Wildlife Service
Endangered Species Program
605 West 4th Avenue, Room G-61
Anchorage, Alaska 99501
Phone: (907) 271-2778
Fax: (907) 271-2786
Email: Greg_Balogh@fws.gov

Vernon Byrd
U.S. Fish and Wildlife Service/ Alaska Maritime National Wildlife Refuge
95 Sterling Highway
Homer, Alaska 99603
Phone: (907) 235-6546
Fax: (907) 235-7783
Email: Vernon_byrd@fws.gov

Nikolai Konyukhov
Senior Scientist
Institute of Ecological Problems and Evolution
Russian Academy of Sciences
Leninsky Prospekt 86-310
Moscow, Russia 119313
Email: konyukh@orc.ru

Russ Oates
U.S. Fish and Wildlife Service/ Alaska Migratory Birds
1011 East Tudor Road: MS 201
Anchorage, Alaska 99503
Phone: (907) 786-3443
Fax: (907) 786-3641
E-mail: russ_oates@fws.gov

Sergey Sergeev
Institute of Ecology and Evolution Russian Academy of Sciences
Leninskiy prospect 33
Moscow, Russia 117071

Art Sowls
U.S. Fish and Wildlife Service/ Alaska Maritime National Wildlife Refuge
95 Sterling Highway
Homer, Alaska 99603
Phone: (907) 235-6546
Fax: (907) 235-7783
Email: Art_sowls@fws.gov

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Life history, population status, threats to and research needs for

BERING SEA ECOREGION SEABIRDS

Introduction

The Bering Sea and adjacent waters are inhabited by thirty-eight species of seabirds, principally the Procellariiformes (albatrosses, shearwaters and petrels), Pelecaniformes (cormorants), Larids (gulls, including kittiwakes), and Alcids (auks, puffins, murres, auklets and murrelets) (Loughlin et al. 1999). Seabirds can be broadly characterized as long-lived species (20 to 60 years) with delayed sexual maturation and breeding, low clutch sizes (in many cases one egg), low annual reproductive rates, and extended chick rearing (up to 6 months) (Schreiber and Burger 2002). Their dependence on concentrations of marine prey that are mobile and patchily distributed obliges most species of seabirds to form large nesting colonies near a reliable food source (Kondratyev et al. 2000a). The life history traits of seabirds are adaptive responses to conditions of living in the marine environment where food is patchy and unpredictable. In the long term, such attributes tend to make populations resistant to environmental variability and dampen fluctuations in population size (Furness and Monaghan 1987). In the short term, however, populations of a species can vary considerably, at different sites and in different years.

Seabirds use a variety of methods to obtain prey and can be categorized based on the primary capture method they employ: diving from the surface and pursuing prey while swimming underwater with the feet (cormorants) or wings (many Alcids and diving petrels), plunge-diving from above the water's surface (e.g. gannets), or picking prey ("dipping") from at or near the water's surface (gulls, terns, large petrels and storm-petrels) (Nelson 1979). Seabirds can be further categorized by their primary prey source: fish or plankton. Most Bering Sea seabird species are piscivorous (fish-eating) and are thus may be more subject to influence from the fisheries and more susceptible to incidental bycatch in fishing gear than are planktivorous species. Six seabird species of three guilds here embody a suite of characteristics representative of piscivorous Bering Sea seabirds: at-sea surface feeding species (Black-legged Kittiwake and Red-legged Kittiwake), at-sea diving species (Thick-billed Murre and Common Murre) and near-shore diving or generalist species (Pelagic Cormorant and Red-faced Cormorant) (M. Flint, A. Sowls; pers. comm.).

Life History

Life history parameters and population trends of the representative species are summarized in Table 1. Specific information on distribution and habitat use for each species is discussed below:

Kittiwakes
The Black-legged Kittiwake (*Rissa tridactyla*) is the most numerous gull in the world (Baird 1994). It is circumpolar in distribution, with over 41% of the Alaskan population on islands in the Bering and Chukchi Seas and 4.7% in the Aleutian Islands.

Concentrations occur on Baffin Island, Prince Leopold Island, Barrow Strait, Wrangel and Herald Islands, and the Commander Islands group (Sowls et al. 1978; Baird and Gould 1983, Kondratryv et al. 2000a). In contrast to the widely distributed and very common Black-legged Kittiwake, the Red-legged Kittiwake (*Rissa brevirostris*) is endemic to the Bering Sea and is known to breed at only four locations: Bogoslof and Fire Islands in the Bogoslof Islands group, Buldir Island in the western Aleutian Islands, the Commander Islands and, most notably, the Pribilof Islands (Byrd 1978; Byrd et al. 1997). Over 75% of the population is found on St. George Island (Pribilof Islands) alone (Byrd and Williams 1993).

Kittiwakes are at-sea surface feeding piscivores. They feed on small fish and marine invertebrates, hunting in flocks over deep water by pursuit-plunging or dipping in the top 0.5 m of water (Hunt et al. 1981). During the breeding season, kittiwakes are found predominantly near the coasts of islands, over the continental shelf. During this time, Red-legged Kittiwakes may forage 120-150 km from their breeding islands while Black-legged Kittiwakes usually remain relatively close to shore (e.g. 0.5km in Alaska; Biderman et al. 1978). During winter, kittiwakes spend more time offshore and forage over the shelf break and oceanic regions (Briggs et al. 1987). Both species nest on ledges of vertical cliff faces, often in association with murres.

Murres

Murres are some of the most numerous seabirds in the Northern Hemisphere. The Thick-billed Murre (*Uria lomvia*) and the Common Murre (*Uria aalge*) inhabit the circumpolar arctic and subarctic. These species, often in association with each other, breed in the Bering Sea from northern Alaska south, along the coasts and offshore islands (St. Mathew, St. Lawrence and the Pribilof Islands) and throughout the Aleutian Islands (Gaston and Hipfner 2000). In Russia, a few hundred murres nest on Wrangel and Herald Islands but most of the Bering Sea murres occur on St. George Island (Pribilof Islands), which supports over 1 million breeders (Gaston and Hipfner 2000). Murres spend winter in Bering Sea, wherever there is open water.

Murres are at-sea diving piscivores. They capture small fishes and invertebrates in deep water, on or above the sea bottom, by wing-propelled pursuit from the surface (Ainley et al. 2002). Common Murres are considered more piscivorous than Thick-billed Murres (Ainley et al. 2002). Both are consummate divers and they prefer foraging habitats that are greater than 10m deep (up to 200m deep for Thick-billed Murres; Croll et al. 1992). Both species commonly breed together at extraordinarily high densities on the ledges of vertical cliff faces, maintaining the smallest personal space of any bird (Gaston and Hipfner 2000). Murres' breeding strategy is unusual: they and exhibit a high degree of egg laying and colony departure synchrony, early departure from the "nest" of chicks, and completion of development at sea in the company of the male parent (Ainley et al. 2002).

Cormorants
The Pelagic Cormorant (*Phalacrocorax pelagicus*) is the most widely distributed of the six cormorant species inhabiting the North Pacific, ranging from northern Alaska to Baja California. Colony sites in the Bering Sea occur in Alaska on Diomede, St. Lawrence and St. Mathew Islands (Hobson 1997), and in Russia on Wrangel and Herald Islands (Kondratyev et al.2000). They generally do not breed on the Pribilof Islands but are commonly found there in winter (Gabrielson and Lincoln 1959). The Red-Faced Cormorant (*Phalacrocorax urile*), in contrast, breeds only in a narrow, latitudinally compressed band from the Kamchatka peninsula east through the Aleutian Islands (Causey 2002). The northernmost breeding colony in Alaska occurs on St. Paul Island (Pribilof Islands). In Russia, most Red-faced Cormorants occur on the Kuril Islands. Other colonies occur on the Commander Islands and Kamchatka coast (Kondratyev et al.2000a).

Like murres, cormorants are diving piscivores. In contrast to sometimes far-ranging kittiwakes and murres, however, cormorants inhabit almost exclusively near-shore waters and are rarely found more than a few kilometers from land (Sowls et al. 1978). They are generalist foragers, capturing medium-sized benthic and demersal fishes, macroinvertebrates and mollusks (Schneider and Hunt 1984) which they capture via foot-propelled pursuit diving from surface in nearshore, shallow, or intertidal waters (Hunt et al 1981). Cormorants are among the least gregarious of colonial seabirds, often foraging alone or in small groups and breeding in loose colonies or far from nearest neighbors (Hobson 1997). Breeding and roosting habitats include the cliffs of oceanic islands and rocky shores and isolated cliffs of mainland coasts, bays, inlets, and estuaries (Hobson 1997; Causey 2002). Both species prefer to nest on high, steep, inaccessible rocky cliffs (Gabrielson and Lincoln 1959). The Pelagic Cormorant will use a wider variety of nest sites than the Red-faced Cormorant, including sea caves, on dirt cliffs, on the ground and on human structures (Vermeer et al. 1989).

Table A1. Life history parameters of representative Bering Sea Ecoregion seabirds

Guild	At-sea surface feeding/ dipping piscivore	At-sea diving/ pursuit piscivore	Near-shore diving/ pursuit piscivore
Representative species	Black-legged kittiwake (BLK) Red-legged kittiwake (RLK)	Thick-billed murre (TBM) Common murre (CM)	Pelagic cormorant (PC) Red-faced cormorant (RFC)
Primary prey	Northern lampfish, walleye pollock, squid and zooplankton.	Mid-deepwater fish (cod, sculpin, lanternfish), amphipods, euphausiids, copepods and squid.	Generalist diet: medium sized fish (sandlance, sculpins), invertebrates, crustaceans, marine worms
Nest	Mud and stick nest on high cliff [ledge]. RLK prefer narrower ledges than BLK[1]	No nest; egg laid directly on high cliff ledge	Guano and stick/ seaweed nest on cliff ledge, ground, or (PC only) human structure
Clutch size	RLK= 1 egg BLK= 1-1.7 eggs[2]	Invariably 1 egg	Average 3 eggs (2-4)
Breeding season (nest-fledge)	RLK= June-September[10] BLK= April-August[14]	CM= June-August[5] TBM= June-August[5]	RFC= Approx. April-July[13] PC= Varies: May-October[15]
Age first breeding	RLK= no data BLK= 3-5 years[3]	CM= 3-6 years[4] TBM= 5.7 years[5]	RFC= 2-3 years[6, 15] PC= 2-3 years[6]

Guild	At-sea surface feeding/ dipping piscivore	At-sea diving/ pursuit piscivore	Near-shore diving/ pursuit piscivore
Annual survivorship	BLK= 92% (adult) to 67% (yearlings)[7]	CM= 94.5%[8] TBM= 89%[9]	RFC= no data PC= no data
Annual productivity	RLK= Ave. 43%[10] BLK= .06-<.1[11]	CM= 50-70%[12] TBM= 36-72%[12]	RFC= Ave. 1.25[13] PC= Similar to RFC[13]
Population status/ trend in Russia[16]	RLK= *Endangered*/ decreasing on Commander Islands BLK= No trend	CM= Increasing TBM= No trend	RFC= Decreasing PC= Decreasing
Population status/ trend in Alaska[17]	RLK and BLK= Decreasing on Pribilof Islands/ increasing on Buldir Island/ stable in Russia[18]	CM= Decreasing overall/ increasing on Bluff Island TBM= Decreasing overall/ increasing on Buldir Island	RFC= No data PC= Decreasing

[1]Squibb and Hunt 1983
[2]Murphy et al. 1991
[3] Coulson 1966
[4]Swann and Ramsay 1983
[5]Ainley et al. 2002
[6] Stejneger 1885; van Tets 1959
[7]Vermeer et al 1993; Hatch et al 1993
[8]Birkhead et al 1985
[9]Gaston et al 1994
[10]Byrd and Williams 1993: %nests w/ egg that fledged
[11]Birkhead and Nettleship 1988: #chicks fledged/ nest with eggs
[12]Byrd et al. 1993: %pairs that laid and produced a fledgling
[13]Causey 2002
[14]Baird 1994
[15]Hobson 1997
[16]Kondratyev 2000
[17]Dragoo et al.2003
[18]S. Sergeev, pers. comm.

Threats

A shared dependence on suitable island or coastal nesting habitat and adequate prey (fish) resources exposes seabirds of different species to a similar suite of threats. The suitability of foraging and at-sea habitats is most affected by commercial fisheries interactions and pollution, and may become highly affected by climate change. The quality of nesting habitat can be compromised by the presence of mammalian predators and by direct disturbance from humans. (Schreiber and Burger 2002). The primary threats to seabirds are commercial fisheries interactions, introduced predators, and oil spills. Other threats include entanglement in marine debris, ingestion of particulate plastics and marine debris, bioaccumulation of contaminants, roads or other on-land development and prey changes due to climate change (N. Konyukhov, S. Sergeev, A. Sowls, V. Zubakin; pers. comm.).

Climate Change

The Bering Sea is experiencing a northward biogeographical shift in response to increasing temperatures and atmospheric forcing. Overland and Stabeno (2004) have observed that mean summer temperatures near the Bering Sea shelf are 2 degrees (C) warmer for 2001-2003 compared with 1995-1997. In the coming decades, this warming trend is expected to have major impacts on the region's arctic species, at all levels of the food web, including seabirds and their prey.

Commercial fisheries interactions

Competition for prey

Seabirds are reproductively constrained by the distance between their breeding grounds on land and feeding zones at sea (Weimerskirch and Cherel 1998). They must have access to prey within efficient foraging range of the breeding colony in order to raise their chicks successfully (Piatt and Roseneau 1998, Suryan et al. 2000). If food supplies are reduced below the amount needed to generate and incubate eggs, or the specific species and size of prey needed to feed chicks is unavailable, local reproductive failure is likely to occur (Croxall and Rothery 1991; Anderson et al. 1992; Hunt et al. 1996; Bukucenski et al. 1998). Additionally, because seabirds may impact fish stocks around colonies in summer (Birt et al. 1987), they are vulnerable to factors that reduce forage fish stocks in the vicinity of colonies (Monaghan et al. 1994). Bering Sea commercial fisheries remove millions of metric tons of fish per year (Guttormsen et al. 1992). Although Bering Sea fisheries operate between September and April and thus do not usually compete directly with breeding seabirds for prey items, there is potential overlap with fisheries effort during the egg-laying and late chick rearing and fledging portions of the breeding season for late-breeding species (e.g. kittiwakes). Indirect effects of fisheries on seabirds include disturbance by boats, alteration of predator-prey relationships among fish species, introduction of rats (below) and incidental bycatch (NPFMC 2000).

Incidental bycatch

Seabirds are incidentally caught and killed in all types of fishing operations (Jones and DeGange 1988). Between 1989 and 1999, longline gear accounted for 90 percent of seabird bycatch, trawls for 9 percent and pots for 1 percent (Whol et al 1995). Feeding behaviors may affect susceptibility of birds to bycatch in different gear types: surface-feeding and shallow-diving birds like gulls, fulmars, and albatross are frequently caught in longlines, while murres and other alcids are most frequently caught in trawl gear while foraging in the water column or near the sea bottom (Melvin et al 1999). Estimates of annual seabird bycatch for the Alaska groundfish fisheries indicate that approximately 14,500 seabirds are incidentally caught in the Bering Sea each year, mostly fulmars and gulls (NPFMC 2000). In Russia, a large Japanese drift net fishery for salmon accounted for approximately 160,000 drowned seabirds per year from 1993 to 1997 (Artyukhin and Burkanov 2000). Fisheries bycatch mortality can significantly affect seabird species: the driftnet salmon fishery in Russia is considered by some the single most important threat for Thick-billed Murres in the western Bering Sea, and the loss of members of rare species such as Short-tailed Albatross (*Diomedea albatrus*) is certainly significant (Artyukhin and Burkanov 2000).

Introduced predators

Many seabird species place their nests on ledges and crevices of steeply vertical sea cliffs, in order to protect their eggs and chicks from terrestrial mammalian predators. Numerous extinctions and drastic reductions in seabird populations have been caused by the intentional and unintentional introduction of nonnative mammalian predators to seabird nesting habitats, especially on islands where they did not evolve with such a threat (e.g. Jones and Byrd 1979; Moors and Atkinson 1984; Burger and Gochfeld 1994). On islands throughout the Bering Sea, introduced predators like fox, mink, and Norway rats prey on seabird eggs and chicks with devastating results, particularly for ground-nesters such as storm petrels, murrelets, auklets, and puffins (Bailey 1990; Bailey and Kaiser 1993; Kondratyev et al. 2000b). The potential introduction of rats to the Pribilof Islands poses a serious threat to Red-legged Kittiwakes in particular: 80 percent of the world's population breeds on St. George Island alone (A. Sowls, pers. comm.).

Oil spills
Many seabird species are extremely vulnerable to the effects of pollution, especially oil spills. Mortality primarily results from hypothermia and malnutrition after oiled feathers lose their insulating properties; some oil is also ingestion during preening, which may affect reproductive capacity (Kahn and Ryan 1991). Alcids (Thick-billed and Common Murres in particular) are particularly vulnerable to oil spills (the 1989 *Exxon Valdez* oil spill resulted in the death of at least 185,000 murres, the largest murre kill yet reported; Piatt and Ford 1996), owing largely to the species' large, dense concentrations in coastal habitats (coincident with major shipping channels) and their persistent presence on the water (Ainley et al. 2002).

Monitoring

In Alaska, the U.S. Fish and Wildlife Service has continually monitored colonies of the breeding seabirds throughout the Alaska Maritime National Wildlife Refuge and elsewhere, collecting and cataloguing data, usually on an annual basis (e.g. Dragoo et al. 2003). The objective has been to provide long-term time-series data from which biologically-significant changes may be detected and from which hypotheses about causes of changes may be tested. Available data include: population size, productivity [Note: Productivity (e.g. # chicks fledged) is determined annually and population counts are conducted every three years at most locations), population trends, survival, estimated timing of nesting events, and prey used by representative species of various foraging guilds (A. Sowls, pers.comm.). Data are also available from other research projects, e.g. those evaluating the impacts of oil spills on marine birds. Observer data from commercial fisheries boats provide estimates of bycatch numbers and concentrations. Research efforts in Russia have focused on monitoring population sizes and trends; little regular monitoring occurs in Russia.

Research Needs

Although research efforts in Russia have increased in recent years, reports are still plagued by information gaps and fragmentary knowledge and there is often little information available in English (Kondratyev 2000a; M. Flint, pers. comm.). Translation of such materials is crucial to a more cohesive understanding of the seabirds of the Bering Sea region. Few seabird biologists currently are trained and work in Russia; qualified personnel are urgently needed (V. Zubakin, pers. comm.) Overall, there is a need to better estimate population size and trends of many species (especially in Russia), better elucidate the causes of seabird population declines as they relate to food abundance (and commercial fisheries competition), document and reduce seabird bycatch; track movements of seabirds via satellite telemetry, and collect data/ fill information gaps for little-studied species (e.g. cormorants) and species in Russia (N. Konyukhov, S. Sergeev, A. Sowls, V. Zubakin; pers. comm).

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Documentation for Viability Table (E5S Planning Tool): Seabirds

Conservation Target: Seabirds (cormorants)

Category: Condition

Key Attribute: Combined long term means (5 yr rolling average) for productivity & population

Indicator: Cormorants: % breeding pairs producing chicks, population count

Indicator Ratings:

Poor: <20% below LT mean pop. & productivity
Fair: <20% below LT mean pop. or productivity
Good: Stable pop. + stable or >20% above LT mean for productivity
Very Good: > 20 % above LT mean for population + stable or > 20% above LT mean productivity

Current Rating: Good
Date of Current Rating: Dec 04 based on 2001 USFWS data

Current rating comment: Note: "%" means % of sites monitored in the Bering Sea

Cormorants
RFCO productivity= 50% below long term mean, 50% above long term mean
RFCO population = no data [so not rated]

PECO productivity= 33% below long term mean, 33% at long term mean, 33% above long term mean
PECO population = 100% at long term mean: [Rated as Good]

Desired Rating: Good
Date for Desired Rating:

Conservation Target: *Seabirds (kittiwakes)*

Category: Condition

Key Attribute: Combined long term means (5 yr rolling average) for productivity & population

Indicator: Kittiwake: % breeding pairs producing chicks, population count

Indicator Ratings:

Poor: <20% below LT mean pop. & productivity
Fair: <20% below LT mean pop. or productivity
Good: Stable pop. + stable or >20% above LT mean for productivity
Very Good: > 20 % above LT mean for population + stable or > 20% above LT mean productivity

Current Rating: Good
Date of Current Rating: Dec 04 based on 2001 USFWS data

Current rating comment: Note: '%' mean percent of site sampled in the Bering Sea

Kittiwakes
BLKI productivity = 30% below LT mean, 70% above LT mean

BLKI population = 30% below, 70% at, 10% above LT mean [Rated as Very Good]

RLKI productivitiy = 50% at, 50% above LT mean
RLKI population = 25 % below, 50% at, 25 % above LT mean [Rated as Good]

Desired Rating: Good
Date for Desired Rating:

Conservation Target: Seabirds (murres)

Category: Condition

Key Attribute: Combined long term means (5 yr rolling average) for productivity & population

Indicator: Murres: % breeding pairs producing chicks, population count

Indicator Ratings:

Poor: <20% below LT mean pop. & productivity
Fair: <20% below LT mean pop. or productivity
Good: Stable pop. + stable or >20% above LT mean for productivity
Very Good: > 20 % above LT mean for population + stable or > 20% above LT mean productivity

Current Rating: Poor
Date of Current Rating: Dec 04 based on 2001 USFWS data

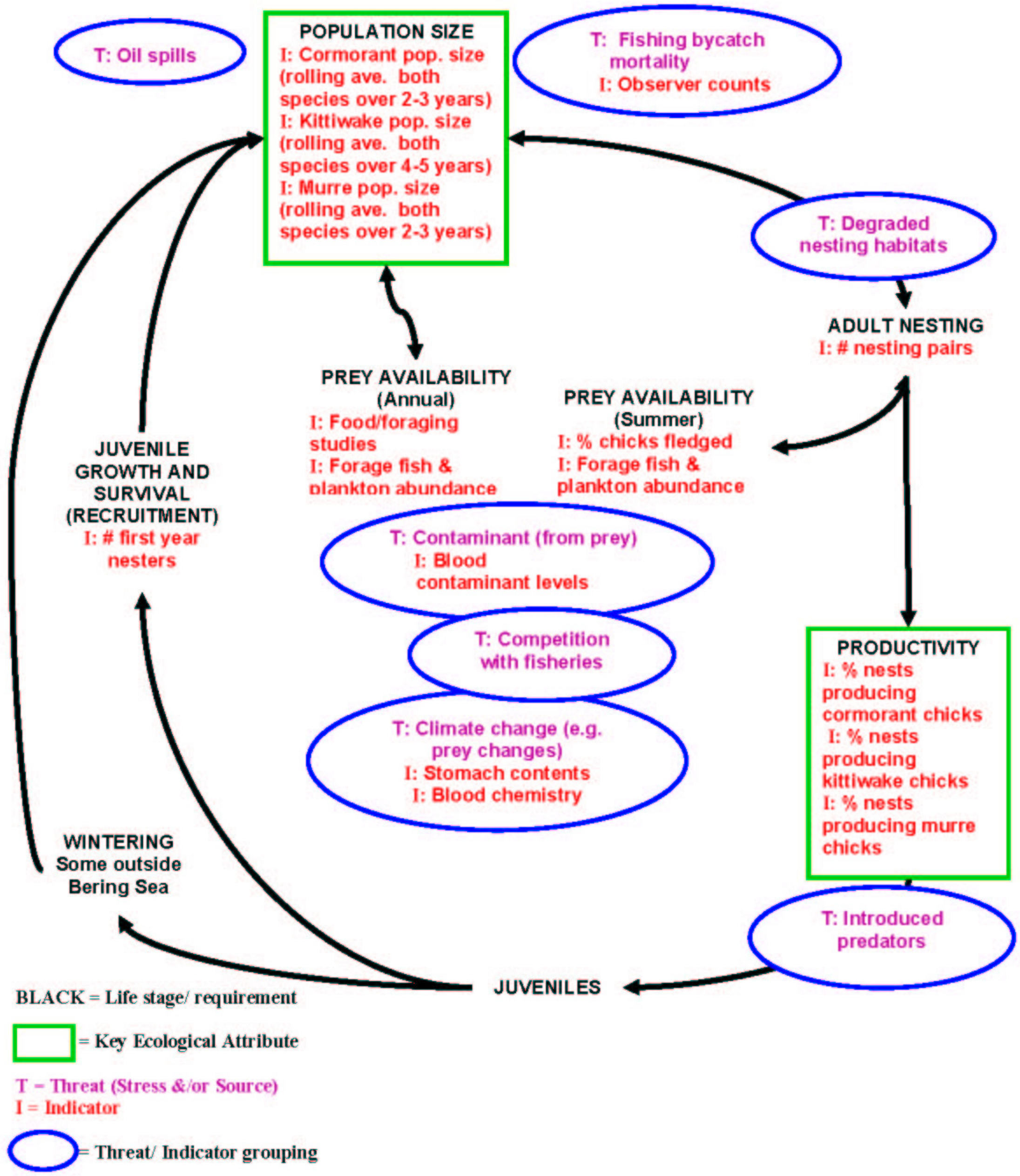
Current rating comment: Note: '%' means percent of sites sampled in the Bering Sea

Murres
COMU productivity = 50% below, 25% at, 25% above LT mean
COMU population = 30% below, 70% at LT mean [rated as Poor]

TBMU productivity =50% below, 33% at, 17% above LT mean
TBMU population = 50% below, 25% at, 25% above LT mean [rated as Poor]

Desired Rating: Good
Date for Desired Rating:

Figure A1: Conceptual Model Developed to Identify Key Ecological Attributes and Threats for Bering Sea Ecoregion Seabirds



	THREATS TO BERING SEA ECOREGION SEABIRDS	Reduced breeding success	Adult mortality	-	-	-	-	-	-	Threat to System Rank
	Stress Rank	*High*	*High*	-	-	-	-	-	-	
1	Threat	Introduced predators								High
	Contribution	Very High	High							
	Irreversibility	High	High							
	Threat Rank (override)									
	Threat Rank	High	High	-	-	-	-	-	-	
2	Threat	Fishing bycatch mortality								Medium
	Contribution		Medium							
	Irreversibility		Medium							
	Threat Rank (override)									
	Threat Rank	-	Medium	-	-	-	-	-	-	
3	Threat	Contaminants								Medium
	Contribution	Low	Low							
	Irreversibility	High	High							
	Threat Rank (override)									
	Threat Rank	Medium	Medium	-	-	-	-	-	-	
4	Threat	Road & infrastructure development								Medium

	Contribution	Low	Low							
	Irreversibility	High	High							
	Threat Rank (override)									
	Threat Rank	Medium	Medium	-	-	-	-	-	-	
5	Threat	Climate change								High
	Contribution	High	High							
	Irreversibility	Very High	Very High							
	Threat Rank (override)									
	Threat Rank	High	High	-	-	-	-	-	-	
6	Threat	Oil spill								High
	Contribution	Medium	High							
	Irreversibility	High	High							
	Threat Rank (override)									
	Threat Rank	Medium	High	-	-	-	-	-	-	
7	Threat	Competition with fisheries								High
	Contribution	Medium	High							
	Irreversibility	High	High							
	Threat Rank (override)									
	Threat Rank	Medium	High	-	-	-	-	-	-	

3.2 Southern Bering Sea Pinnipeds (Northern Fur Seal, Steller Sea Lion, and Harbor Seal

The following resources on northern Bering Sea pinnipeds were compiled for the first iteration of this Strategic Action Plan for the Bering Sea:

- Life History, Population Status, Threats to and Research Needs for Bering Sea Ecoregion Northern Fur Seals (Denise Woods, WWF Bering Sea Ecoregion Program)
- Documentation for Viability Table (E5S Planning Tool)
- Conceptual Model Developed to Identify Key Ecological Attributes and Threats for Bering Sea Ecoregion Northern Fur Seals (Randy Hagenstein, TNC Alaska; Evie Witten and Denise Woods, WWF Bering Sea Ecoregion Program) (Figure A2)
- Threats to Southern Bering Sea Pinnipeds (Table A2)
- Key Ecological Attributes, Indicators, and Established Threshold Levels: Northern Fur Seal and other Selected Species (Bruce Robson)
    - This paper was the basis for some of the indicator ratings for Bering Sea pinnipeds that appear in Table 5, Part I of the Strategic Action Plan.

The following experts were consulted with regard to southern Bering Sea pinnipeds:

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LIFE HISTORY, POPULATION STATUS, THREATS TO AND RESEARCH NEEDS FOR BERING SEA ECOREGION NORTHERN FUR SEALS

Introduction

The northern fur seal (*Callorhinus ursinus*) is the only fur seal species that occurs the temperate waters of the North Pacific and is endemic to the region. Northern fur seals range from the Sea of Japan north to the Bering Sea, and south along the Pacific coast to near the U.S.-Mexico border. Each spring and summer, individuals congregate to breed on a handful of islands in the Bering Sea: in Russia on Robben (Tyuleniy), Kuril, and the Commander Islands; and in the U.S. on the Pribilof Islands (St. Paul and St. George) and Bogoslof Island. There is also a small breeding rookery on San Miguel Island, off the coast of California. Approximately 70 percent of the world's 1.2 million northern fur seals (about 99 percent of the U.S. population) breed and pup on the Pribilof Islands alone (primarily on St. Paul Island) (NFMS 1993).

Northern fur seals have been hunted for their luxuriant pelts since their discovery by Russia in the late 1700's. Unrestricted hunting ended in 1911, following population declines and the subsequent ratification of the Treaty for the Preservation and Protection of Fur Seals and Sea Otters. The managed commercial harvest and processing of fur seals by Russian and American fur companies continued until 1973 on St. George and until 1984 on St. Paul; no commercial harvest has since been authorized. In recognition of the significant cultural and economic value of traditional fur seal hunts to the residents of the Pribilof Islands, a small cooperatively-managed Alaska Native subsistence harvest was soon initiated on both islands and continues until this day.

Life History

Breeding

Northern fur seals begin to return to islands (primarily the Pribilof Islands) in May of each year to breed. Adult male arrive first and vie with each other to establish breeding territories prior to the arrival of females. Northern fur seals are polygynous and each male will mate with many females, all of whom he maintains within his defended territory. Males become sexually mature at 5-7 years but they will likely be unable to establish and hold a breeding territory (and thus, females) until 7-9 years (Johnson 1968). Mature males without females ("idle males") may or may not establish territories; they often congregate with sub-adult males on shoreline haulouts. Females begin to arrive in June and give birth within a day or two. They breed again within 3-8 days of arriving on-island (Gentry and Holt 1986). Females become sexually mature at 4-7 years (York 1983) and can breed until they are at least 23 years old (Lander 1981), usually producing one pup each year.

Annual distribution/ migration
Beginning in late October and November, following pupping, mating and weaning of pups, adult females move from their breeding islands through passes in the Aleutian Islands into the North Pacific Ocean to spend the winter. Adult males follow this route but are thought to travel only as far south as the Gulf of Alaska (Kajimura 1984). Young-of-the-year are weaned during migration south and will remain on their own in the North Pacific Ocean for about 22 months before returning to their islands of origin as 2-year olds (USFWS 1994).

Natural mortality and survival
Neonatal mortality on land is density dependent (Fowler 1990) and relatively low (less than 10 percent for pups under 4 months; NMFS 1993). Mortality at sea is highest during the first 2 years of a fur seal's life (60 to 80 percent; York 1987), especially during the winter following weaning; young fur seals exhibit correspondingly low recruitment rates following natal dispersal (NMFS 1993). Survival of females remains high until age 14 (greater than 80 percent; Smith and Polacheck 1981). Males have a higher mortality rate than females, particularly after age 7 when they begin to defend territories (Lander and Kajimura 1982). Sources of natural mortality (and potential contributors to population declines) for northern fur seals include: parasites and disease, injuries, poor nutrition, starvation (especially for pups), climate change/ regime shift and associated changes in prey availability, and predation by killer whales (NMFS 1993, Springer et al. 2003).

Diet and foraging
Northern fur seals' primary prey are schooling fishes and, to a lesser extent, cephalopods (NMFS 1993). The relative importance of different prey species varies by sample area and year. Generally, juvenile (<1 year) walleye pollock have been consistently cited as major prey of fur seals in the eastern Bering Sea (up to 79 percent of the diet; Sinclair 1988), as have gonatid squids and bathylagid fish. (e.g. Scheffer 1950; Kajimura 1985; Perez and Bigg 1986; NMFS 1993). Primary prey of fur seals in the Gulf of Alaska include Pacific herring, Pacific sandlance, capeline, and walleye pollock (NMFS 1993). During migration through British Columbia and along the coasts of Washington, Oregon, and California, fur seals incorporate more herring, salmonids, northern anchovies, and squids into their diets (Perez and Bigg 1986; Antonelis and Perez 1984).

Habitat requirements
The haulouts and breeding rookeries of the Pribilof Islands are critical for pupping, mating and rearing of pups, and the surrounding feeding grounds (out to at least 200-300 km from the Islands) are especially important for lactating females (Goebel et al. 1991). The subpolar continental shelf and shelf break from the Bering Sea to California are essential feeding grounds while fur seals are at sea. On the open ocean, the highest concentrations of northern fur seals occur in association with major oceanographic frontal features such as seamounts, valleys, canyons, and along the continental shelf break, where prey items may be most available (Lander and Kajimura 1982; Kajimura 1984). Due to the presumed high loss of juveniles at sea as a factor in the population decline,

open-ocean areas such as these should be considered essential to the northern fur seal's long-term survival (NMFS 1993).

Population Status and Trends

During the past century, the number and trends in abundance of northern fur seals have been determined both via direct annual counts of bulls on rookeries and via biennial estimates derived from "shear-sampling" (mark/resighting) of pups (Chapman and Johnson 1968; York and Kozloff 1987); the latter method produces more reliable results.

Since their discovery there in 1786, the abundance of fur seals on the Pribilof Islands has fluctuated dramatically (Roppel 1984). The greatest decline occurred in the late 1800's and early 1900's because the commercial fur seal harvest at the time included the take of pregnant females. Another period of female harvest during 1956 through 1968 further reduced the stock and likely accounted for the subsequent observed reduction in pup production (York and Hartley, 1981). Despite a brief stabilization of population trends following the end of the commercial harvest in 1984, unexplained declines among fur seal populations continued and the U.S. population was listed as "threatened" under the MMPA in 1988.

Today, approximately 1.2 million northern fur seals exist worldwide, a fraction of their pre-harvest abundance. Since the early 1950's, the Pribilof Islands population alone has declined by 65 percent. Recent data from the National Marine Fisheries Service (NMFS) demonstrate that seal pup production on the Pribilof Islands has declined 5.2 percent per year during at least the past 4 years, resulting in pup production estimates for the two islands that are 32 percent of their recorded maxima (R. Ream, pers. comm.).

Interestingly, not all populations have shown such declines: fur seal numbers at Bogoslof Island, for example, increased 59 percent each year from 1980 to 1997 and the population continues to grow (this population is small, however, and immigration to Bogoslof Island does not account for the declines observed at the Pribilof Islands; R. Ream, pers. comm.).

Threats

During its final years (1976 through 1984), the commercial fur seal harvest removed only juvenile male fur seals, and because the take was small relative to total pup production, it is highly unlikely that residual effects of the harvest can account for the ongoing decline observed since 1976 (Swartzman 1984). In recent decades, a co-managed Alaska Native subsistence harvest has taken fewer than 2000 sub-adult male seals from the Pribilof Islands per year; the subsistence harvest is not believed to contribute significantly to the observed population declines (NMFS 1993). Current data indicate that parasites and pathogens are not a significant contributor to fur seal declines. However, they pose a potential threat due to the dense congregating habits of the species. The following human-related activities have been identified as the primary anthropogenic causes of fur seal declines: commercial fisheries interactions, human disturbance and coastal development, and petroleum transport/ oil spills (USFWS1994; R. Ream, pers.comm.).

Climate Change

The Bering Sea is experiencing a northward biogeographical shift in response to increasing temperatures and atmospheric forcing. Overland and Stabeno (2004) have observed that mean summer temperatures near the Bering Sea shelf are 2 degrees (C) warmer for 2001-2003 compared with 1995-1997. In the coming decades, this warming trend is expected to have major impacts on the region's arctic species, at all levels of the food web, including northern fur seals and their prey.

Commercial fisheries interactions

Competition for prey

The effect of removing potential fur seal prey by commercial fisheries in the North Pacific Ocean and eastern Bering Sea is unknown (NMFS 1993). Several important fur seal prey species are the target of commercial fisheries on the continental shelf of the Bering Sea; in combination, these fisheries remove millions of metric tons of fish (Guttormsen et al. 1992), some of which may influence the availability and abundance of food to northern fur seals. However, for the most part, these fisheries target larger fish than are preferred by fur seals (Sinclair 1988; Wespestad and Dawson 1992). The complexity of ecosystem interactions and limitations of data and models make it difficult to determine how fishery removals have influenced fur seals and other marine mammals (Lowry et al. 1982; Loughlin and Merrick 1989).

Entanglement in fishing gear

Although the amount of trawl webbing debris in the Bering Sea may be diminishing (Fowler et al. 1989), fur seals still become entangled in and die in marine debris, principally trawl webbing, packing bands, and monofilament nets, and these same items litter the beaches fur seals use for breeding. Young seals may or may not be more susceptible to entanglement than adult seals (Trites 1992), but the survival of young seals is known to be negatively correlated with entanglement rate (Fowler 1985) and it is clear that entanglement has contributed to the overall mortality in, and possibly the decline of, fur seal populations (NMFS 1993).

Incidental take/ bycatch

While at sea, northern fur seals are sometimes unintentionally caught and killed by commercial fishing gear. The number of fur seals taken incidental to commercial fisheries recently has been relatively low and has declined with a decline in overall fishery effort. It is unlikely that the effect of incidental take in domestic fisheries during the period of the greatest decline of fur seals was significant (Fowler 1982).

Human disturbance and coastal development

Disturbance from repeated human intervention onto breeding rookeries, increasing vessel traffic close to shore, and low flying aircraft are all potential disturbances that might affect the long-term use of a rookery area (NMFS 1993). Although there are few data on the effects of human activities (such as harbor development) on fur seals, some short-term studies suggest little or no effect from brief disturbance episodes (Gentry et al. 1990). However, the effect of chronic, long-term disturbance is unknown.

Petroleum transport/ oil spills

Fur seals are vulnerable to the physiological effects of oiling and subsequent loss of control of thermal conductance (Wolfe 1980). Any oil spill from a vessel near areas where fur seals concentrate to breed (i.e. near the Pribilof Islands) or migrate could thus cause significant direct morality (Reed et al. 1987). During migration into (spring) and out of (late fall-early winter) the Bering Sea, fur seals are concentrated at passes through the Aleutian Islands; one of the most common routes taken is through Unimak Pass, the same route favored by most large vessels in the region. Fur seals are also vulnerable to oil spills during their southern migration along the heavily trafficked coasts of Washington, Oregon, and California (NMFS 1993).

Monitoring

The National Marine Fisheries Service (NMFS) is the only organization consistently conducting research on the Pribilofs, Bogoslof, and San Miguel Islands, both recently and historically. The sole exception is the Tribal Government of St. Paul; they have been conducting small research/ management projects for the past 5 to 10 years. Other organizations (e.g. universities) have, in the past, conducted short-term projects on the Pribilof Islands, but not at the present.

The focus of current NMFS research is population monitoring (abundance, distribution, and trends). Available data include: annual adult male counts and biennial pup production estimates (these counts have been conducted nearly every year since the early 1900's); foraging ecology (location, dive behavior, energetics, and diet composition); rates of entanglement in fishing gear; winter migration and dispersal patterns (of tagged individuals); causes of mortality on land (especially pup mortality); and health and condition indices and tissue contaminant levels (from harvested individuals) (NMFS 1993; R. Ream, pers. comm.).

Research Needs

In light of their sustained decline, there is an urgent need to expand the existing NMFS northern fur seal research program to: increase research efforts on Bogoslof Island (where numbers are increasing) and compare results to those from the Pribilof Islands; expand genetic studies of the different populations; document human disturbances on beaches and assess their effects on fur seal reproductive success; and investigate the complex relationships between fur seals, fisheries, and fish resources to determine how fisheries practices are affecting fur seal populations (NMFS 1993; R. Ream, pers. comm.).

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Documentation for Viability Table (E5S Planning Tool): Pinnipeds

Conservation Target: Pinnipeds

Category: Landscape Context

Key Attribute: Prey availability

Key attribute comment: Prey availability is thought to be one of the key factors influencing northern fur seal recruitment and survival.

Indicator: Female fur seal trip distance and duration

Indicator comment: Female foraging distance and duration may provide an indirect measure of foraging effort and prey
availability within fur seal foraging habitat. In theory, the benefit of habitat conservation efforts may be evaluated based on the effective foraging radius of lactating fur seals around the breeding site or alternatively the distribution of foraging effort in specific areas of interest. Foraging distances and durations will likely show a density dependant response to population levels or the overall availability of prey species, but may vary in relation to the patchy distribution of prey species {Furness, 1984 #89}.

Indicator Ratings:

Poor: data needed
Fair: data needed
Good: data needed
Very Good: data needed

Current Rating:
Date of Current Rating:

Current rating comment: unknown; see comments

Desired Rating:
Date for Desired Rating:

Other comments: The distance traveled during a foraging trip can serve as an index of foraging effort for lactating female fur seals. Theoretical studies of species using a central-place foraging strategy (Orians and Pearson 1979) predict that dispersal distances from the central breeding site will vary in relation to the size of the foraging population and the density of prey in the surrounding environment. Empirical studies of foraging seabirds from nearby colonies provide support for this theory (Furness and Birkhead 1984, Lewis et al. 2001). The ability to effectively measure linear foraging distance for large samples of pinniped foragers has improved due to advances in satellite telemetry. Robson et al. (2004) presented data for 119 foraging trips made by 97 females from the Pribilof Islands during 1995-96. The maximum distance traveled ranged from 40–450 km and did not differ significantly among islands in either 1995 or 1996 (Table 5). For St. Paul and St. George Island combined, females traveled slightly farther on average during 1995 (260.8 km ± 76.3) than during1996 (229.0 ± 64.6 km) (Robson et al. 2004).

In contrast, foraging distances were considerably shorter for females tracked on Bogoslof Island, where approximately 5000 pups were born during 1997 (compared to approximately 198,000 pups born in 1996 on the Pribilof Islands). Only one out six females tracked by satellite from Bogoslof Island traveled further than 75 km the island; 3 females did travel more than 22 km from the island (Ream et al. 1999). The average maximum distance traveled from Bogoslof

Island was 51.2 km.
Additional satellite tracking studies of both juvenile male and lactating northern fur seals have been conducted during the 1998, 1999, 2000 and 2002 breeding seasons (NMFS unpublished data), however study objectives and instrumentation packages differed among years. Female fur seals will be tracked on St. Paul and St. George Islands in 2004 and on Bogoslof and St. Paul Islands during the 2005 breeding season.

The utility of foraging distance as an ecological indicator is limited by the availability of comparable historical data and consequently, a sufficient time series of data. The ability to track entire foraging trips using satellite telemetry now provides a relatively cost-effective means to collect an adequate sample over time to evaluate changes in relation to population numbers, indices of prey availability and environmental variables. It is important to ensure that sampling protocols and tracking methods are standardized between studies to provide comparable data between years. Researchers frequently assume that measurements of foraging distance and direction are not affected by differences in the size and weight of instruments, however this has not been shown empirically.

Foraging Distance:

The duration of foraging trips made by lactating female fur seals and other Otariids has been used in a number of studies to measure foraging effort (Loughlin et al. 1987, Goebel et al. 1991, Boyd et al. 1994, Merrick and Loughlin 1997, Boyd et al. 1998, Gentry 1998, Goebel 2002) as an index of foraging effort. The mean foraging trip duration over the first 6 foraging trips postpartum is one of a suite of parameters used to monitor foraging conditions for keystone predators under the Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR) protocol (http://www.ccamlr.org/pu/e/pubs/std-meth04.pdf). Recent studies of both northern fur seals and Antarctic fur seals have shown that the linear distance traveled during feeding trips is positively correlated with foraging trip duration (Robson et al. 2004, Boyd et al. 1998) and varies in response periods of contrasting prey abundance (Boyd et al. 1994). In contrast to data on foraging distance however, trip duration has been measured in behavioral studies on the Pribilof Islands intermittently since the early 1950s, providing a time series that spans the recent period of decline of the Pribilof fur seal population.

Loughlin et al. (1987) compiled data for the mean trip duration of the first foraging trip, July trips and all trips made during July and August in behavioral studies conducted at Kitovi rookery from 1951-1977 for comparison with radio telemetry studies conducted in 1984 at Zapadni Reef rookery (Bartholomew and Hoel 1953, Peterson 1965, Gentry and Holt 1986, Goebel et al. 1991). A comparable sample of radio tracked females was collected during 1995 on St. Paul Island and 1996 on St. George Island by Goebel (2002). Foraging trips were shorter in 1984 than the earlier studies, averaging 3.5 d, 5.7 d, and 5.9 d for perinatal trips, July trips and July-August trips, respectively (Loughlin et al. 1987; Table 6). Trip durations in the earlier studies ranged from 7.1 to 9.7 d between 1951 and 1997. Mean trip durations of July trips and July-August trips in 1995 and 1996 were slightly longer than 1984 trips, but were still shorter on average than the 1950-1977 data.

Foraging trip durations recorded for Bogslof Island females during the 1997 were shorter than those of Pribilof Island females. Most females made overnight foraging trips and the maximum foraging trip duration was four days (Ream et al. 1999).

Similar to data on foraging distance, foraging trip duration may provide an effective, although indirect measure of foraging effort and prey availability within fur seal foraging habitat. The availability of a longer time series of data may provide an index of foraging effort for lactating females during periods of declining fur seal abundance on the Pribilof Islands. However consideration should be given to the potential bias in comparing foraging trip durations measured by radio telemetry studies with data from observational studies. Because observations are not typically made at all hours of the day, trip duration measurements may be biased upward due to

the additional time required for an observer to detect the presence of a marked individual. In contrast, radio telemetry allows for relatively precise measurements of trip durations.
It is theoretically possible to design a modeling experiment that would resample telemetry data in a manner that is consistent with behavioral observations made in the earlier studies. This method would allow for more accurate comparisons between the two data sets and would also set the stage for a broader analysis of historical trip duration data. Additional data sets exist for the St. George Island Program during the 1970s and 1980s (Gentry and Holt 1986, Gentry 1998), and behavioral studies conducted by Japanese and Canadian researchers on St. Paul Island during the early to mid 1990s.

Ongoing foraging studies conducted by NMML should provide additional data on the duration of female foraging trips at Bering Sea breeding sites during 2004 and 2005. However it is important to consider whether trip durations of fur seals equipped with satellite transmitters will provide comparable data to that of behavioral and radio telemetry studies. Attachments of larger instruments such as time-depth recorders and satellite transmitters have been shown to increase foraging trip durations for fur seal females (Walker and Boveng 1995, Boyd et al. 1997). Alternatively, useful data may be available from behavioral studies and tag resight efforts conducted in recent years.

Conservation Target: Pinnipeds

Category: Landscape Context

Key Attribute: Prey availability

Key attribute comment: Prey availability is thought to be one of the key factors influencing northern fur seal recruitment and survival.

Indicator: NFS pup weight

Indicator comment: Pup weight measurements for use as an index of pup condition, maternal investment and
foraging conditions.

Indicator Ratings:

Poor: data needed
Fair: data needed
Good: data needed
Very Good: data needed

Current Rating:
Date of Current Rating:

Current rating comment: unknown. See comments

Desired Rating:
Date for Desired Rating:

Other comments: Weight measurements have been collected as a condition index of northern fur seal pups on
Pribilof Island rookeries intermittently since the 1940s. Pups are usually weighed at approximately 2 months of age, although some data has been collected at other times during the breeding season (Table 8). Weight data have also been collected from pups tagged during

studies to estimate survival rates of Pribilof Island fur seals. Comparable weight data have been collected at other fur seal breeding sites (e.g. Commander Islands and San Miguel Island) and for fur seal and other Otariid species worldwide.

Pup weight data has been collected annually in late August since 1987 on St. George Island and 1992 on St. George Island (Table 8). In general, pup weights on the Pribilof Islands have varied between islands and sexes, but have shown no apparent trend over time. However differences between the timing of data collection and area may be able to be standardized using recently available growth curves and a more detailed analysis may uncover significant trends in the data. Data collected since 2001 that may help to determine the value of this index as a measure of pup condition are not yet published. If pup weight data are collected in conjunction with annual estimates of early season foraging trip duration, the two indices may serve as a combined measure of the quality of foraging conditions.

Conservation Target: Pinnipeds

Category: Landscape Context

Key Attribute: Prey availability

Key attribute comment: Prey availability is thought to be one of the key factors influencing northern fur seal recruitment and survival.

Indicator: Number (%) NFS pup starvations/year

Indicator comment: An indirect measure of prey availability based on neonatal mortality due to emaciation.

Indicator Ratings:

Poor: data needed
Fair: data needed
Good: data needed
Very Good: data needed

Current Rating:
Date of Current Rating:

Current rating comment: Unknown. Data are insufficient at present to quantitatively determine the significance of any
trend in the in the rate of pup starvation.

Basis for current rating: Terry Spraker, Rolf Ream, Pers Comm.

Desired Rating:
Date for Desired Rating:

Other comments: Starvation is one of the predominant causes of death observed in northern fur seal neonates from
the Pribilof Islands. The earliest studies of fur seal pup mortality were conducted in the late 1800s (Lucas 1899). More recent estimates of pup mortality range from 4 to 20 percent during the first 120 days of life (York 1985). The causes underlying pup mortality have been assessed annually during the first week of July through the second week of August, 1986 through 2003 by Dr. Terry Spraker in conjunction with the National Marine Mammal Laboratory. However the

St. Paul Island pup mortality study does not include a site-specific index of the number of pups born or population density. Pup mortality has been shown to be density dependent in three species of fur seals, including northern fur seals (Wickens and York 1997) and the inability to relate starvation rates to population density limits the utility of the from this study.

Emaciation rates among neonatal fur seal pups may be indicative of early season foraging conditions for Pribilof Island females. Emaciation was the most common cause of death in pups between 1986 and 2003, occurring in an average of 52% of the pups examined (Table 7; Terry Spraker Personal Comm.). A more rigorous analysis of the 1986-2003 data may yield meaningful threshold values for use in characterizing the rate of starvation in the Pribilof population.

Conservation Target: Pinnipeds

Category: Size

Key Attribute: Population size & dynamics

Key attribute comment: Harbor seal (Phoca vitulina richardsi) population trends in Alaska vary by region (Jemison et al.
2001, Small et al. 2003). The Alaska Scientific Review Group recognizes three distinct Alaskan harbor seal stocks or management regions; southeast Alaska, the Gulf of Alaska and the Bering Sea (Angliss and Lodge 2004). In the Bering Sea, recent genetic analyses suggest that the Pribilof Islands harbor seal population is genetically distinct from the Bristol Bay population and may constitute a separate management stock (Westlake and O'Corry-Crowe 2002). Counts have been conducted sporadically at Otter Island in the Pribilof Archipelago since 1974 (Jemison et al. 2001). Maximum numbers observed on Otter Island declined 40% from 1974 (n=1175) to 1978 (n=707). The most recent census in 1995 recorded a maximum count of 202 harbor seals, a 71% decline from 1978 (83% from 1974-1995). However, the Alaska SRG has noted that the recolonization Otter Island by fur seals may have resulted in a loss of habitat for harbor seals, and may play a role in the decline.
Counts of harbor seals on the north side of the Alaska Peninsula in 1995 were less than 42% of the 1975 counts, representing a decline of 3.5% per year over the time period (Angliss and Lodge 2004). In 1998, a new harbor seal trend site north of the Alaska Pennisula in Bristol Bay was added to the annual census route. Over a four year period from 1998-2001, Bristol Bay counts declined at approximately 1.3% (SE 2.35) per year for a cumulative change of -3.8% (Small et al. 2003). Counts of harbor seals in northern Bristol Bay have also declined in recent decades, but have remained stable since 1990 (Angliss and Lodge 2004).

Indicator: Harbor seal population growth rate

Indicator comment: The number of harbor seals in the eastern Bering Sea is thought to have declined in recent
decades, but current data are insufficient to fully characterize the population status and trend. The lack of data is confounded by the need to reconsider the current definition of management stocks in the Bering Sea. As with other marine mammal stocks, the stated goal mandated by the MMPA is to recover and maintain each stock at or above OSP. Under the current Alaska Harbor Seal Research Plan (NMFS 2003), census activities will target trend sites in Bristol Bay that have a longer time series of observations. No census activities are indicated for Pribilof Island haulouts. The apparent genetic differentiation between the Bristol Bay and Pribilof harbor seal populations and the potential for an isolated Pribilof population should be considered in the evaluation of the harbor seal ecological attribute. The lack of definitive census data for the entire region makes it advisable to use trend data to define the ecological attribute. Based on data from other regions, the Alaska SRG recommends 12 percent as the Maximum Net Productivity Level (MNPL) for

the Bering Sea stock (Angliss and Lodge 2004). A simple approach that partitions the approximate rate of population change into intervals of 5 and 10 percent on either side of a zero rate of growth or decline may serve as a categorical method for qualitatively rating the status of the Bering Sea population. Based on the observed population trend for the Bristol Bay region (-1.3%) relative to the declines observed over the previous decades, the current population trend would fall in to the fair category (Appendix 1, Table 1). However, the estimated status for this indicator should be considered to represent the Bering Sea stock, as the available data are insufficient to determine the current population trend for the Pribilof Islands stock alone.

Indicator Ratings:

Poor: >5% per yr decline
Fair: 0-5% per yr decline
Good: 0-5% per yr growth
Very Good: >5% per yr growth

Current Rating: Fair
Date of Current Rating: 1/15/2001

Current rating comment: -1.3% per year. (Jemison et al. 2001, Westlake and O'Corry-Crowe 2002, Small et al. 2003)

Desired Rating: Good
Date for Desired Rating:

Conservation Target: Pinnipeds

Category: Size

Key Attribute: Population size & dynamics

Key attribute comment: An annual census of adult male fur seals on the Pribilof Islands has been conducted since 1911.
For the purpose of the census, adult males are classified into categories of “harem” and “idle” based on whether a male is defending a territory containing one or more females (Loughlin et al. 1994). The counts of adult males are an important parameter used to estimate the distribution of adult females during the mark-recapture method used for the shearing-sampling method of conducting pup counts.
Following the cessation of the commercial harvest of juvenile males on each island, counts of both harem and idle males spiked for a short period, and subsequently began a downward trend at roughly the same time in the late 1990s (Fowler et al. 2001). In recent years, the numbers of both territorial and idle males have declined significantly on both St. George and St. Paul Island (Figure 2).

Indicator: Northern fur seal bull counts

Indicator comment: Although adult male fur counts are not used to estimate the total stock size, they can serve as a
useful index of abundance and trends. The 1992 counts of approximately 19,000 adult males on both islands can serve as a bench mark goal for determining indicator ratings to measure any apparent shifts in the number of adult males in the population due to conservation actions.

Indicator Ratings:

Poor: <10 K
Fair: 10-15 K
Good: 15-20 K
Very Good: > 20 K

Current Rating: Fair
Date of Current Rating: 10/15/2003

Current rating comment: Fair with an apparent downward trend (2003). Data compiled from Fur Seal Investigations annual reports and NMFS 2004 population assessment data (http://nmml.afsc.noaa.gov/AlaskaEcosystems/nfshome/pribbullnew.htm).

Desired Rating: Good
Date for Desired Rating:

Conservation Target: Pinnipeds

Category: Size

Key Attribute: Population size & dynamics

Key attribute comment: Northern fur seal populations are declining in the Bering Sea. Population dynamics and the reason for the declines are poorly understood.

Indicator: Northern fur seal pup counts

Indicator comment: The primary index of northern fur seal population status and trends is the estimated number of pups born in a census year.

K for northern fur seals is defined as the 1950s population level, or approximately 530,000 pups born each year for the two islands combined (Table 1). OSP, defined as sixty percent of this value is approximately 300 K. This figure can serve as a benchmark for the division between the good and very good indicator ratings; thus pup estimates in the 200-300 K range receive a good rating as they approach the OSP level, and pup numbers in excess of 300 K result in delisting under the MMPA, which is obviously "very good". The current estimate of 139,679 pups born in the Pribilof Islands falls into the fair category (100-200 K). The threshold for the poor rating, <100 K pups born per year, is approaching the historical level at which international action was taken to implement conservation measures in 1911.

Indicator Ratings:

Poor: <100 K
Fair: 100-200 K
Good: 200-300 K
Very Good: >300 K

Current Rating: Fair
Date of Current Rating: 10/15/2004

Current rating comment: The current estimate of 140 K is based on NMFS pup counts during the 2004 census year on the Pribilof Islands and MMPA stock assessment guidelines. The confidence level in the information is high

Desired Rating: Good
Date for Desired Rating:

Desired rating comment: 200-300 K

Other comments: This method for establishing indicator ratings could be improved and made less arbitrary through population modeling. An obvious advantage to this method is that is able to effectively utilize the long time-series of information on northern fur seal population trends.

Conservation Target: Pinnipeds

Category: Size

Key Attribute: Population size & dynamics

Key attribute comment: The NMFS monitors commercial fisheries that have the potential to interact with northern fur seals. These data are summarized annually in the Alaska Status of Stocks Report (SAR) following the guidelines established under the MMPA (Wade and Angliss 1997). This information may be useful to establish an ecological attribute for fisheries interactions in order to identify any changes in interaction rates which may impact fur seal population trends. The current threshold Potential Biological Removal (PBR), calculated in the Draft 2004 Alaska SAR is 16,162. The combined human caused mortality, the sum of subsistence harvest mortality (1,132) and estimated fishery mortality (17) is less than 10% of the PBR for this species, and is therefore considered to be insignificant and approaching a zero mortality and serious injury rate. In spite of the low level of human caused mortality, the Alaskan stock of northern fur seals is listed as a strategic stock due to its depleted status under the MMPA (Angliss and Lodge 2004).

Indicator: Number of northern fur seal caught incidentilly in commercial fisheries/year

Indicator comment: Anthropogenic mortality associated with fishing is important to monitor in the event that fisheries interactions develop in new fisheries, or if vessels move into previously un-fished areas. However, the current rate of incidental mortality is only a small number of animals, and is likely to have little effect on the population.

Indicator Ratings:

Poor: >16,000
Fair: 1,600-16,000
Good: 160-1,600
Very Good: <160

Current Rating: Very Good
Date of Current Rating: 10/15/2003

Current rating comment: 17 - Very good. Angliss and Lodge 2004 (Draft Alaska SAR)

Desired Rating: Very Good
Date for Desired Rating:

Conservation Target: Pinnipeds

Category: Size

Key Attribute: Population size & dynamics

Key attribute comment: Adult female entanglement has been studied intermittently since the 1970s. Table 4 shows the
results of surveys conducted in conjunction with bull counts span the period from 1991 to the present (Kiyota and Fowler 1994, NMFS Unpublished Data). During this period the rate of entangled females has averaged approximately 0.01% in surveys with sample sizes ranging from several thousand to greater than 30,000 female fur seals checked for evidence of entangling debris. Several studies have conducted additional surveys from July through September (Scordino et al. 1988, Kiyota and Fowler 1994). Both studies observed seasonal changes in the incidence of female entanglement with increasing rates of entanglement as the season progressed.

Indicator: Percent of female northern fur seals entangled/year

Indicator comment: It is important to monitor the incidence of female entanglement as a component of adult fur seal
mortality. There has been little change during the period for which comparable data are available (Table 4), and historical data does not indicate an increasing trend in the number of females returning to the breeding islands encumbered by debris. Indicator ratings are based on the idealized goal of zero mortality due to entanglement (very good) with the intermediate indicator thresholds (good and fair) set at practical levels to detect a change over time should it occur. The poor indicator level is referenced to the maximum levels of entanglement observed in historical data.

Indicator Ratings:

Poor: >0.1
Fair: 0.1-0.01
Good: 0.01-0.001
Very Good: <.001

Current Rating: Fair
Date of Current Rating: 10/15/2004

Current rating comment: Fair: .01 , based on:

Kiyota and Fowler 1994, Rolf Ream Personal Communication, NMML fur seal website

Desired Rating: Good
Date for Desired Rating:

Other comments: The ability to conduct a detailed assessment of the incidence of female entanglement has been
hindered by the difficulties involved in estimating the age of individual females. Methods being used to conduct stage-based assessments of the age distribution of fur seal females (see above) may provide an opportunity for better resolution in data collected to assess female entanglement.

Conservation Target: Pinnipeds

Category: Size

Key Attribute: Population size & dynamics

Indicator: Steller sea lion adult/juvenile counts

Indicator comment: The Alaskan population of Steller sea lions has declined by approximately 85% since the 1950s,
leading to the designation of the western Alaskan stock as endangered under the Endangered Species Act (ESA). Counts of Juvenile and adult sea lions in the Bering Sea/Aleutian Islands region have declined by more than 75% from the late 1970s through 2002 (Table 9)(Angliss and Lodge 2004). Similar rates of decline have occurred in the Pribilof Islands, located near the northern extent of the species range. Only one declining breeding area remains in the Pribilof Archipelago, on Walrus Island. Several haul-out areas where sea lions come on the beach to rest and care for their young are located on St. Paul and St. George Islands. The number of pups born on Walrus Island has declined from over 300 in the early 1980s to less than 50 in the late 1980s (Table 10).

Indicator Ratings:

Poor: <11
Fair: 11-18
Good: 18-44
Very Good: >44

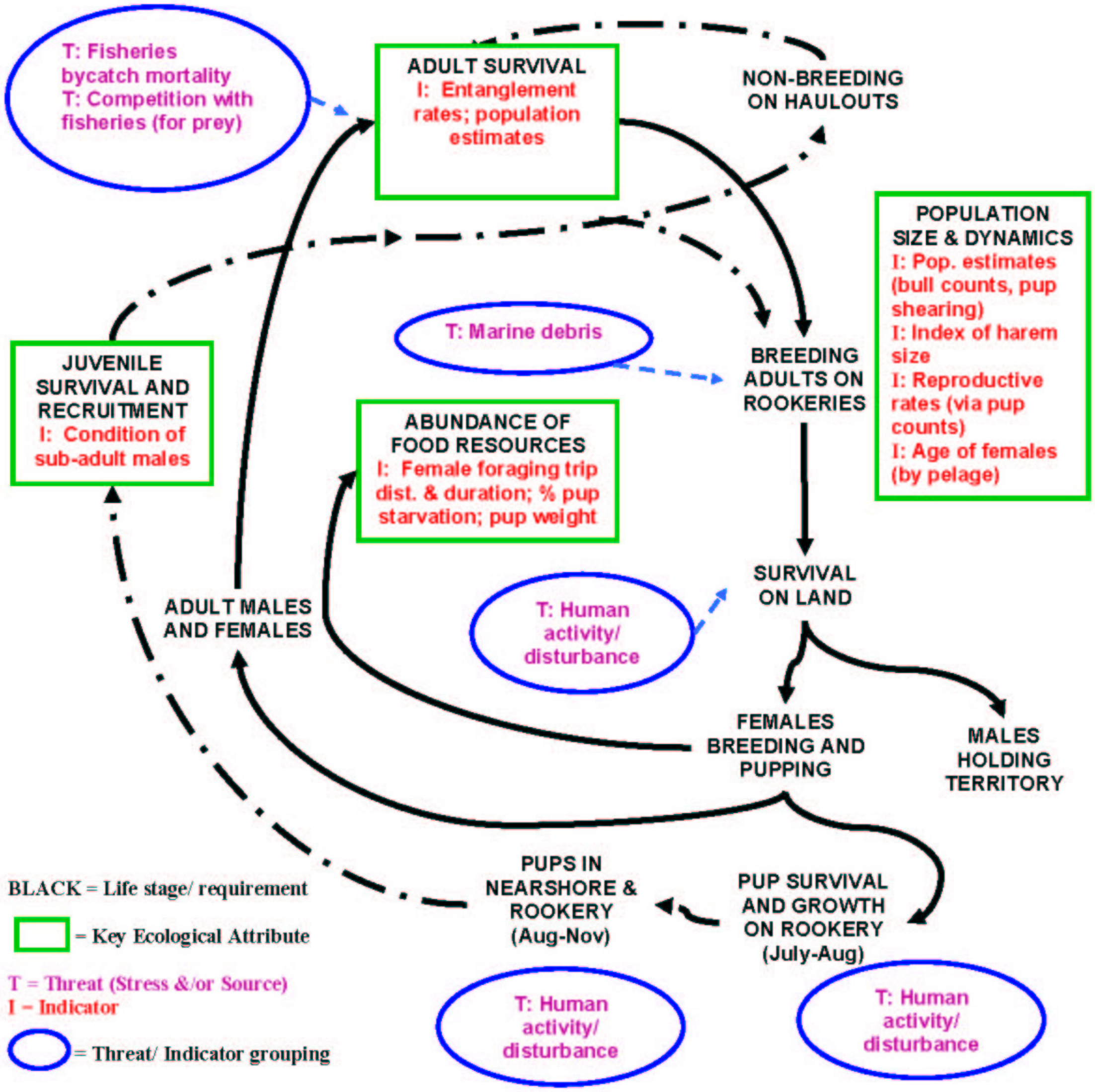
Current Rating: Poor
Date of Current Rating: 10/15/2004

Current rating comment: 10,250 = poor. (NMFS 1992, Loughlin and York 2000, Angliss and Lodge 2004)

Desired Rating: Good
Date for Desired Rating:

Other comments: Current rating methodology should be considered provisional, pending the release of the new
Recovery Plan for the Steller Sea Lion.

Figure A2: Conceptual Model Developed to Identify Key Ecological Attributes and Threats for Bering Sea Ecoregion Northern Fur Seals



	THREATS TO SOUTHERN BERING SEA PINNIPEDS	Direct mortality	Reduced prey availability	-	-	-	-	-	-	Threat to System Rank
	Stress Rank	*Low*	*High*	-	-	-	-	-	-	
1	Threat	Climate change								High
	Contribution	High	Very High							
	Irreversibility	Very High	Very High							
	Threat Rank (override)									
	Threat Rank	Low	High	-	-	-	-	-	-	
2	Threat	Competition with fisheries								High
	Contribution	Medium	Very High							
	Irreversibility	Medium	Medium							
	Threat Rank (override)									
	Threat Rank	Low	High	-	-	-	-	-	-	
3	Threat	Parasites/pathogens								Medium
	Contribution	Low	Low							
	Irreversibility	High	High							
	Threat Rank (override)									
	Threat Rank	Low	Medium	-	-	-	-	-	-	
4	Threat	Marine debris								-

	Contribution	Medium								
	Irreversibility	Low								
	Threat Rank (override)									
	Threat Rank	-	-	-	-	-	-	-	-	
5	Threat	Contaminants								Medium
	Contribution	Low	Low							
	Irreversibility	High	High							
	Threat Rank (override)									
	Threat Rank	Low	Medium	-	-	-	-	-	-	
6	Threat	Oil spill								Medium
	Contribution	Medium	Medium							
	Irreversibility	High	High							
	Threat Rank (override)									
	Threat Rank	Low	Medium	-	-	-	-	-	-	
7	Threat	Lack of basic management data								Medium
	Contribution	High	High							
	Irreversibility	Medium	Medium							
	Threat Rank (override)									
	Threat Rank	Low	Medium	-	-	-	-	-	-	

Key Ecological Attributes, Indicators, and Established Threshold Levels: Northern Fur Seal and other Selected Species

By Bruce Robson

I: KEY ECOLOGICAL ATTRIBUTE: ABUNDANCE OF FOOD RESOURCES

<u>Indicators</u>

1. Female foraging trip distance

Basis for indicator rating

<u>Background</u>

The distance traveled during a foraging trip can serve as an index of foraging effort for lactating female fur seals. Theoretical studies of species using a central-place foraging strategy (Orians and Pearson 1979) predict that dispersal distances from the central breeding site will vary in relation to the size of the foraging population and the density of prey in the surrounding environment (citations).

The ability to effectively measure linear foraging distance for large samples of pinniped foragers has improved due to advances in satellite telemetry. Robson et al. (2004) presented data for 119 foraging trips made by 97 females from the Pribilof Islands during 1995-96. The maximum distance traveled ranged from 40–450 km and did not differ significantly among islands in either 1995 or 1996. For St. Paul and St. George Island combined, females traveled slightly farther on average during 1995 (260.8 km ± 76.3) than during1996 (229.0 ± 64.6 km; Robson et al. 2004). In contrast, foraging distances were considerably shorter for females tracked on Bogoslof Island, where approximately 5000 pups were born during 1997 (in contrast to approximately 198,000 pups born in 1996 on the Pribilof Islands). Only one out six females tracked by satellite from Bogoslof Island traveled further than 75 km the island, while 3 females did travel more than 22 km from the island (Ream et al. 1999). The average maximum distance traveled from Bogoslof Island was 51.2 km.

Additional satellite tracking studies of both juvenile male and lactating northern fur seals have been conducted during the 1998, 1999, 2000 and 2002 breeding seasons (NMFS unpublished data), however study objectives and instrumentation packages differed among years. Female fur seals will be tracked on St. Paul and St. George Islands in 2004 and on Bogoslof and St. Paul Islands during the 2005 breeding season.

<u>Management objective</u>

Female foraging distance may provide an indirect measure of foraging effort and prey availability within fur seal foraging habitat. In theory, the benefit of habitat conservation efforts may be evaluated based on the effective foraging radius of lactating fur seals around the breeding site, the distribution of foraging effort in specific areas of interest. Foraging distances will likely show a density dependant response population but may vary in relation to the patchy distribution of prey species.

Current Status (date)

The utility of foraging distance as an ecological indicator is limited by the availability of a sufficient time series of data. The ability to track entire foraging trips using satellite telemetry, will soon provide a adequate time series to evaluate changes over time in relation to population numbers, indices of prey availability and environmental variables. It is important to ensure that sampling protocols and tracking methods are standardized between studies to provide comparable data between years.

Basis for current rating

Robson et al. 2004, Ream et al. 1999, NMFS unpublished data

2. Female foraging trip duration

Basis for indicator rating

Background

The duration of foraging trips made by lactating female fur seals and other Otariids has also served as an index of foraging effort. Recent studies of both northern fur seals and Antarctic fur seals have shown that the linear distance traveled during feeding trips is positively correlated with foraging trip duration (Robson et al. 2004, Boyd et al. 1998) and varies in response periods of contrasting prey abundance (Boyd et al. 1994). In contrast to data on foraging distance, trip duration has been measured in behavioral studies on St. Paul Island since the early 1950s, providing a time series that spans the recent period of decline of the Pribilof fur seal population.

Loughlin et al. (1987) compiled data for the mean trip duration of the first foraging trip, July trips and all trips made during July and August in behavioral studies conducted at Kitovi rookery from 1951-1977 for comparison with radio telemetry studies conducted in 1984 at Zapadni Reef rookery (citations). A comparable sample of radio tracked females was collected during 1995 on St. Paul Island and 1996 on St. George Island by Goebel (2003). Foraging trips were shorter in 1984 than the earlier studies, averaging 3.5 d, 5.7 d, and 5.9 d for perinatal trips, July trips and July-August trips, respectively (Loughlin et al. 1987). Trip durations in the earlier studies ranged from 7.1 to 9.7 d between 1951 and 1997. Mean trip durations of July trips and July-August trips in 1995 and 1996 were slightly longer than 1984 trips, but were still shorter on average than the 1950-1977 data. Foraging trip durations recorded for Bogslof Island females during the 1997 were shorter than those of Pribilof Island females. Most females made overnight foraging trips and the maximum foraging trip duration was four days (Ream et al. 1999).

Management objective

Similar to foraging distance, foraging trip durations may provide an effective, although indirect measure of foraging effort and prey availability within fur seal foraging habitat. The longer time series of data may provide an index of foraging effort for lactating females during periods of declining fur seal abundance on the Pribilof Islands.

Current Status (date)

Ongoing foraging studies conducted by NMML should provide additional data on the duration of female foraging trips at Bering Sea breeding sites during 2004 and 2005. However it is important to consider whether trip durations of fur seals equipped with satellite transmitters will provide comparable data to that of behavioral and radio telemetry studies. Attachments of larger instruments such as time-depth recorders and satellite transmitters have been shown to increase foraging trip durations for fur seal females (Boyd et al. 1997, Walker and Boveng 1995). Alternatively, useful data may be available from behavioral studies and tag resight efforts conducted in recent years.

Basis for current rating

Loughlin et al. 1987 (earlier studies should be cited individually), Goebel 2003, Robson et al. 2004

Comments

St. George data should be evaluated separately by mining the St. George Island Program data on foraging trip duration.

3. Number % of pup starvations

Basis for indicator rating

Background

Starvation is one of the predominant causes of death observed in neonatal northern fur seals from the Pribilof Islands. The earliest studies of fur seal pup mortality were conducted in the late 1800s by Lucas (1899) and York (1985) estimated that pup mortality ranges from 4 to 20 percent during the first 120 days of life. The causes underlying pup mortality have been assessed annually during the first week of July through the second week of August, 1986 through 2003 by Dr. Terry Spraker in conjunction with the National Marine Mammal Laboratory. However the St. Paul Island pup mortality study does not include a site-specific index of the number of pups born or population density. Pup mortality has been shown to be density dependent in three species of fur seals, including northern fur seals (Wickens and York 1997) and the inability to relate starvation rates to population density limits the utility of the from this study.

Management objective

Emaciation rates among neonatal fur seal pups may be indicative of early season foraging conditions for Pribilof Island females.

Current Status (date)

Emaciation was the most common cause of death in pups between 1986 and 2003, occurring in an average of 52% of the pups examined (Terry Spraker Personal Comm.).

Basis for current rating

Terry Spraker, Personal Communication

4. Pup weight

Basis for indicator rating

Background

Weight measurements have been collected as a condition index of northern fur seal pups on Pribilof Island rookeries intermittently since the 1950s. Pups are usually weighed at approximately 2 months of age, although some data has been collected at other times during the breeding season. Weight data have also been collected from pups tagged during studies to estimate survival rates of Pribilof Island fur seals. Comparable weight data have been collected at other fur seal breeding sites (e.g. Commander Islands and San Miguel Island) and for fur seal and other Otariid species worldwide. In general, pup weights on the Pribilof Islands have varied between islands and sexes, but have shown no apparent trend over time. However differences between the timing of data collection and area may need to be standardized using recently available growth curves and a more detailed analysis may uncover significant trends in the data.

Management objective

Pup weights may be a useful index of condition and maternal investment.

Current Status (date)

Pup weight data has been collected annually since 1987.

Basis for current rating

Fur Seal Investigations annual data report.

5. Forage fish index – Prey Diversity

Basis for indicator rating

Background

Selected characteristics of foraging trips made by lactating fur seals (e.g. trip duration and distance) provide an indirect assessment of foraging conditions based on foraging effort. In a similar fashion, measurements of pup condition and maternal investment (e.g. growth rates, pup weight and starvation rates) only provide indices of foraging success. The effectiveness of these parameters as indicators environmental changes and the success (or failure) of conservation efforts is enhanced by direct measures of prey availability in the foraging environment.

The Alaska Fisheries Science Center (AKFSC) conducts an annual bottom trawl survey of the eastern Bering Sea continental shelf and slope during July and August. Total biomass for selected species is estimated from the survey data by averaging the density (CPUE) of fish from all survey stations and extrapolating to the surveyed area of the Bering Sea. However, fur seals do not utilize all of the habitat covered by trawl surveys, and also forage in shelf break and ocean basin areas not covered by the trawl surveys. The effectiveness of an index of prey availability is therefore dependent on an

appropriate definition of the foraging habitat utilized by northern fur seals during the breeding season.
Ciannelli et al. (2004) used mass-balance ecosystem models of circular regions with a radius of 50, 100, and 150 nm around the Pribilof Archipelago to evaluate potential ecosystem boundaries relative to the foraging range of local central place foragers. The model predicted that the minimum boundary for an energetically balanced Pribilof ecosystem was 100 nm, although lactating fur seals spend considerable time foraging at greater distances (Robson et al. 2004). The majority of energy production in the model occurred along the shelf break, where fur seals forage extensively. In this study, the use of circular food web areas was primarily driven by computational convenience. A more appropriate shape of the Pribilof ecosystem may resemble an ellipse with the longest axis oriented along the Bering Sea shelf edge (Ciannelli et al. 2004).

The spatial delineation of fur seal foraging habitat into discrete areas allows for the development of comparative measures of prey diversity and abundance. The combined frequency of occurrence (FO) for selected fur seal prey species caught in summer bottom was calculated annual index of prey diversity around the Pribilof Islands from 1982-2003 following the methods of Brodeur et al. 1999. We used these methods to calculate the combined FO and estimate the probability of occurrence for individual species within 50, 100 and 150 nm ellipses around the Pribilof Islands.

Management objective

The index of prey diversity will serve as a spatial index of prey availability for use in conjunction with ecological indicators based on foraging effort for Pribilof Island fur seal colonies.

Current Status (date)

NA

Basis for current rating

NA

II: KEY ECOLOGICAL ATTRIBUTE: ADULT SURVIVAL

Indicators

1. Juvenile male entanglement rate

Basis for indicator rating

Background

Mortality caused by entanglement in marine debris has been implicated as a contributing factor to the decline of the Pribilof Islands northern fur seal population during the 1970s and early 1980s (Fowler 1987, Trites and Larkin 1989, Fowler 2002). The incidence of entanglement among juvenile males on St. Paul Island increased in the early 1970s to a high of 0.71% in 1975. Fowler et al. (1993) attributed a decline in the rate of entanglement on St. Paul Island from a mean rate of 0.4% between 1976 and 1985 to the approximately 0.2% level observed from 1988-92 to a reduction in the fraction of seals entangled in trawl net fragments. The rate remained constant at approximately 0.2% from 1995-97, but may have increased in recent years based on data from harvest surveys.

<u>Management objective</u>

As a human-caused source of mortality, the management objective should be to reduce mortality due to entanglement to insignificant levels. Entanglement surveys are the only effective method to evaluate whether existing measures designed to reduce the mortality due to entanglement are working (e.g. laws to eliminate illegal discard of debris) (NMFS 1993-nfscp).

<u>Current Status (date)</u>

The rate of entanglement estimated during harvest surveys on St. Paul Island during 2002 was 0.37% (Zavadil et al. 2003). It should be noted however, that harvest surveys may be subject to bias due to small sample sizes and other sampling issues (Stepetin et al. 2000, Zavadil et al. 2003).

<u>Basis for current rating</u>

Northern fur seal entanglement was studied from 1967 through 1985 in conjunction with the commercial harvest from (Scordino and Fisher 1983, Scordino 1985) and using research roundups after the cessation of the commercial harvest (Fowler 1987, Fowler et al. 1992) Surveys conducted in conjunction with the subsistence harvest were conducted in 1995 in a collaborative effort between NMFS, the Tribal Governments of St. Paul and St. George Islands and the Pribilof Islands Stewardship Program (Robson et al. 1999, Stepetin et al. 2000). Data for 2002 were provided by Tribal Government of St. Paul Island, Ecosystem Conservation Office.

<u>Comments</u>

Efforts are underway to assess the degree of bias present in the harvest survey data (Phillip A. Zavadil, personal communication, 2004.

2. Adult female entanglement rate

Basis for indicator rating

<u>Background</u>

Adult female entanglement has been studied intermittently since the 1970s with a consistent time series of surveys conducted in conjunction with bull counts that span the period from 1991 to the present (Kiyota and Fowler 1994, NMFS Unpublished Data). During this period the rate of entangled females has averaged approximately 0.01% in surveys with sample sizes ranging from several thousand to greater than 30,000 female fur seals checked for evidence of entangling debris. Several studies have conducted additional surveys from July through September (Scordino et al. 1988, Kiyota and Fowler 1994). Both studies observed seasonal changes in the incidence of female entanglement with increasing rates of entanglement as the season progressed.

Management objective

To monitor incidence of female entanglement as a component of adult fur seal mortality.

Current Status (date)

Little change during the period for which data are available.

Basis for current rating

Rolf Ream Personal Communication

Comments

The ability to conduct a detailed assessment of the incidence of female entanglement has been hindered by the difficulties involved in estimating the age of individual females. Methods being used to conduct stage-based assessments of the age distribution of fur seal females (see below) may provide an opportunity for better resolution in data collected to assess female entanglement.

3. Incidental catch in commercial fisheries

Basis for indicator rating

Background

The NMFS monitors commercial fisheries that have the potential to interact with northern fur seals. These data are summarized annually in the Alaska Status of Stocks Report (SAR) and may be useful as an ecological attribute in order to identify any changes in interaction rates which may impact fur seal population trends. The current threshold Potential Biological Removal (PBR) calculated in the Draft 2004 Alaska SAR is 16,162. The combined human caused mortality, the sum of subsistence harvest mortality (1,132) and estimated fishery mortality (17) is less than 10% of the PBR for this species, and is therefore considered to be insignificant and approaching a zero mortality and serious injury rate. In spite of the low level of human caused mortality, the Alaskan stock of northern fur seals is listed as a strategic stock due to its depleted status under the MMPA.

Management objective

To monitor trends in direct human-caused mortality of northern fur seals.

Current Status (date)

Low

Basis for current rating

Angilss and Lodge 2004 (Draft Alaska SAR)

II: Key Ecological Attribute: Population Size and Dynamics

1. Bull counts

Basis for indicator rating

Background

An annual census of adult male fur seals on the Pribilof Islands has been conducted since 1911. For the purpose of the census, adult males are classified into categories of "harem" and "idle" based on whether a male is defending a territory containing one or more females (Loughlin et al. 1994). In recent years, the numbers of both territorial and idle males have declined significantly on both St. George and St. Paul Island. Counts of adult males are also an important parameter necessary to calculate the ratio of adult females (often using pup counts) to adult males.

Management objective

The use of adult male fur seal counts as an index of stock abundance and trends.

Current Status (date)

Counts of adult males represent an exceptionally long time series of census data for the Pribilof fur seal population. It will be difficult to categorize adult male trend counts due to factors involving the effect of commercial harvesting of adult males from the Pribilof population. However the adult male numbers have likely recovered from the effect of previous harvest levels and the declining trends are cause for concern.

Basis for current rating

NMFS data

Comments

The amount of comparative data for other populations should be assessed.

2. Number of pups born

Basis for indicator rating

Background

The Pribilof Island fur seal population has declined at approximately 5.2% from 1998-2002 (NMFS 2002). Current estimates of northern fur seal pup production on St. Paul and St George Islands have fallen below levels observed in 1921 and 1916, respectively (NMFS 2002), when the population was at a historical low following the decline caused by high female mortality in pelagic sealing operations.

Management objective

To monitor northern fur seal population trends through counts of the number of pups born.

Current Status (date)

Low

Basis for current rating

NMFS Data

Comments

Pup numbers have fallen below historical minimums.

3. Reproductive rates via pup counts

Basis for indicator rating

Background

The number of fur seal pups born is currently the primary index of abundance used to determine population trends. Total population size is estimated suing a correction factor of 4.47 times the number of pups. However this correction factor was derived from life history parameters collected from females killed from 1958 to 1974. It is not known whether survival and fecundity estimates from this time period are accurate at current population levels. The Alaska Scientific Review Group (SRG) has recommended further research on the part of NMFS to determine whether this correction factor is biased, thus requiring a re-evaluation of the stock relative to carrying capacity.

Management objective

To use fur seal pup counts as an index of fecundity in the Pribilof population.

Current Status (date)

Unknown (July, 2004)

Basis for current rating

NMFS data

4. Stage based index of female age structure (estimated by vibrissae color)

Basis for indicator rating

Background

An understanding of the factors influencing current trends in the Pribilof fur seal population complicated by a lack of information on vital reproductive parameters. Currently, total population estimates are calculated by multiplying the average number of pups born over the past three censuses by a correction factor derived from estimates of survival and fecundity based on data collected at sea during 1958-74. These estimates must be viewed as a rough approximation, however, since it is unknown if the vital rates used are still valid and whether these rates are changing as the population declines.

Management objective

Development a stage-based index of female age structure based on vibrissae color.

Current Status (date)

Unknown

Basis for current rating

Several previous studies have described the vibrissae (whisker) color of adult female northern fur seals and attempted to correlate changes in vibrissae color with female age (Scheffer 1962, Baba et al. 1991, Vladimirov and Nikulin 1991). Three general categories of vibrissae color; dark, mixed and white have been described in relation to known age females. Unfortunately, the age distributions of females in each color category differed greatly between the studies by Scheffer (1962) and Baba (1991), casting doubt on the utility of vibrissae color as a precise indicator of female age structure (Jason Baker, unpublished data). In spite of the differences between the earlier studies, the relative proportion of females in each vibrissae color category may still prove useful as a stage-based index of whether the relative age distribution of females on Pribilof rookeries tends to change over time (See Holmes and York 2003).

Comments

Baker (unpublished data) proposed a method for collecting "minimally biased" samples of vibrissae color that may serve as a useful index of a trend in the female age structure on Pribilof rookeries. The Pribilof Island Stewardship Program is currently conducting a study to determine the feasibility of using this methodology to develop a stage-based index of female age structure based on vibrissae color. The primary objective of this study is to collect baseline information on vibrissae color on a small sample of rookeries and to evaluate the practical utility of initiating a more comprehensive sampling program in the future.

3.3 Pelagic Fishes (Pacific Salmon and Pollock)

The following resources on pelagic fish were compiled for the first iteration of this Strategic Action Plan for the Bering Sea:

- Life History, Population Status, Threats to and Research Needs for Bering Sea Ecoregion Pacific Salmon (Denise Woods, WWF Bering Sea Ecoregion Program)
- Documentation for Viability Table (E5S Planning Tool)
- Conceptual Model Developed to Identify Key Ecological Attributes and Threats for Bering Sea Ecoregion Pacific Salmon (Randy Hagenstein, TNC Alaska; Evie Witten and Denise Woods, WWF Bering Sea Ecoregion Program) (Figure A3)
- Threats to Pelagic Fishes (Table A3)
- Questions and Answers Regarding Bering Sea Walleye Pollock (Gennady Evsikov, WWF Bering Sea Ecoregion Program)
- Brief description of the Russian Far East Salmon Fishery, It's Management System and WWF Potential Involvement (Konrad Zgurovsky, WWF Bering Sea Ecoregion Program)

The following experts were consulted with regard to Bering Sea Ecoregion pelagic fish:

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Life history, population status, threats to and research needs for Bering Sea Ecoregion Pacific Salmon

DRAFT 6/24/04- needs expert input

Introduction

Five species of Pacific salmon inhabit the Bering Sea: sockeye or "red" salmon (*Oncorhynchus nerka*), chum or "dog" salmon (*O. keta*), pink or "humpback" salmon (*O. gorbuscha*), coho or "silver" salmon (*O. kisutch*), and chinook or "king" salmon (*O. tshawytscha*). Pink and chum are the main species in the western Bering Sea; sockeye, Chinook and, in summer, pink salmon are the main species in the eastern Bering Sea (Karpenko 2003). Pacific salmon have been a vital subsistence food, a valuable trade commodity, and a cultural icon for Native people of the Bering Sea for thousands of years. Salmon aquaculture, wild harvest and processing remain vital components of Bering Sea economies.

Life History

Breeding

Pacific salmon are anadromous, spending from one to several years at sea, depending on the species, migrating hundreds or even thousands of miles before returning to natal streams to spawn. All species spawn during the summer and fall in northern regions (chinook may also spawn in spring; Eschmeyer and Herald 1983). Salmon eggs are laid and fertilized in depressions or nests ("redds") on the bottom gravel of cold water streams and lakes and are buried in gravel. Except for some yearling chinook salmon, all Pacific salmon die after spawning. After several months, larvae emerge from the gravel and may move directly to the ocean or may remain in fresh water for several years, again depending on the species (pink spawn at 2 years; chum spawn at 3-5 years; chinook spawn at 4-5 years; coho spend 1 year in streams, then spawn at 2-4 years; sockeye spend 1-3 years in streams associated with lakes, then spawn at 1-4 years (Eschmeyer and Herald 1983).

Migration/ ocean movements

In cold regions (e.g. the Bering Sea), the timing of juvenile salmon migration to coastal waters tends to correspond to spring ice breakup in rivers and to maximal water temperatures along migration corridors (Orsi et al. 2000). When they first leave streams and enter coastal marine waters, small juvenile salmon generally are distributed in shallow, littoral habitats (beach areas between low and high tide). As summer progresses and the fish grow, they move to neritic habitats (shallow pelagic areas near shore or over the continental shelf to depths of about 200m). The extent of distribution of juvenile salmon over the shelf varies regionally, annually, seasonally, and by species and stock (e.g. Straty and Jaenicke 1980; Straty 1981; Hartt and Dell 1986; Jaenicke and Celewycz 1994; Carlson et al. 2000). The vertical distribution of juvenile salmon in these neritic habitats is influenced by a variety of biotic (species, age, size, forage location) and abiotic (water temperature, salinity, season, light, turbidity, currents, tides, and bottom topography) (Orsi and Wertheimer 1995). Seasonal habitat use varies by species, stock, water temperature, and zooplankton distribution (Orsi et al. 2000).

There has not been a comprehensive U.S. field research effort to determine the timing and extent of movements of juvenile salmon from coastal waters to the high seas and the proportion of U.S. salmonids migrating to the high seas and those remaining in coastal waters are not known (Brodeur et al. 2003). Available information for sockeye salmon in the eastern Bering Sea indicate that by September large numbers are distributed to at least 167 km offshore in the eastern Bering Sea. By January and early February relatively few remain in the Bering Sea but are distributed broadly across the central and eastern North Pacific. Migration routes are through the Aleutian passes, with salmon covering an estimated horizontal distance of 1,300-1,850 km at a rate of at least 14.8-18.5 km/day (French and Bakkala 1974).

Diet and Foraging

Survival of salmon depends on successful growth in coastal waters which, in turn, depends on the abundance and availability of food (Karpenko 2003). In general, juvenile salmon in northern marine habitats feed on large zooplankton (euphausiids, copepods, decopods and others) and small fish (e.g. Brodeur et al. 2003a). Studies have found some intraspecific differences in type and size of prey consumed by salmonids: coho and chinook salmon tend to be mainly piscivorous, while pink, chum, and sockeye salmon more planktivorous (Carlson 1976; Karpenko 2003). Diet composition changes markedly with ontogeny toward larger and more evasive prey in later juvenile stages and with movement from protected coastal waters to open ocean (Brodeur 1991; Boldt 2001). Interannual and seasonal differences in prey availability can lead to major differences in diet composition for a species between years (Brodeur and Pearcy 1990).

Population Status and Trends

Beginning in the late 19th century, the Alaska commercial salmon industry flourished and salmon stocks throughout the region exhibited a boom and bust cycle as natural salmon runs were exploited and depleted, with commercial activity peaking during the 1930's (Freeburn 1976). After WWII, Alaska salmon runs declined, likely as a result of overfishing during a period of low ocean productivity. Numbers continued to decline through the 1950's. However, prior to the expansion of the walleye pollock fishery in the 1970's, Alaska's salmon industry was still considered the single most valuable U.S. commercial fishery in the North Pacific Ocean (Browning 1974). Conservation measures in the 1960's and favorable climate conditions in the late 1970's led to a sharp increasing trend that continued to the mid-1990's (Wertheimer 1997). The main species fished during the 1990's were are pink (41%) and sockeye (38%), followed by chum (14%), coho (6%), and chinook (1%) (Brodeur et al. 2003a).

Threats

Although the long-term survival of most salmon stocks are dependent on both freshwater and ocean conditions (Lawson 1993), we will focus on Bering Sea (marine) lifestages of

North Pacific Salmon. Over the past 200 years, the cumulative effects of overfishing, poor fishery and hatchery practices, human development, unfavorable climate, and environmental degradation have resulted in the decline or extirpation of many natural salmon populations, especially in the Pacific Northwest. Even in relatively pristine areas of Alaska, where habitats and salmon runs are healthy, commercial salmon fisheries are experiencing difficulties, mostly as a result of market forces (for example, the estimated landed value of the Alaska commercial salmon catch has declined from $489 million in 1994 to $141 million in 2002; Brodeur 2003a).

Primary threats to salmon in the Bering Sea include: intense commercial, recreational, and subsistence fishing; estuarian and freshwater habitat alteration; competetion with invasive species; effects from salmon farming and ranching; and diseases and parasites (Lackey 2003). Climate change will also have effects on salmon. The Bering Sea is experiencing a northward biogeographical shift in response to increasing temperatures and atmospheric forcing. Overland and Stabeno (2004) have observed that mean summer temperatures near the Bering Sea shelf are 2 degrees (C) warmer for 2001-2003 compared with 1995-1997. In the coming decades, this warming trend is expected to have major impacts on the region's arctic species, at all levels of the food web, including salmon and their prey.

Monitoring

Salmon in the North Pacific Ocean are relatively well studied and data for all species are available for the region, to varying degrees. There are two excellent recent reviews of past and current Pacific salmon studies and available salmon data: Karpenko 2003 reviews Russian studies (unfortunately, most of the studies therein are in Russian) and Brodeur et al. 2003 reviews U.S. studies; both reviews are found in Symons 2003. Russia's TINRO-Center and KamchatNIRO have conducted the majority of studies in the western Bering Sea; the majority of eastern Bering Sea research has been conducted by the National Marine Fisheries Service (NMFS) or by universities funded in part by NMFS. A summary of Bering Sea-related studies follows:

Russia/ Western Bering Sea

Regular studies of juvenile Pacific salmon in Kamchatka began in 1960 with the establishment of a lab to study the marine ecology of North Pacific salmon in open ocean and coastal habitats (see Birman 1985). These and other early investigations (e.g. Baranenkova 1934; Semko 1939; Gribanov 1948; Piskunov 1955, 1959) addressed the following: juvenile ecology during early marine life in estuaries and coastal waters; ecology of juvenile salmon during autumn, and assessment of their brood abundance; and the role of juvenile salmon in coastal marine ecosystems of Russia's far eastern seas and northwest Pacific Ocean (Karpenko 2003). The most regular and long standing recent investigations of Pacific salmon have been conducted in the southwest Bering Sea; such studies yield data on feeding periods, growth patterns, distribution, and migration (Karpenko 1991, 1998). Available data from Russia's TINRO-Center and KamchatNIRO include (for some sites): zooplankton counts, distribution, migration, major biological parameters, food, growth rates (which may be a reliable indicator of feeding conditions; Karpenko 2003), and some interspecific interactions (Andrievskaya 1988; Birman 1985; Shuntov et al. 2000). Nearly all such investigations have been reported in Russian only.

Alaska/ Eastern Bering Sea

The Fisheries Research Institute of the University of Washington (under contract to NMFS) has conducted sampling inside Bristol Bay and along the north side of the Alaska Peninsula (Hartt and Dell 1986). The dominant species in the region is sockeye salmon. Starting in the late 1960's, the Auke Bay Laboratory initiated research on juvenile salmon migration (horizontal and vertical distribution, migration routes and rates), food habits, predators, environmental variables, and zooplankton (Straty 1974). The Auke Bay Lab renewed this research in 1999-2002 (Farley et al. 1999, 2000a, 2001a,c).

Research Needs

The following priority research needs for Russia were identified by Karpenko (2003). They include: establishment and use of defined standard areas for identifying/monitoring the causes of mortality and abundance of each year's brood class; assessment of interrelations between wild and hatchery produced salmon in areas where these stocks mix to feed; establishment of a rational combination of sustainable natural production and efficient hatchery production; development of improved methods for stock assessment and sustainable use of Pacific salmon (e.g. assessment of juvenile abundance in the fall); and integration, organization, and translation of ecosystem studies.

Future U.S. research needs include: refinement/ expansion of studies to determine juvenile salmon habitat preferences; advancement of techniques to mark salmon and determine stock sources, tracking growth and migration rates; determining early ocean mortality factors and rates; understanding the interactions between wild and hatchery salmon; sampling during nocturnal and winter periods; prey consumption rates relative to food availability; and changes in abundance and body size of salmon caused by global warming (Brodeur et al. 2003a).

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Documentation for Viability Table (E5S Planning Tool): Pelagic Fish

Conservation Target: Pelagic Fish

Category: Condition

Key Attribute: Sustainabilty of Pollock fishery

Key attribute comment: The pollock fishery is the largest fishery in the Bering Sea in terms of biomass removal, and is currently managed from a single speices perspective

Indicator: Marine Trophic Index (MTI)

Indicator comment: The mean trophic level of the catch has received considerable attention in recent years as an
index of sustainability and overexploitation of global fisheries (Pauley et al. 1998, Caddy and Garibaldi 2000). Two frequently used indices of trophic changes related to fishing are the Marine Trophic Index (MTI) and the Fishing In Balance (FIB) index (Pauley et al. 2000). The MTI measures the change in mean trophic level of fisheries landings calculated from catch data and is used as an indicator of the sustainable use of living resources (CBD 2004). The FIB is used as an alternative to the MTI, to account for the possibility that trends in the MTI may be a reflection of selectivity for lower trophic level species rather than a fishing down of the food web. The FIB declines only when catches do not increase as the fishery moves down the food web (Pauley et al. 2000).
Management objective
To evaluate the ecosystem goal of sustainability for consumptive and non-consumptive uses, the Resource Ecology and Fisheries Management Division of NMFS Alaska Fishery Science Center calculates the MTI and FIB indices for the eastern Bering Sea groundfish fishery. These indices are included in the Ecosystem Considerations Section of the annual Stock Assessment and Fishery Evaluation (SAFE) Report prepared for submission to the North Pacific Fishery Management Council (Livingston 2003). The 2003 section showing plots for these indices are included in the electronic reference library (Appendix 2) in PDF format. (SAFE03_Ecosystem_Goal_Sustainability.pdf).

The species composition of the catch expressed as biomass (Figure 1 in Livingston 2003) shows that the Eastern Bering Sea catch is dominated by Walleye pollock from the mid-1960s to the present. The MTI was calculated from a combination of published accounts of diet for nongroundfish species and from the food habits data collected by fisheries observers and assessment surveys conducted by the AFSC (Livingston et al. 1999, Livingston 2003). The data show a high level of stability in the trophic level of the catch (MTI of approximately 3.75) from the mid-1970s to the present. Similar results are observed for the FIB index (Figure 3 of Livingston 2003), indicating a relative stability in catch rates as well as mean trophic level. The mean level of 3.75 is approximately equal to the trophic level of adult pollock, indicating the dominance of the pollock fishery in catch calculations.

Pauly et al. (2002) state “the observed global decline of 0.05-0.10 trophic levels per decade in global fisheries landings is extremely worrisome, as it implies the gradual removal of large, longlived fishes from the ecosystems of the worlds oceans. Thresholds for qualitative categories are difficult to determine based on available literature, but the initiation of a negative trend in the MTI of -0.05 to -0.10 may serve as a benchmark value for rating the MTI indicator. A negative trend greater than -0.10 would receive a “poor” rating and MTI between 0 and > -0.05 can be considered “good”. The consistent trend in the MTI observed for the Eastern Bering Sea Groundfish fishery provides a useful baseline to monitor future declining trends in MTI an FIB should they occur.

Indicator Ratings:

Poor: <-0.1
Fair: > -0.1-<0.05
Good: >-0.05<0
Very Good: 0

Current Rating: Good
Date of Current Rating: 11/15/2003

Current rating comment: Current rating = >0.05-<0

Pauley, D., V. Christensen, S. Guenette, T. J. Pitcher, U. Rashid Sumaila, C. Walters, R. Watson, and D. Zeller. 2002. Towards sustainability in world fisheries. Nature 418:689-695.

Pauley, D., V. Christensen, and C. Walters. 2000. Ecopath, Ecosim, and Ecospace as tools for evaluating ecosystem impact of fisheries. ICES Journal of Marine Science 57:697-706.

Livingston, P. A. 2003. Trophic Level of the Catch, Ecosystem Considerations Chapter, Stock Assessment and Fishery Evaluation. National Marine Fisheries Service, Seattle, WA.

CBD. 2004. Indicators for Assessing Progress Towards the 2010 Biodiversity Target: Marine Trophic Index. in Ad Hoc Technical Expert Group On Indicators For Assessing Progress Towards The 2010 Biodiversity Target. UNEP Convention on Biological Diversity, Montreal.

Desired Rating: Very Good
Date for Desired Rating:

Other comments: It should be noted that data presented by Pauly (1998) showed a declining trend in the mean
trophic level of the catch for North Pacific fisheries based on FAO data. The Eastern Bering Sea catch data is on a smaller scale and the dominance of the Walleye pollock fishery may mask declining trends in other upper trophic level fish species (e.g. Pacific Ocean perch or Pacific cod).

Conservation Target: Pelagic Fish

Category: Condition

Key Attribute: Sustainabilty of Pollock fishery

Key attribute comment: The pollock fishery is the largest fishery in the Bering Sea in terms of biomass removal, and is currently managed from a single speices perspective

Indicator: Marine Trophic Index (MTI)

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Garibaldi 2000). Two frequently used indices of trophic changes related to fishing are the Marine Trophic Index (MTI) and the Fishing In Balance (FIB) index (Pauley et al. 2000). The MTI measures the change in mean trophic level of fisheries landings calculated from catch data and is used as an indicator of the sustainable use of living resources (CBD 2004). The FIB is used as an alternative to the MTI, to account for the possibility that trends in the MTI may be a reflection of selectivity for lower trophic level species rather than a fishing down of the food web. The FIB declines only when catches do not increase as the fishery moves down the food web (Pauley et al. 2000).

Management objective
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Indicator Ratings:

Poor: <-0.1
Fair: > -0.1-<0.05
Good: >-0.05<0
Very Good: 0

Current Rating: Good
Date of Current Rating: 11/15/2003

Current rating comment: Current rating = >0.05-<0

Pauley, D., V. Christensen, S. Guenette, T. J. Pitcher, U. Rashid Sumaila, C. Walters, R. Watson, and D. Zeller. 2002. Towards sustainability in world fisheries. Nature 418:689-695.

Pauley, D., V. Christensen, and C. Walters. 2000. Ecopath, Ecosim, and Ecospace as tools for evaluating ecosystem impact of fisheries. ICES Journal of Marine Science 57:697-706.

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Desired Rating: Very Good
Date for Desired Rating:

Other comments: It should be noted that data presented by Pauly (1998) showed a declining trend in the mean
trophic level of the catch for North Pacific fisheries based on FAO data. The Eastern Bering Sea catch data is on a smaller scale and the dominance of the Walleye pollock fishery may mask declining trends in other upper trophic level fish species (e.g. Pacific Ocean perch or Pacific cod).

Conservation Target: Pelagic Fish

Category: Size

Key Attribute: Pollock biomass

Key attribute comment: The Eastern Bering Sea pollock fishery is the largest fishery in the Bering Sea in terms of biomass removal.

Indicator: Pollock biomass as % of unfished biomass

Indicator comment: This indicator is also used in condition 1.1.1.3 of the MSC certification of the BSAI Pollock fishery: The harvest control rule results in appropriate reductions in exploitatation rate at low stock sizes.

Under the Magnuson-Stevens Fishery Conservation and Management Act, a system of harvest strategies are in place to regulate groundfish catches in Alaskan fisheries. Referred to as the Tier System, this management strategy defines an overfishing level (OFL), and a minimum stock size threshold (MSST) for groundfish fisheries. (Witherell and Ianelli 1997, NMFS 2004). Based on the recommendations of NMFS fisheries managers, the OFL is generally set at a level corresponding to FMSY, the fishing mortality rate associated with (single species) maximum sustainable yield. The MSST is generally set at one half BMSY, the biomass associated with MSY. Allowable biological catches (ABCs) are set below the OFL levels.
Uncertainty in the information used to manage individual fisheries are incorporated into the management structure using a tier system. Stocks with the best information are managed at Level 1, while those with the least information are managed at Level 6. The EBS pollock stock is managed under tier 1. A harvest control rule is employed under tier 1 that involves a maximum exploitation rate at high stock size. Reduced exploitation rates are progressively set at levels below target stock sizes. The current harvest control rule closes the fishery if the stock falls below 20% of average unexploited biomass.

Indicator Ratings:

Poor: <B 20%
Fair: B 20-35%
Good: B 35-45%
Very Good: >B 45%

Current Rating: Very Good
Date of Current Rating: 11/15/2004

Current rating comment: Goodman, D., M. Mangel, G. Parkes, T. Quinn, V. Restrepo, T. Smith, and K. Stokes. 2002.
Scientific Review of the Harvest Strategy Currently Used in the BSAI and GOA
Groundfish Fishery Management Plans. North Pacific Fishery Management
Council, Anchorage.

Ianelli, J. N., S. Barbeaux, G. E. Walters, and N. Williamson. 2003. Eastern Bering Sea
Walleye Pollock Stock Assessment, Stock Assessment and Fishery Evaluation.
National Marine Fisheries Service, Seattle, WA.

Desired Rating: Very Good
Date for Desired Rating:

Other comments: A recent scientific review of the current harvest strategy for the groundfish fisheries (Goodman
et al., 2002) endorsed the current system as a viable single species management approach, however the authors pointed out the need for further testing of the models regarding uncertainty related to environmental variability and stock structure. Marz and Stump (2002) in their comments regarding the Marine Stewardship Council certification of the pollock fishery argue that the implicit target level B40% is too low for a key prey species in the Bering Sea ecosystem. They point to the management of krill under the CCAMLR convention, where the target stock level is at B75%.

Conservation Target: Pelagic Fish

Category: Size

Key Attribute: Population size & dynamics

Indicator: Percentage of streams meeting salmon escapement goals

Indicator Ratings:

Poor:
Fair:
Good: good management generally on US side
Very Good:

Current Rating: Good
Date of Current Rating:

Desired Rating:
Date for Desired Rating:

Category: Condition

Key Attribute: Sustainabilty of Pollock fishery

Key attribute comment: The pollock fishery is the largest fishery in the Bering Sea in terms of biomass removal, and is currently managed from a single speices perspective

Indicator: Marine Trophic Index (MTI)

Indicator comment: The mean trophic level of the catch has received considerable attention in recent years as an
index of sustainability and overexploitation of global fisheries (Pauley et al. 1998, Caddy and Garibaldi 2000). Two frequently used indices of trophic changes related to fishing are the Marine Trophic Index (MTI) and the Fishing In Balance (FIB) index (Pauley et al. 2000). The MTI measures the change in mean trophic level of fisheries landings calculated from catch data and is used as an indicator of the sustainable use of living resources (CBD 2004). The FIB is used as an alternative to the MTI, to account for the possibility that trends in the MTI may be a reflection of selectivity for lower trophic level species rather than a fishing down of the food web. The FIB declines only when catches do not increase as the fishery moves down the food web (Pauley et al. 2000).
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Pauly et al. (2002) state "the observed global decline of 0.05-0.10 trophic levels per decade in global fisheries landings is extremely worrisome, as it implies the gradual removal of large, longlived fishes from the ecosystems of the worlds oceans. Thresholds for qualitative categories are difficult to determine based on available literature, but the initiation of a negative trend in the MTI of -0.05 to -0.10 may serve as a benchmark value for rating the MTI indicator. A negative trend greater than -0.10 would receive a "poor" rating and MTI between 0 and > -0.05 can be considered "good". The consistent trend in the MTI observed for the Eastern Bering Sea Groundfish fishery provides a useful baseline to monitor future declining trends in MTI an FIB should they occur.

Indicator Ratings:

Poor: <-0.1
Fair: > -0.1-<0.05
Good: >-0.05<0
Very Good: 0

Current Rating: Good
Date of Current Rating: 11/15/2003

Current rating comment: Current rating = >0.05-<0

Pauley, D., V. Christensen, S. Guenette, T. J. Pitcher, U. Rashid Sumaila, C. Walters, R. Watson, and D. Zeller. 2002. Towards sustainability in world fisheries. Nature 418:689-695.

Pauley, D., V. Christensen, and C. Walters. 2000. Ecopath, Ecosim, and Ecospace as tools for evaluating ecosystem impact of fisheries. ICES Journal of Marine Science 57:697-706.

Livingston, P. A. 2003. Trophic Level of the Catch, Ecosystem Considerations Chapter, Stock Assessment and Fishery Evaluation. National Marine Fisheries Service, Seattle, WA.

CBD. 2004. Indicators for Assessing Progress Towards the 2010 Biodiversity Target: Marine Trophic Index. in Ad Hoc Technical Expert Group On Indicators For Assessing Progress Towards The 2010 Biodiversity Target. UNEP Convention on Biological Diversity, Montreal.

Desired Rating: Very Good
Date for Desired Rating:

Other comments: It should be noted that data presented by Pauly (1998) showed a declining trend in the mean trophic level of the catch for North Pacific fisheries based on FAO data. The Eastern Bering Sea catch data is on a smaller scale and the dominance of the Walleye pollock fishery may mask declining trends in other upper trophic level fish species (e.g. Pacific Ocean perch or Pacific cod).

Conservation Target: Pelagic Fish

Category: Size

Key Attribute: Pollock biomass

Key attribute comment: The Eastern Bering Sea pollock fishery is the largest fishery in the Bering Sea in terms of biomass removal.

Indicator: Pollock biomass as % of unfished biomass

Indicator comment: This indicator is also used in condition 1.1.1.3 of the MSC certification of the BSAI Pollock fishery: The harvest control rule results in appropriate reductions in exploitatation rate at low stock sizes.

Under the Magnuson-Stevens Fishery Conservation and Management Act, a system of harvest

strategies are in place to regulate groundfish catches in Alaskan fisheries. Referred to as the Tier System, this management strategy defines an overfishing level (OFL), and a minimum stock size threshold (MSST) for groundfish fisheries. (Witherell and Ianelli 1997, NMFS 2004). Based on the recommendations of NMFS fisheries managers, the OFL is generally set at a level corresponding to FMSY, the fishing mortality rate associated with (single species) maximum sustainable yield. The MSST is generally set at one half BMSY, the biomass associated with MSY. Allowable biological catches (ABCs) are set below the OFL levels.
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Indicator Ratings:

Poor: <B 20%
Fair: B 20-35%
Good: B 35-45%
Very Good: >B 45%

Current Rating: Very Good
Date of Current Rating: 11/15/2004

Current rating comment: Goodman, D., M. Mangel, G. Parkes, T. Quinn, V. Restrepo, T. Smith, and K. Stokes. 2002.
Scientific Review of the Harvest Strategy Currently Used in the BSAI and GOA Groundfish Fishery Management Plans. North Pacific Fishery Management Council, Anchorage.

Ianelli, J. N., S. Barbeaux, G. E. Walters, and N. Williamson. 2003. Eastern Bering Sea Walleye Pollock Stock Assessment, Stock Assessment and Fishery Evaluation. National Marine Fisheries Service, Seattle, WA.

Desired Rating: Very Good
Date for Desired Rating:

Other comments: A recent scientific review of the current harvest strategy for the groundfish fisheries (Goodman
et al., 2002) endorsed the current system as a viable single species management approach, however the authors pointed out the need for further testing of the models regarding uncertainty related to environmental variability and stock structure. Marz and Stump (2002) in their comments regarding the Marine Stewardship Council certification of the pollock fishery argue that the implicit target level B40% is too low for a key prey species in the Bering Sea ecosystem. They point to the management of krill under the CCAMLR convention, where the target stock level is at B75%.

Conservation Target: Pelagic Fish

Category: Size

Key Attribute: Population size & dynamics

Indicator: Percentage of streams meeting salmon escapement goals

Indicator Ratings:

Poor:
Fair:
Good: good management generally on US side
Very Good:

Current Rating: Good
Date of Current Rating:

Desired Rating:
Date for Desired Rating:

Category: Size

Key Attribute: Pollock biomass

Key attribute comment: The Eastern Bering Sea pollock fishery is the largest fishery in the Bering Sea in terms of biomass removal.

Indicator: Pollock biomass as % of unfished biomass

Indicator comment: This indicator is also used in condition 1.1.1.3 of the MSC certification of the BSAI Pollock fishery: The harvest control rule results in appropriate reductions in exploitatation rate at low stock sizes.

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Uncertainty in the information used to manage individual fisheries are incorporated into the management structure using a tier system. Stocks with the best information are managed at Level 1, while those with the least information are managed at Level 6. The EBS pollock stock is managed under tier 1. A harvest control rule is employed under tier 1 that involves a maximum exploitation rate at high stock size. Reduced exploitation rates are progressively set at levels below target stock sizes. The current harvest control rule closes the fishery if the stock falls below 20% of average unexploited biomass.

Indicator Ratings:

Poor: <B 20%
Fair: B 20-35%
Good: B 35-45%
Very Good: >B 45%

Current Rating: Very Good
Date of Current Rating: 11/15/2004

Current rating comment: Goodman, D., M. Mangel, G. Parkes, T. Quinn, V. Restrepo, T. Smith, and K. Stokes. 2002.
Scientific Review of the Harvest Strategy Currently Used in the BSAI and GOA Groundfish Fishery Management Plans. North Pacific Fishery Management Council, Anchorage.

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Other comments: A recent scientific review of the current harvest strategy for the groundfish fisheries (Goodman et al., 2002) endorsed the current system as a viable single species management approach, however the authors pointed out the need for further testing of the models regarding uncertainty related to environmental variability and stock structure. Marz and Stump (2002) in their comments regarding the Marine Stewardship Council certification of the pollock fishery argue that the implicit target level B40% is too low for a key prey species in the Bering Sea ecosystem. They point to the management of krill under the CCAMLR convention, where the target stock level is at B75%.

Conservation Target: Pelagic Fish

Category: Size

Key Attribute: Population size & dynamics

Indicator: Percentage of streams meeting salmon escapement goals

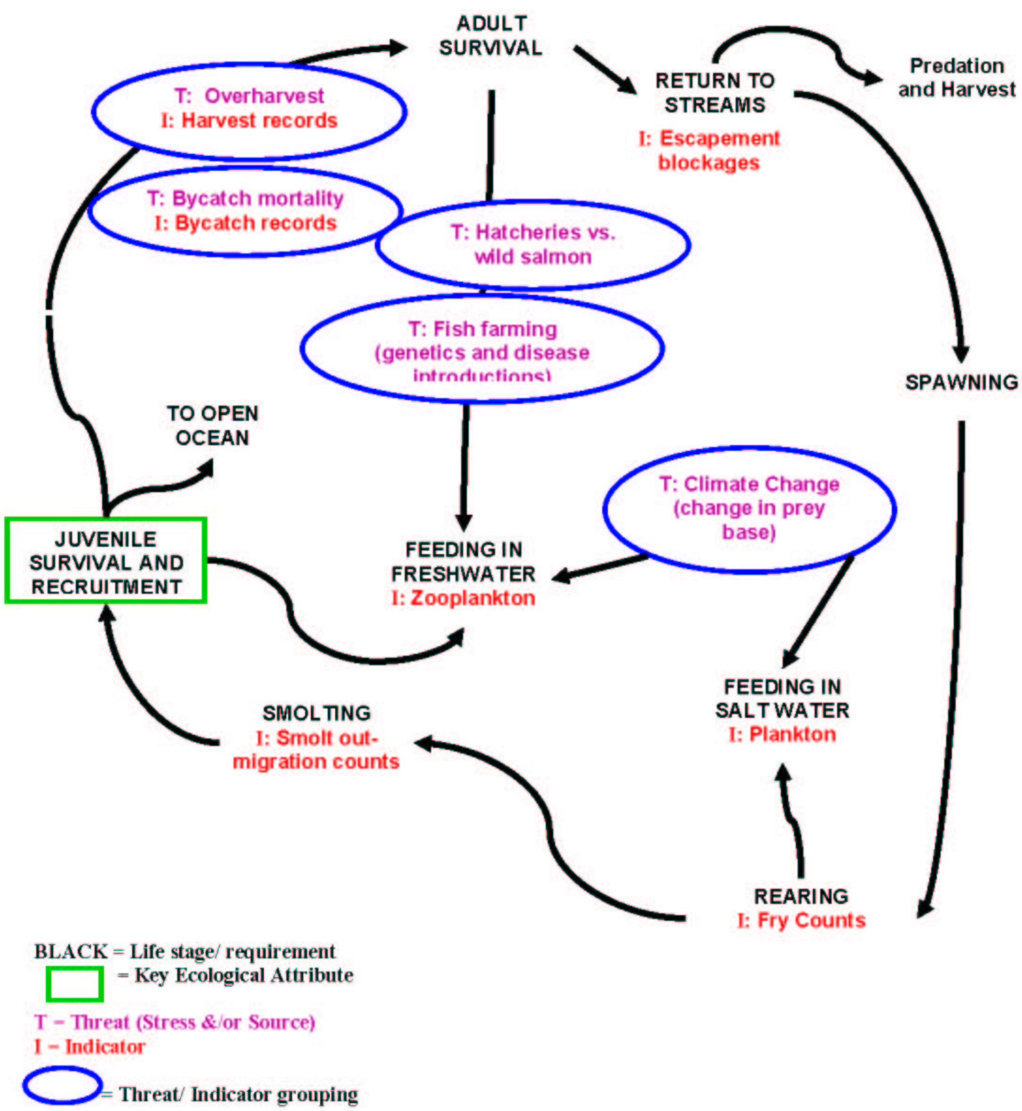
Indicator Ratings:

Poor:
Fair:
Good: good management generally on US side
Very Good:

Current Rating: Good
Date of Current Rating:

Desired Rating:
Date for Desired Rating:

Figure A3: Conceptual Model Developed to Identify Key Ecological Attributes and Threats for Bering Sea Ecoregion Pacific Salmon



	THREATS TO BERING SEA ECOREGION PELAGIC FISHES	Adult mortality	Juvenile survival and recruitment	-	-	-	-	-	-	Threat to System Rank
	Stress Rank	*High*	*Medium*	-	-	-	-	-	-	
1	Threat	Climate change								High
	Contribution	High	High							
	Irreversibility	Very High	Very High							
	Threat Rank (override)									
	Threat Rank	High	Medium	-	-	-	-	-	-	
2	Threat	Fishing bycatch mortality								Medium
	Contribution	High	Low							
	Irreversibility	Medium	Medium							
	Threat Rank (override)									
	Threat Rank	Medium	Low	-	-	-	-	-	-	
3	Threat	Competition with hatchery fish								Medium
	Contribution	Medium	Medium							
	Irreversibility	Medium	Medium							
	Threat Rank (override)									
	Threat Rank	Medium	Low	-	-	-	-	-	-	
4	Threat	Disease, genetic dilution, and competition from aquaculture								Medium

	Contribution	Medium	Medium							
	Irreversibility	High	High							
	Threat Rank (override)									
	Threat Rank	Medium	Low	-	-	-	-	-	-	
5	Threat	Oil spill								Medium
	Contribution	Medium	Medium							
	Irreversibility	High	High							
	Threat Rank (override)									
	Threat Rank	Medium	Low	-	-	-	-	-	-	
6	Threat	Overfishing								Medium
	Contribution	High								
	Irreversibility	Medium								
	Threat Rank (override)									
	Threat Rank	Medium	-	-	-	-	-	-	-	

Questions and Answers Regarding Bering Sea Walleye Pollock

The following document was provided by Gennady Evsikov (WWF Bering Sea Ecoregion Program; retired, Russian Laboratory of Commercial Fishery of the Pacific Research Institute for Fishery & Oceanography-TINRO) in response to questions posed by Konstantin Zgurovsky (WWF-Russian Far East) with regard to Walleye Pollock in the Bering Sea.

1. ***What is the current state of Walleye Pollock population in the Bering Sea (stock abundance, dynamics of fluctuations, conditions in the area inhabited)?***

If to talk about the state of Walleye Pollock population in the whole, it might be characterized, as the state of beginning restoration after depression caused by global climate changes and relatively sparing regime of exploitation of this stock either. For the period from 1988 to 1997 a decrease of Walleye Pollock natural stock went under the coefficient k=0.0706 averagely, and for the period from 1997 to 2000 an increase took place under the coefficient k=0.1139. In the other words, the loss rate was less than the growth rate. Complete cycle of fluctuations consists of 48 years approximately; it began in 1960 to be finished in 2008. The maximum of natural stock, equal to 38 million tons, was in 1972. Since the time the stock has been decreasing steadily being determined by climatic cycle mentioned above until 1996, when climatic cycle and poor abundant generations of 1995-1996 got critical both, afterwards world Walleye Pollock stock has been about 6 million tons, the composition of this stock being represented by young fishes mostly small-sized. However, the assessment is quite doubtful. Since 1997 a tendency to increase of natural stock has been taking shape. To 2000 the natural stock has been almost 8.2 million tons, it being represented either mostly by small-sized immature fishes, on the reason of minimum abundant generations in 2000 and 2001, repeating regularly every 5-6 years and relating to solar activity. In 2002-2003 Walleye Pollock stock has been increased up to 10.7-12.3 million tons. After that the natural stock has been reducing again. If to anticipate, the Walleye Pollock natural stock can be hypothetically about 11.4 million tons in 2004. Afterwards a local depression has been expected. And than, in 2005-2006, the depression can cause a decrease of the stock down to 4.9-5.5 million tons. In 2007-2008 the natural stock can go increasing hypothetically up to 16.1-22 million tons. It should be remarked that the more intent interest, demonstrating by Russian and American fish biologists in the concern of this subject, the more disappointing are the gaps in studies from 1 to 2-3 observation years long, when surprising and giving an insight fluctuations might take place and be omitted, alas. Moreover, judging from publications by Russian fish biologists, experts in stock assessment, no one comprises data on stock abundance dynamics one could be able to create an insight about a real annual loss or growth of the stock under simultaneous press of fishery and climate changes. At that it could be revealed a dynamics of throwing out the small-sized fish by the resource users due to economic considerations or to escape penalty sanctions. One of the most sensible gaps in our knowledge of the state of Walleye Pollock stock and of exploitation level for several years is doubtful mean coefficient of loss k=0.0706 itself. Calculation indicates the loss rate of stock under the coefficients in range $0,136 \geq k \leq 0,422$. That gives evidence that the volumes of natural stock, obtained instrumentally by American and Russian fish biologists in the course of monitoring, were permanent underestimated, or the statistics concerning the volumes of annual catches was incorrect. As for the state of the area inhabited, the most problematic is a part of Russian buffer zone, 5 miles wide and 150 miles long approximately, along the line by Shevardnadze & Baker, which has not been visited by Walleye Pollock on somewhat reasons, still unknown, in the time settled for the feeding within Russian waters historically and evolutionally. A suggestion takes place that ecology of this part has been misbalanced extensively as a result of commercial fishery presence. More in details about this below.

2. What knowledge gaps have been occurring concerned the state of Walleye Pollock population?

In a respect to all said above and having no data on Walleye Pollock stock abundance dynamics in Russian publications, for today we can say about a sensible gap in our knowledge about in fact exploitation of the stock in past and present and how to forecast exploitation in visible feature. On this only reason one cannot figure out in fact intensity of fishery all this time and effects to the state of natural stock brought by global and local climate changes. Another gap in our knowledge about ecology of Walleye Pollock can be described in a few words: it is not clear for today what is the survival of Walleye Pollock came through the meshes of trawl gears? An answer to this question, which solution requires a complex experimental approach, should be obtained nevertheless, probably through hard and extensive work. Or else it cannot be excluded the development of things on the worst of possible scripts, when fishes in abundant Walleye Pollock generations would not reach a commercial length on one simple reason – post traumatic death after multiple coming through selective trawls and the mesh of trawl purse, enlarged up to 100-110mm. Here I even don't mean that the generations would hardly join the fishery stock. The fish can get exhausted or killed in the course of multiple coming through the trawl mesh, if to take into account the intensity of fishery in this zone is about one.

3. What can be a real threat for Walleye Pollock population in the Bering Sea?

A real threat for Walleye Pollock population of the Bering Sea and for the other populations might be, firstly, post traumatic mortality of Walleye Pollock of the size less than commercial, noted in the item 2. This mortality is expected to be increased with prompting the fishery with those radical measures, as regulation of fishery by mesh size, either with further increasing the fishery quota, and on the reason of throwing out the small-sized fish to please market economics and conjuncture. Simple logics and empathy prompt that the bottom of the fishery area and its' nearest vicinities is totally covered by fishes, dying from the traumas got and scale loose, including those thrown out as none useful for commerce and decaying. Secondly, there is a risk of overcatch, if to take into account that under the optimal coefficient of natural stock removal k=0.2 the coefficient of spawning stock (principal stock, which for a fishery license has been given in fact) removal is t=0,333. I have found from Baranov's fishery equation that numeral volumes of the coefficients can be estimated from simple arithmetic formulas: $k = 1 / [(1/t)+ 2]$ and $t = 1 / [(1/k) - 2]$. It is not difficult to have counted t = 0.5 at the fishery regime, when k = 0.25, which has been reckoning by experts as sparing. In the other words, in this case we catch exactly a half of spawning (principal) stock. When k = 0.333 t has been equal to one. In the other words, in this case we catch the whole principal (spawning) stock, keeping safe in the habit only fishes of young age groups. When k = 0.5 $t \rightarrow \pm\infty$, what gives evidence that fishes of young age groups, they being not of commercial interest, have been involved into fishery. Moreover, when k= 0.5 the function has been broken and gets uncertain. The result of that fishery has been either uncertain respectively from both, biological or economical points of view. Thirdly, a certain threat for Walleye Pollock population can be the uncontrollability of specialized fisheries (SF) as in principal species, as in bycatch. The bycatch 8%, allowed in the regulations of fishery for all kinds of bycatch, turns into a fiction in practice and has been an occasion of infringement of the regulations, i.e. of throwing out the undesirable fish. At last, a serious threat for ecological well being of Walleye Pollock in the Bering Sea is shortages of normative legal rules of fishery and absence of the low about fishery in Russia, in this relation any activity of authorities, for example, on making the size of mesh larger or the fishery quota more, launching selective gears, ect. have been taken by fishermen as illegal, frankly voluntaristic, unreasoned and associated as an attempt to the rights and liberties.

4. ***What methods of control for the state of the population occur for today? Have been various affects to the abundance of this species monitored (frequency, scale and area of monitoring)?***

There is only one method of Walleye Pollock fishery control and monitoring currently in Russia – the method of trawl surveys. The method of echo sounding, widely spread in the US and the other countries, has not been recognized on some reasons as basic and the most accurate, although both methods actually give the same result. As for the monitoring of affects to Walleye Pollock populations, the absolute vacuum one can found in this field in practice. Actually I don't know any publications enlightening these problems and any measures to eliminate the affects, in exception, perhaps, the publications concerned mineral oil exploration in Sakhalin, Kamchatka and Chukotka. Ecological state of fishery gears has been recognized as satisfactory, although the state has never been estimated really. Nobody is dealing officially with figuring out the threshold, which out the gears have been ecologically threatening. The affects of fishery gears to the ecology of fishery objects in the most problematic areas has not been monitoring elementary, especially in the concern of the most debatable and uncertain items. The water in the area of fishery has been never analyzed chemically. Bottom sediments in the area have been never examined for fish remains might occur. It is no use trying to say about any visual control of bottom from underwater apparatuses or using television robots…

5. ***What other methods of monitoring can you recommend?***

The extra measures of monitoring to recommend follow from the item 4 in fact. The next can be recommended as extra: regular (annual) monitoring of natural (spawning) stock and bycatch species, none listed in fishery licenses. In its' turn, that can actually provide turning specialized fishery into the multi-species managed fisheries in feature, as throwing out the undesirable bycatch makes worthier the strained ecological situation in the Bering Sea, where thousand (or millions maybe) tons of small-sized Walleye Pollock, thrown out or came through trawl mesh, get found their last shelter.

6. ***What measures to avoid real threats for Walleye Pollock population can you recommend (for nearest period and for a long-term perspective either)?***

Elimination of real threats for the population of Walleye Pollock in the Bering Sea and the other seas should imply nearest time the next:

a) working out and launching The Low about Fishery and Bioresouces, where all the most problematic items, including ecological ones, would be clarified;

b) reformation and simultaneous liberalization of legal regulations currently existing on principal questions, concerning interactions between the fishery, the bioresources and the environment;

c) conscious and prompt reduce of the mesh step to 30-34mm, existed until 1998, not reckoning that as a regress or a step back; liquidation of Walleye Pollock fishery quote and obliging the users of bioresources to process 100% of catches, the losses being covering with State subsidies;

d) prompt return of bottom trawls into the practice of legal fishery for any types of vessels, an exception can be for the area of spawning only. This measure allows, first of all, to collect from the sea bottom and near the bottom waters, at least partly, the fish exhausted from the contacts with pelagic trawls before the fish have been dead in order not to lose a luxury product which might be obtained. It allows, secondly, to carry out Walleye Pollock fishery during the period of «light nights» typical for the Bering Sea, when for 1-1.5 months approximately Walleye Pollock creates specific bottom aggregations. In this period the mid-water trawl fishery simply gets impossible technically, what makes the fishermen to deform the trawl almost to a vertical opening, what is 13-18m the consequences of that are harmful for dimersal fauna and bottom itself, it is no use trying to say about the losses from damaging the trawls from rocks, boulders, ect.;

e) immediate turning to multi-special managed fishery and making any throws out of fish prohibited for users of bioresources principally, the simple idea about the fact that any living organism caught occasionally is invaluable gift of Nature or, as you wish, a gift of Creator should be developed in the minds of the users. Throwing out the gifts, even to please economical or another conjuncture causes, is a grave crime as against Creator, as against mankind. Developing the idea implies firstly, to include a short ecological educational program, which has been discussed so much, but has not been launched till now, into the program of fish biology universities, technical secondary schools and courses of raising the level of skills for specialists of various levels and management links. Secondly, it is required, as soon as possible, to make a study in order to get an assessment of manageability of multi-species fisheries, taking into account that the study like mentioned has been already carried out partly by the author of these answers, based on the data by TINRO-center on the example of Korf-Karaginsky subzone of the Bering Sea.

7. ***What steps should be undertaken for conservation of Walleye Pollock population? What stock abundance level does indicate a normal state of the population? What stock abundance level is critical to indicate potential risky state of this species? What other measures on conservation of Walleye Pollock population can you recommend?***

There was said so much about the measures to undertake ultimately for conservation of Walleye Pollock population in the Bering Sea and declared as well, but there is nobody to start doing something. To the opposite, many countries have built their activity according to a prejudice, a wide spread narrow view, that the fish came through the mesh of fishery gear and small-sized fish staying in its' neighbor habitat will grow ultimately and contribute recruitment in time. Alas! This is just an illusion, not knowing, or, to put it mildly, intentional closing eyes to the fact of total or partial loose of scales by fishes on coming through the trawl mesh, the scales being nor rudimental, and loosing the scales being an equivalent to a death verdict. Getting things put in order and making correct assessment of both, natural and principal, stocks regular should be either attributed to the top priority measures, directed to conservation of Walleye Pollock. At the same time with that it has been very important to get information about bycatches by species to create the possibility to legal turn to the multi-species managed fisheries nearest time, canceling or transforming extensively the definition "specialized fisheries". It is important either to monitor in the course of these works not only and not that much the stock biomass, but the dynamics of stock abundance; a corresponding mathematical processing of the data can provide a maximum accurate assessment of real, instead official, statistical results of fishery and allows to make necessary correctives instantly. As soon, as we have got able doing this and got things put in order on the resource assessments it has been of some use to think about a really rational, instead declared, management and regulation of fishery. That would require a newly strategy, grounded biologically and economically, and a tactics of Walleye Pollock fishery renewed on the basis of knowledge about dynamics of stock and temporal intensity of exploitation. We can either attribute here a normative-legal basis of fishery and The Low about Fishery anyway substantiated, which could be executable, just and conciliating, if the latter can describe the essence of the matter, the interests of living resources, habitats, environment and of users of the resources.

8. ***What materials and/or recent publications (studies, references to protocols of scientific conferences, general scientific issues) can you recommend to get an insight to current state of Walleye Pollock population in the Bering Sea?***

I possess plenty various literature sources on Walleye Pollock studies; nevertheless I cannot remember any more or less impressive publication on this theme. At a look from the outside one gives the impression that Walleye Pollock fishery in the Bering Sea and the Okhotsk Sea is absolute all right yet. Just one circumstance… the fishery folk "romp" there: sometimes steal the fish, sometimes poach or use forbidden fishery gears, bottom trawls for example, sometimes throw out small-sized fish and bycatch; and the climate “romps” too, resulted in current exhausted state of Walleye Pollock stock. “All the rest things are all right, beautiful marquise” as it is in a well known song. But it is not! Not at all! Contemporary scientific conception actually stagnates in the attempts to describe quantitatively all negative and positive processes in their interrelations or neglects all the problems described above. Moreover. Official and bureaucratic science turns its’ back on people (as they were troublesome flies), who, at least, are trying somehow steal up to solution of the problems like these, due to possessing neither specialists, funds, thematic plans, nor a will to improve things to the better.

Brief description of the Russian Far East Salmon Fishery, It's Management System and WWF Potential Involvement

By Konrad Zgurovsky, WWF Bering Sea Ecoregion Program

The first step in the quota allocation process is an annual stock assessment. Stock and future salmon recruitment assessments are conducted annually for salmon either counting number of juveniles (smolts) going downstream in spring and taking into consideration number of spawning salmon coming to rivers or counting salmon in the course of surveys on the ways of salmon migrations at sea. Survey results are analyzed and a forecast of the meteorological and biological conditions of the fishery is transferred from the regional fishery institute (like the Pacific Centre for Fishery & Oceanography, TINRO and its branches) to the Federal Institute for Fisheries and Oceanography, known in Russia as VNIRO. VNIRO subordinated to the Agency for Fishery of the Ministry of Agriculture now is a leading fishery research institution. It is based in Moscow, and has a right to change stock assessments and provide a final annual forecast to the Agency for Fishery as a basis for quota allocations. Any official salmon fishery activities are based on the forecast. The annual fishing season (named in Russian - "putina") forecasts incorporate information on TAC, terms and conditions of fishery, including hydrological conditions, expected number of coming salmon to different areas of the Far East by species, size and sex composition analysis, processing recommendations and legislative basis for fishing operations. The Russian salmon fishery management scheme is shown in Fig.1.

Management of fisheries (including the governance, interagency coordination of "rational use", monitoring and research, the protection of stocks and their environment, and stock replenishment) is the specific responsibility of another federal agency, the State Agency for Fishery.

The approved by scientific councils of regional and federal institutions, and signed by the head of Fishery Agency, forecast TAC figures should be under environmental assessment by the State Ecological Expert Panel, subordinated to the Ministry of Natural Resources. After that, the TAC figures obtain a legal status, and quotas allocation process starts. This process mechanism is under scrutiny and reconstruction now, but in general, the TAC is divided to parts, shares for different regions, fishing areas and fishery companies.

The Rybvod system updates fishing rules, issuing fishing permits, controls daily reporting by vessels, collecting fishery statistics for a range of fisheries, including recreational, operative management of fisheries, marine mammal assessment, enforcement in internal marine waters and estuaries, managing salmon hatcheries.

The annual TAC forecast for main targets is divided into groups of quotas:

- Inter-governmental agreements, like one that allowed the Japanese to fish for salmon in the RF EEZ (in particular in the Bering region) for the Koreans and Japanese. In their turn, the Japanese provided quotas in their zone and made financial contributions, for example for artificial reproduction of salmon in Russian waters.

- Research and experiments (for research surveys and a so-called "experimental" fishery for new targets). These quotas are allocated for local fishery research institutes. These institutes either use the quotas themselves during resource exploration or sign an agreement with commercial fishermen to use their commercial vessels for this purpose:
- Quotas for regions. These quotas are divided by local administrations based on recommendations from the "Nauchno-Promyslovyi Sovet" (Scientific Fishery Council – analog of the NPFMC). Quotas are divided between companies, near shore fisheries, local coastal processing plants, small enterprises and indigenous communities;
- There supposed to be secondary market for quotas, but still its proceedings are not stipulated in details. These quotas supposed to be purchased by companies, who do not have enough quotas to fish. Type of vessel and gear is determined by company itself, according their capacity and local fishery regulations

The Russian quotas allocation system is currently undergoing a transformation. Recently, the government gave up the quotas auction system and moves to some kind of "royalty" system with a fixed payment for certain a amount of different targets' quotas. This system has also come under some criticism from several fishermen's associations, who believe that fisheries require some support from government or subsidies for development. It is also a very centralized system, because local administrations have influence on 12-miles zone only. The majority of quotas will be distributed by the government, or to put it differently, by the Agency for Fishery, taking into consideration "historical principle" – the history of the company's catches during last 3 years for 5 years period.

Starting in January 2004, this system began to work. The recently established interagency commission worked out shares for companies, which will be involved in the main fishery for salmon. If companies violate fishery or customs regulations seriously – they should be excluded from the list. Companies, who are on the list, should pay 10% of "royalties" upfront, to sign an agreement with the Agency and could start to get licenses and permissions to fish after 1st of June (?). Agreement and shares will be in force for a 5 year period.

There are main several gears, used to fish salmon. During feeding period, salmon are caught by driftnets. Salmon, coming to mouths of rivers for breeding are caught by fish traps and gill nets. Last 5 years the main targets of Russian salmon catches were pretty high and more or less stable (Table 1).

Table 1.

Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	Average
TAC	179.5	142.8	191.0	204.8	181.4	173.9	221.6	141.2	188.3	180.5
Official catch data	183.0	140.7	210.7	226.3	225.9	188.3	211.1	167.0	229.9	198.1
Japanese official catch	28.1	21.9	25.3	16.7	16.5	14.6	10.1	10.7	5.7	18.0

The Russian government (according TINRO data) has approved TAC for salmon in the Far East equal to 255.8 thousand MT for 2004 fishing season. The main portion will consist of Pink salmon – 194.3 thousand MT, including:

- Kamchatka – 116.8 thous. MT;
- South Kuril Islands - 42.6 thous. MT;
- Primorye - 9.0 thous. MT.

Chum salmon TAC 2004 is equal to 36.8, sockeye salmon – 20.3 thousand MT. Share of other species like Coho or Chinook salmon is not significant due to low recruitment and high level of illegal catch.

There are some other institutions and governmental structures involved. The Ministry for Natural Resources is a governmental institution charged with the protection, control and regulation of the use of any organisms belonging to the Animal Kingdom (Government of RF Bill 726 of 25 September 2000). The Special Marine Inspection of the Ministry for Natural Resources is charged with protection of the marine environment and protecting the biodiversity of marine living and non-living resources. Its ability to enforce fisheries was reduced by the new Code of Administrative Violations, however this agency continues to play a rather important role in enforcement, particularly in regards to environmental regulations.

Coordination of enforcement activities concerning marine biological resources is the task of another federal body, the Federal Border Service (*Federlanaya Pogranichnaya Sluzhba- FPS*). Recently (2003), this service was transferred to the Federal Security Service (*FSB*). However, other agencies also have enforcement responsibilities for fisheries. In particular, the Agency for Fisheries and its regional bodies perform enforcement in the inland waters, but the demarcation becomes unclear in the case of estuaries, lagoons and other types of internal marine waters.

The State Customs Committee enforces regulations regarding export and import operations with fish and seafood. According to Russian legislative customs clearance procedures are obligatory for the export of all fish and seafood caught in the territorial sea (up to12 miles offshore) and in the internal marine waters, including products caught outside of the national waters and landed in Russian ports. The State Committee for Statistics collects and provides official information on the catch, processing and trade of fish and seafood.

During fishing season, a special salmon fishing stuff used to be created. It consists of different experts on salmons, enforcement bodies and management structures representatives; its mission was an executive management of fishing operations, observations, and recommendations for current TAC change. Last two years, those, very useful and operative informal bodies in different regions either stopped its activity or lost its influence on fishery management and played only supervising role.

Besides high level of poaching, there are some other problems to solve. Sophisticated life circle and population structure, sharp unpredictable changes of abundance and ways of salmon migration for variety of reasons, complicated process of stock assessment, lack of knowledge for forecasting of TAC and ways of migrations, sluggishness and weakness of management bodies, lack of transparency, dissociation between different enforcement and management bodies, very centralized system of decision making, etc.

All those reasons make the fishery management issues and involvement of local fishermen associations and non- governmental organizations for salmon conservation and sustainability very significant. The question is whether any NGO, even so well-known like WWF, could have impact upon it? Let's consider potential ways to exert our influence on management improvement on different levels: federal, regional and local ones. It is obvious that WWF only without stakeholders' involvement can do nothing or little to improve the situation. We can see many partners to work with.

On federal levels there are some members of Russian Parliament and state structures, who are concerned by present situation. First step on legislative level should be adoption of the Russian Law on fishery ASAP. There are several versions of it with a different degree of sophistication and WWF and its partners (like Ecojuris) involvement is very essential. Quotas allocation process is not enough transparent and very centralized. Federal regulations of fishing operations are very complicated and hard to understand, some preposterous and hard to enforce rules force fishermen to violate them. Information and opinions of specialists on stock condition, regulation of fishery are pretty differ.

Oil and gas companies' plans to drill on shelf also required strong supervising and expertise on different level. Thus, independent expertise required and NGO involvement would be very important. We already started some negotiations with several specialists on their involvement as experts in those processes. Planned new fishery policy officer in Moscow engagement would be very helpful.

On regional and local level our natural partners are associations of environmentally responsible fishermen, who are worried about resources for their sustainable fishery and market protection against illegal products prices undermining. Our meetings and discussions during the last Far East Fishery Forum in Vladivostok in July 2004, showed increased environmental concern of fishermen and good will to cooperate with us. We also plan to support of local communities involvement in fish stock management to win over them to our side.

Other partners are enforcement bodies, including: Rybvods, Customs, Special Marine Inspection, and Federal Border Service. We have good experience working with them, which we obtained during our support of their anti-poaching, illegal trade (TRAFFIC program) and fishery satellite monitoring activity.

Big scale present and potential civilized importers of Russian fish products, who require transparency and sustainability of sources of products, environmental certification according MSC standards, are other supporters of our efforts. For example, UNILEVER Company expressed their interest to work with us.

Well-organized fishing observers system creation in Russia, which we consider as a good tool for transparent catch and by-catch data collection, require international support. We currently work with some other international partners like the Marine Stewardship Council, US Fish & Wildlife Service, NOAA, and Fund for Sustainable Fishery (USA), Wild Salmon Center, NPAFC, WWF US, WWF Intl. and WWF Japan. Last one contact is very important to assess and influence Japanese fishing activity in our waters and big scale artificial breeding of Chum salmon influence on the stock and population structure of Russian salmons. US fishermen experience on salmon by-catch reduction should be used and gear influence data exchange would be very helpful.

3.4 Sea Ice Ecosystem (Polar Bear and Pacific Walrus)

The following resources on sea ice ecosystem species were compiled for the first iteration of this Strategic Action Plan for the Bering Sea:

a) Polar Bear

- Life History, Population Status, Threats to and Research Needs for Bering Sea Ecoregion Polar Bears (Denise Woods, WWF Bering Sea Ecoregion Program)
- Documentation for Viability Table (E5S Planning Tool)
- Conceptual Model Developed to Identify Key Ecological Attributes and Threats for Bering Sea Ecoregion Polar Bears (Randy Hagenstein, TNC Alaska; Evie Witten and Denise Woods, WWF Bering Sea Ecoregion Program) (Figure A4)
- Threats to Bering Sea Ecoregion Sea Ice Ecosystems (Table A4)

The following experts were consulted with regard to Bering Sea Ecoregion polar bears:

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b) Pacific Walrus

- Life History, Population Status, Threats to and Research Needs for Bering Sea Ecoregion Pacific Walrus (Denise Woods, WWF Alaska)
- Documentation for Viability Table (E5S Planning Tool)
- Conceptual Model Developed to Identify Key Ecological Attributes and Threats for Pacific Walrus (Randy Hagenstein, TNC Alaska; Evie Witten and Denise Woods, WWF Alaska) (Figure A5)
- Threats to Bering Sea Ecoregion Sea Ice Ecosystems (Table A4)

The following experts were consulted with regard to pacific walrus:

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LIFE HISTORY, POPULATION STATUS, THREATS TO AND RESEARCH NEEDS FOR BERING SEA ECOREGION POLAR BEARS

Introduction

Polar bears (*Ursus maritimus*) occur in most ice-covered seas of the Northern Hemisphere (Canada, Norway, Denmark, the United States, and Russia). The centers of six apparently distinct populations in the main polar basin are: Wrangel Island and western Alaska (the Chukchi Sea population), northern Alaska and northwestern Canada (the Southern Beaufort Sea population), the Canadian arctic archipelago, Greenland, Spitsbergen-Franz Josef Land, and central Siberia (Parovschikov 1968; Uspenskii 1965; Vibe 1967; Lentfer 1974a, 1983; Stirling and Smith 1975). The worldwide number of polar bears is estimated to be 21,500-25,000 (Lunn et al. 2002).

Polar bears have been, and continue to be, an important resource for coastal dwelling Native people, to whom they provide a source of meat and raw materials for construction of clothing and handicraft. Traditional hunting of polar bears is an important component of the Native culture, providing a source of pride, prestige, and accomplishment.

Life history

Breeding

Polar bears typically mate on sea ice from late March through May (Lono 1970), although implantation does not occur until September (Stirling et al. 1984). Pregnant females seek denning sites in drifting snow on land or pack ice during late October and November (Harington 1968; Jonkel el al. 1972; Lentfer and Hensel 1980). Cubs are born in December and January (Lentfer 1982) and will emerge with the mother in late March and April (Lentfer 1976). Twins occur regularly: average litter size has been 1.52 to 2.0 (Lono 1970; Stirling and Smith 1975; Lentfer et al. 1980; Ramsay and Stirling 1982; Kolenosky and Prevett 1983). Male polar bears become sexually mature at 3 years (Lentfer and Miller 1969) but generally do not compete for females until age 6 (Demaster and Stirling 1981). Females, on average, become mature at 6.3 years (Lentfer et al. 1980). Cubs remain with the mother for about 2.5 years and females will usually breed only every 4 years (Lentfer et al. 1980). Thus, although females may breed up to age 20 or more (Ramsay and Stirling 1988), they will likely produce only 5 litters in a lifetime, one of the slowest reproductive rates of any mammal (Amstrup 1986); survival of cubs can be quite low, as well (S. Schliebe, pers. comm.)

Annual distribution/ migration

Polar bears in the Beaufort and Chukchi Seas migrate seasonally with changes in the annual ice pack. Bears in the Beaufort Sea move primarily between the U.S. and Canada, traveling north during May through August and south in October (USFWS 1995). Individuals in the Chukchi Sea travel extensively between the U.S. and Russia, first north from the northern Bering Sea to the southern Chukchi, then primarily on an east-west axis within the Chukchi (Garner et al. 1990).

Natural mortality and survival

Survival rates for polar bears vary by age class and location. Adult survival has been estimated at 88 percent (Amstrup et al. 1986). Survival estimates for yearlings range between 70 and 75 percent (DeMaster and Stirling 1983). Polar bears have few natural enemies other than humans. They occasionally kill each other (Jonkel 1970, Russell 1975; Lunn and Stenhouse 1985; Taylor et al. 1985), and there is limited evidence that walrus occasionally kill polar bears (Kiliaan and Stirling 1978). Disease does not appear to be a significant source of mortality for polar bears (USFWS 1995).

Diet and foraging

Polar bear's main food source is ringed seals (*Phoca hispida*), followed by bearded seals (*Erignathus barbatus*) (Stirling and Archibald 1977; Smith 1980). Skin and blubber are consumed preferentially (Stirling 1974). They hunt seals using a variety of techniques depending on ice type and seal activity: lying in wait at seal breathing holes (Stirling and Archibald 1977); extracting pups or adults from lairs under snow (Stirling and Latour 1978); stalking on ice flows or along leads, polynyas and other open water (Stirling 1974, Stirling et al. 1993); and pursuit in open water (Furnell and Oolooyuk 1980). Other food sources are relatively infrequently utilized or are of local importance. They include: walrus (*Odobenus rosmarus*), beluga whales (*Delphinapterus leucas*), other marine mammals, birds, terrestrial vegetation, kelp, carrion and garbage (Lono 1970; Freeman 1973; Russell 1975; Stirling and Smith 1975; Heyland and Hay 1976; Stirling and Archibald 1977; Fay 1982; Lowry et al. 1987; Derocher et al. 1993; Schideler 1993).

Habitat requirements

Access to high quality sea ice is essential. Polar bears also require access to suitable foraging habitats and undisturbed denning areas. Sea ice of sufficient thickness, area, extent, and annual duration (S. Schliebe, pers. comm.) is a critical component of polar bear habitat because it provides a hunting platform, allows pregnant females to reach land dens, and provides a platform for ice dens and long range movements (Lunn et al. 2002). Large annual variations in sea ice distribution and abundance are common, and affect reproduction and survival of both polar bears and their prey (Stirling et al. 1976; Stirling et al. 1982; Smith et al. 1991).

Undisturbed maternity denning areas are especially important habitats for polar bears because this is where reproductive success can most easily be disrupted. Bears may den in snowdrifts on land, on shorefast ice, or on drifting ice. For example, in the Beaufort Sea region, 53 percent of known den sites were on drifting ice, 4 percent were on shorefast ice, and 42 percent were on land. Of the dens on land, 43 percent were within the Arctic National Wildlife Refuge, considered to be the most important denning area in Alaska (Amstrup and Gardner 1991). Denning bears in Russia are concentrated on Wrangel and Herald Islands and on the north Chukotka coast (USFWS 1994; S. Schliebe, pers. comm.).

Less is known about habitat preferences for feeding than for denning. However, open water or active ice areas that persist throughout winter and early spring are clearly preferred hunting and feeding areas for polar bears (Stirling and Cleator 1981).

Population Status and Trends

Today, polar bears are believed to occur throughout their historical range in the Arctic Circle. Alaska has two populations of polar bears, one in the Bering and Chukchi Seas that it shares with Russia, and one in the Southern Beaufort Sea that it shares with Canada (Lunn et al. 2002). Past estimates of the size of the polar bear populations have been derived from observations of dens, telemetry studies, and from aerial surveys (Stishov et al. 1991). In 1997, the Chukchi Sea population was estimated at 2000-5000 individuals (S.Belikov, A. Bultunov, N. Ovsyanikov; pers. comm.), and in 2001 the Southern Beaufort Sea population was estimated at 1800 individuals (Lunn et al. 2002). In combination, the Bering Sea, Chukchi Sea, and a strip of north coast from Barrow to Canada were estimated to contain a minimum of 3,000 and possibly 5,000 bears (USFWS 1995).

During the 1900's, commercial whalers began opportunistically hunting polar bears from boats, possibly contributing to local extinctions in some populations (Hanna 1920; Leffingwell 1919). The hunting of polar bears was banned in Russia in 1956 and in the U.S. in 1973. A small native subsistence harvest is currently allowed in Alaska and in Russia, a limited number of cubs are authorized each year for removal to zoos and circuses (USFWS 1994). Polar bear numbers declined during the late 1960's and early 1970's, presumably as a result of excessive harvest. Populations are believed to have recovered by the late 1970's and have since remained stable (USFWS 1995). Recently, more frequent sightings of bears (likely as a result of ice conditions) have led to the impression that bears are numerous and populations stable. This may be a false impression and bears may be in local decline, as evidenced by recent observations (e.g. emaciated dead bears found on Wrangel Island; S. Belikov, A. Boltunov, N. Ovsyanikov; pers. comm.). In Russia, polar bears are listed in the 2nd edition (2001) of the Red Data Book for rare and endangered species.

In 2000, the US and Russia signed an agreement "On the Conservation and Management of the Alaska-Chukotka Polar Bear Population." This agreement between Russia, the U.S., Norway, Denmark, and Canada provides a mechanism for international research and management of the polar bear population. The agreement is novel in its allowance of a native subsistence harvest to begin in Chukotka, Russia, after a ban on all hunting was put in place in 1956. The agreement currently awaits implementing legislation.

Threats

Because they are dependent on sea ice, polar bears are vulnerable to the effects of global climate change and subsequent alteration of sea ice habitats (Stirling and Derocher 1993; S. Schliebe, pers. comm.). Human-bear encounters at dumps and other inadvertent feeding stations also contribute to polar bear mortality (DLP killings). Bioaccumulation of contaminants, although not currently a significant problem in the U.S., may present an emerging threat to bears in Russia (S. Belikov, A. Boltunov, N. Ovsyankov, S. Schliebe; pers. comm.). The following have been identified as the principal current or potential threats to polar bears: illegal harvest or overharvest of bears (especially in Russia), and industrial activity, particularly oil and gas development and exploitation of new shipping routes in polar bear habitats.

Climate Change

The Bering Sea is experiencing a northward biogeographical shift in response to increasing temperatures and atmospheric forcing. Overland and Stabeno (2004) have observed that mean summer temperatures near the Bering Sea shelf are 2 degrees (C) warmer for 2001-2003 compared with 1995-1997. In the coming decades, this warming trend is expected to have major impacts on the region's arctic species, at all levels of the food web, including polar bears and their prey.

Illegal harvest/ overharvest

Polar bear skins and gall bladders have substantial value on the world market. Recent reports of unregulated and illegal harvests in the Chukotka district of Russia are cause for concern, particularly because the magnitude of the kill is unknown and the size of the population is not known with certainty (S. Belikov, A. Boltunov, N. Ovsyankov; pers. comm.). Some Russian experts estimate that as many as 100-200 bears were harvested annually in recent years. Although the main motivation for taking polar bears in Russia is for food, many of the hides from these animals are entering commercial markets illegally and are acting to fuel additional harvest demand. In the Alaska Chukchi Sea, a 50 percent reduction in harvest between the 1980's and 1990's has been detected (Schliebe et al. 1998). The Alaska Native subsistence harvest removes approximately 90 bears per year; harvests at this level are believed to be sustainable (USFWS 1994).

Industrial activity

Oil and gas development and transportation

Human activities in the Arctic, particularly those related to oil and gas exploration and development, may pose risks to polar bears. Lentfer (1990) noted that oil and gas development may lead to the following: death, injury, or harassment resulting from direct interactions with humans (including DLP killings); damage or destruction of essential habitat (especially denning habitats); attraction to or disturbance by industrial noise; and direct disturbance by aircraft, ships, or other vehicles. Additionally, it is well established that contact with and ingestion of oil from acute and chronic oil spills or other industrial chemicals can be fatal to polar bears (Oritsland et al. 1981; Amstrup et al. 1989). Some oil and gas activities may also affect polar bears indirectly by displacing ringed seals (Kelly et al. 1988).

Shipping

Current politics support the development of polar sea shipping routes and governments of the Arctic have promoted the expansion of the Northern Shipping Route (NSR), which passes through polar bear habitats. Increases in shipping through the Bering and Chukchi seas by icebreakers in the fall, winter, and spring has the potential to disrupt Alaska polar bears (USFWS 1995). Ships would likely use leads and polynyas to reduce transit time. Such areas are critical to polar bears, especially in winter and spring, and heavy shipping traffic could directly affect bears. Concomitant with increased traffic is the increased potential for accidents resulting in fuel spills that affect bears and their food chain.

Monitoring

Current research on polar bears in the U.S. focuses on describing movements and distribution patterns of bears in the Beaufort Sea, estimation of population size, and on denning ecology (Lunn et al. 2002; S. Schliebe, pers. comm.). Annual aerial coastal surveys are conducted in the Beaufort Sea, and annual den surveys are performed when funds allow. Annual harvest records contain data on bear size, blubber and blood chemistry, which allow determination of condition. In Russia, lack of funding is constraining research: the last den survey on Wrangel Island occurred in 1993. However, behavioral and ecological monitoring still occurs there and Chukotka Natives now provide year-round observation of dens in some areas (S. Belikov, A. Boltunov, N. Ovsyanikov; pers. comm). As part of a joint Russian-American research program, satellite telemetry data on polar bear movements together with ice data from remote sensing are being used to study the distribution and mobility of bears in relation to sea ice dynamics. A joint Russian-Norwegian research program is examining basic population parameters, identifying critical habitat, and examining the influence on bears of environmental pollution (Lunn et al. 2002).

Research Needs

High priority research needs include the following: better estimating population size using refined aerial survey techniques; annual monitoring of life history parameters (population structure, sex and age ratios, birth and mortality rates etc.), which requires a shore-based mark-recapture study in the U.S. and Russia; tracking of bears relative to sea ice; systematic collection of body condition parameters from harvested animals; reactivation of annual spring den surveys on Wrangel and Herald Islands to determine reproductive success; diet analysis; population information on prey species (walrus, bearded seals and ringed seals); and tissue contaminants sampling (USFWS 1995; S. Belikov, A. Boltunov, S. Schliebe, N. Ovsyanikov; pers. comm.).

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Documentation for Viability Table (E5S Planning Tool): Sea Ice Ecosystem

Conservation Target: Sea Ice Ecosystem (polar bear)

Category: Landscape Context

Key Attribute: Prey availability

Indicator: Polar bear body weight, physiological parameters, blood chemistry

Indicator Ratings:

Poor: Data not available
Fair: Data not available
Good: Data not available
Very Good: Data not available

Current Rating:
Date of Current Rating:

Current rating comment: current rating unknown

Note: Scott Schliebe (USFWS) explained that some measures taken during annual harvest monitoring. Need to follow up with Scott to explore if can be used to develop ratings

Desired Rating:
Date for Desired Rating:

Conservation Target: Sea Ice Ecosystem

Category: Landscape Context

Key Attribute: Sea ice habitat integrity

Indicator: Aerial extent and timing of pack ice (km2) over shelf; winter maximum and summer minimum

Indicator Ratings:

Poor:
Fair: OK today but declining rapidly in extent, thickness, structure, and duration
Good:
Very Good:

Current Rating: Fair
Date of Current Rating:

Desired Rating:
Date for Desired Rating:

Conservation Target: Sea Ice Ecosystem

Category: Landscape Context

Key Attribute: Sea ice habitat integrity

Indicator: Amount (km2) of multi-year ice vs. annual ice

Indicator Ratings:

Poor:
Fair: Declining in thickness and amount of multi-year ice
Good:
Very Good:

Current Rating: Fair
Date of Current Rating:

Desired Rating:
Date for Desired Rating:

Conservation Target: Sea Ice Ecosystem

Category: Size

Key Attribute: Population size & dynamics

Indicator: Polar bear population size

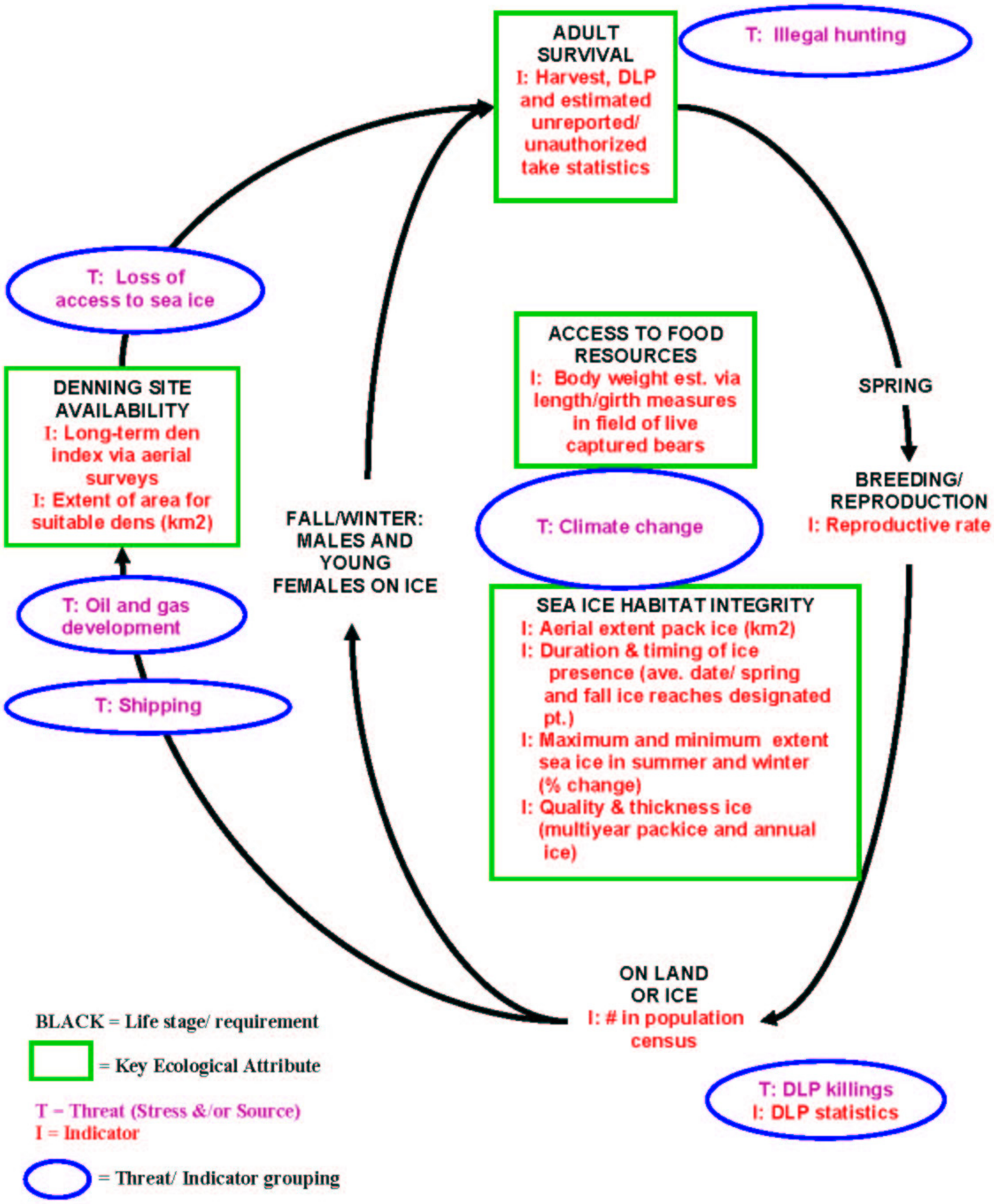
Indicator Ratings:

Poor:
Fair:
Good:
Very Good:

Current Rating:
Date of Current Rating:

Desired Rating:
Date for Desired Rating:

Figure A4: Conceptual Model Developed to Identify Key Ecological Attributes and Threats for Bering Sea Ecoregion Polar Bears



LIFE HISTORY, POPULATION STATUS, THREATS TO AND RESEARCH NEEDS FOR BERING SEA ECOREGION PACIFIC WALRUS

Introduction

The pacific walrus (*Odobenus rosmarus divergens*) is represented by a single population inhabiting the continental shelf waters of the Bering and Chuchki Seas of the United States and Russia. The size of the population is uncertain but was estimated at approximately 210,039 in 1990 (Gilbert et al. 1992). Pacific walrus today occupy most of their historic range, although they were absent from some regions following over-harvest in the 19th and 20th centuries (Fay et al. 1983).

The inhabitants of the Bering and Chuchki sea coasts have depended on the pacific walrus for thousands of years (Fay 1982, Krupnik 1984). These large pinnipeds have provided meat, oil for fuels, and raw materials for a variety of needs (including hides for making houses, boats, and ropes and ivory for making tools and carvings). Following a period of commercial harvest, U.S. Department of Commerce regulation (1937) and the Walrus Act of 1941 limited the killing of walruses to Native hunters. Today, the Native subsistence harvest of walrus and sale of their meat and ivory carvings adds significantly to the economy of coastal Natives (USFWS 1994); the cultural value of the resource is immeasurable.

Life History

Breeding

During the breeding season (January through March) of years with average ice extent, Pacific walruses congregate to breed mostly in two areas, one immediately southwest of St. Lawrence Island and the other in outer Bristol and Kuskokwin bays (USFWS 1994). On the moving pack ice of the Bering Sea, males compete for females by fighting and performing aquatic displays (Fay et al. 1984b); displaying males monopolize access to multiple females but the degree of polygyny is unknown since walrus breeding behavior is rarely observed. No male parental care is evident. Males are sexually mature at 9 to 10 years but will not compete successfully for females until approximately 15 years (Fay 1982). Females sexually maturity has occurred between 4 and 8 years (Fay 1982) but has increased by about 2 years recently, presumably due to changes in the food supply (Fay et al. 1989). Single calves are born from late April to early June during the northward migration; twins are rare (Fay 1982, Fay et al. 1991). Because pregnancy lasts 15 to 16 months and calves are typically nursed for 2 years, females can produce only one calf every two years, less often for older females (Krylov 1962). As a consequence, the pregnancy rate in walruses is considerably lower than that observed in other pinnipeds (USFWS 1994).

Annual distribution/ migration

The distribution of the pacific walrus population shows marked seasonal and inter-annual variation (Fay 1982, Garlich-Miller and Jay 2000). In winter and during the breeding season virtually the entire population is found hauled out on pack ice in the central Bering Sea. Winter concentrations of walruses are most commonly found in areas where open leads, polynyas, and thin ice occur (such as in the Gulf of Anadyr, near St. Lawrence and St. Matthew Islands, and into northwestern Bristol Bay; Garlich-Miller and Jay 2000). In May and June, walrus begin their spring migration north, following the retreating ice edge, passing through the Bering Strait toward the Chuchki Sea. These walrus frequently haul out to rest on ice flows but are not known to haul out on land (Garlich-Miller and Jay 2000). During the summer months, walruses that have migrated through the Bering Strait continue moving northward with the receding ice pack. Those associating with ice are found along the southern margin of the Chukchi pack ice (Fay 1974, Richard 1990). Others, primarily adult males, are not associated with pack ice and may remain south of the Bering Strait, utilizing terrestrial haulouts in Bristol Bay and the Gulf of Anadyr. By September, walruses are at the northernmost extent of their range. Concentrations occur in the vicinity of Wrangel Island and along the northwestern coast of Alaska, usually within 150 km of the southern edge of the ice pack. Fall migration south begins in late September and, by November, most individuals are again concentrated on ice flows in the central Bering Sea (Garlich-Miller and Jay 2000).

Natural mortality and survival

The natural mortality rate for the Pacific walrus population is low (approximately 3 percent; Demaster 1984). Sources of natural mortality include starvation (especially during poor ice conditions), injury due to intraspecific interactions (primarily during male-male combat), and predation by polar bears, killer whales, and humans (Fay 1982).

Diet and foraging

Walruses are benthic foragers, feeding mostly on invertebrates that live on or in bottom sediments (USFWS 1994). Pacific walruses in the Bering Strait region eat mostly bivalve mollusks, especially *Mya truncata*, *Serripes groenlandicus*, *Hiatella arctica*, and *Macoma* and *Tellina* clam species (Fay et al. 1977, Fay and Stoker 1982, Fay et al. 1989). They will also consume annelids, gastropod mollusks, crustaceans, echinoderms, and rarely fishes (Delyamure and Popov 1975) and phocid seals (Lowry and Fay 1984). The structure of the benthic community of the Bering and Chuchki shelves may be influenced strongly by walrus foraging. While foraging, walruses disturb the sediments in ways that may influence the release of nutrients and the settling of benthic invertebrates (Ray 1973, Fay et al. 1977, Oliver et al. 1987). Their removal of large, mature bivalve mollusks may also influence productivity of those prey species (Vibe 1950, Fay et al. 1977, Sease and Fay 1987).

Habitat requirements

Access to high quality sea ice is essential. Walrus also require access to suitable foraging habitats and undisturbed terrestrial haulouts. Walruses are ice-dependent: they must rest and give birth on sea ice. They require ice conditions that will support their weight (60 cm or more in thickness; Fay 1974, Richard 1990), allow ready access to the water in which they forage (generally first-year ice with natural openings such as leads or polynyas; Fay 1982), and be of sufficient area, extent, and duration; Joel Garlich-Miller, pers. comm.).

Although capable of diving to greater depths, walruses usually occur in waters of 100m or less (e.g. over continental shelves), possibly because of higher productivity of their benthic foods in shallower waters (Fay and Burns 1988). Feeding areas are typically composed of sediments of soft, fine sands (coarser sediments apparently inhibit preferred prey; Richard 1990). The range of feeding habitats they require likely varies with walrus and prey population densities.

Use of terrestrial haulouts seems to be influenced by ice conditions (e.g. ice is used preferentially during migration) and natural or human disturbance; isolated sites such as islands, points, spits, and headlands are occupied most frequently (Richard 1990). Consistent seasonal occupation of specific haulouts by some individuals suggests at least some site fidelity. Major currently used terrestrial haulouts in Alaska are Cape Seniavin, Cape Peirce, Cape Newenham, Round Island, and the Punuk Islands. Major sites used in Russia include: Meechken Spit, Rudder Spit, Arakamchechen Island, and Wrangel Island (USFWS 1994).

Population Status and Trends

In recent years, aerial surveys, supplemented by ground counts at terrestrial haulouts, have been used to assess the size and trends in the Pacific walrus population. The size of the population is unknown and may never be known with great accuracy due to constraints on the effectiveness of aerial surveys (Garlich-Miller and Jay 2000). By agreement between the U.S. and Russia, cooperative surveys of the Pacific walrus population were been conducted at 5-year intervals between 1975 and 1990. Efforts were suspended after 1990 due to unresolved problems with survey methods and budgetary constraints in the United States and Russia (Garlich-Miller and Jay 2000). Population estimates have ranged from between approximately 201,000 and 246,000 individuals, numbers that do not currently warrant listing under the MMPA (Gilbert et al. 1992, USFWS 1994). New technologies are being developed to better derive population estimates; meanwhile, the imprecision of current survey methods makes detection on any more than gross trends in the size of the population extremely difficult and assessment of population status relative to its Optimum Sustainable Population (OSP) impossible.

While they today occupy most of their historic range, the size of the pacific walrus population has fluctuated markedly under the influence of alternating periods of high harvest levels and near total protection (Fay et al. 1989). Commercial exploitation of walruses was banned in the United States in 1937 (Brooks 1953, Fay 1957) and in Russia in 1957 (Krylov 1968). An Alaskan/ Russian Native subsistence harvest was initiated in 1941 and is a significant source of food and cash for those living on both sides of the Bering Strait. The harvest is the single activity with the most immediate impact to population size and trend, although the current level of harvest is unlikely to impact walrus significantly (USFWS 1994). The size and structure of the Native harvest is not subject to Federal regulation unless the population size falls below its OSP range (currently unknown).

Threats

The Pacific walrus population has been made to fluctuate greatly over the past 150 years with severe consequences for both walruses and humans. The following have been identified as the principal current threats to walruses: lack of information about population size, overharvest, human disturbance (especially at haulouts), and commercial fisheries interactions. Because they are dependent on sea ice, walrus are also vulnerable to the effects of global climate change and subsequent alteration of ice habitats. Potential or emerging threats include contaminants bioaccumulation, shipping, tourism and oil and gas development (USFWS 1994; Joel Garlich-Miller, pers. comm.).

Climate Change

The Bering Sea is experiencing a northward biogeographical shift in response to increasing temperatures and atmospheric forcing. Overland and Stabeno (2004) have observed that mean summer temperatures near the Bering Sea shelf are 2 degrees (C) warmer for 2001-2003 compared with 1995-1997. In the coming decades, this warming trend is expected to have major impacts on the region's arctic species, at all levels of the food web, including walrus and their prey.

Unknown population size

The lack of reliable information about the current walrus population size, environmental carrying capacity, and many life history parameters makes it impossible to accurately determine OSP for this species. Determination of population status relative to OSP is important because it provides the basis for implementing regulatory activities that can influence population size and composition, and it indicates if conservation actions are effective and if additional actions are needed. Perhaps most importantly, an accurate estimate of population size is critical for setting sustainable harvest levels to ensure that overharvest does not reoccur (USFWS 1994).

Overharvest

The human activity with the greatest potential for impact on walrus numbers is hunting (Fay 1982, Fay et al. 1989). Natives on both sides of the Bering Strait hunted walruses from the Bering and Chukchi Seas for thousands of years before the 19^{th} century and probably had little effect on the population (Fay 1982). Past commercial exploitation has severely reduced the population at least three times since the mid-1800's, but each time it recovered when protected (Fay et al. 1989). Estimates of the total annual kill of walruses during the mid-1980's (a period of high harvest) were 10,000 to 15,000 individuals, or 4 to 6 percent of the estimated minimum population (Sease and Chapman 1988, Fay et al. 1989). Recent harvest rates are lower than historic highs but lack of information about population size and trends precludes a meaningful assessment of the impact of the harvest (Garlich-Miller and Jay 2000).

Commercial fisheries interactions
Although commercial fisheries' impacts to feeding habitat and prey resources is not currently an issue with respect to walruses, it could become one if commercial harvesting of clams is done on a large scale (Fay and Lowry 1981). Available data on benthic resources are not sufficient to assess adequately the impacts of a clam fishery on walruses. However, studies have found that walrus may be near their environmental carrying capacity and thus, perturbations in its benthic food resources is likely to adversely affect the population (Fay et al. 1977). The potential also exists for adverse impacts to feeding habitats due to sea floor destruction from bottom trawls for fish (USFWS 1994). Incidental catch of walruses in the groundfish trawl fishery in the eastern Bering Sea has been low, (1-40 animals per year) according to observer data (USFWS 1994).

Human disturbance

Land based disturbance:
A major threat to walrus is disturbance by human activities, especially on terrestrial haulouts. Although responses of walruses to humans are variable, they often flee haulouts en masse (trampling calves in the process) in response to the sight, sound, and especially odors from humans and machines (Fay et al. 1984a, Kelly et al. 1986). Walruses also flee or avoid areas of intense industrial activity (Mansfield 1983, Brueggeman et al. 1990, 1992).

Disturbance on pack ice:
Increasing aircraft and boat traffic in the Bering and Chukchi Seas, largely associated with fisheries and petroleum exploration and development, may disturb walruses in important breeding, nursing, and feeding areas on pack ice (USFWS 1994). Females with young show the most negative response to noise disturbance and the greatest potential for harm occurs when mother and calf are separated. Polar bears will often take advantage of such separations of to prey on calves (Fay et al. 1984a).

Monitoring

Current, accurate data on walrus numbers are unavailable. Annual harvest records contain a rich data set that can offer important opportunities for monitoring trends in some vital population parameters (e.g. age distribution and reproductive status), diet (from stomach contents), body condition (blubber thickness and blood chemistry), and contaminant loads (USFWS 1994; Joel Garlich-Miller, pers.comm.). There has been some research on the benthic food resources. Satellite-linked radio transmitters have been used on walrus since 1987 and some data on walrus movements at sea are available.

Research needs

There is a critical need to accurately determine the size and trends of the pacific walrus population. Development of more cost-effective, precise, and accurate methods to visualize and count individuals (such as infrared/ multi-spectra images) is needed. There is an ongoing need to determine cooperatively acceptable harvest levels, provide that information to hunters in the U.S. and Russia, and to monitor the harvest to ensure those levels are not exceeded. Other research needs include: identify essential walrus habitats (breeding, haulout, and feeding); assess the distribution and status of prey species; assess the potential for competition with commercial fisheries; determine the role of pack ice integrity/quality on use of terrestrial and ice haulouts; and assess and mitigate the impacts of human disturbance (tourism and development), especially at terrestrial haulouts (Joel Garlich-Miller, pers. comm.).

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Documentation for Viability Table (E5S Planning Tool): Sea Ice Ecosystem

Conservation Target: Sea Ice Ecosystem (Pacific walrus)

Category: Landscape Context

Key Attribute: Prey availability

Indicator: Walrus blubber thickness, blood chemistry

Indicator Ratings:

Poor: Data not available
Fair: Data not available
Good: Data not available
Very Good: Data not available

Current Rating:
Date of Current Rating:

Current rating comment: current rating unknown

Note: Joel Garlich-Miller(USFWS) explained that some measures taken during annual harvest monitoring. Need to follow up with Joel to explore if can be used to develop ratings

Desired Rating:
Date for Desired Rating:

Conservation Target: Sea Ice Ecosystem

Category: Landscape Context

Key Attribute: Sea ice habitat integrity

Indicator: Aerial extent and timing of pack ice (km2) over shelf; winter maximum and summer minimum

Indicator Ratings:

Poor:
Fair: OK today but declining rapidly in extent, thickness, structure, and duration
Good:
Very Good:

Current Rating: Fair
Date of Current Rating:

Desired Rating:
Date for Desired Rating:

Conservation Target: Sea Ice Ecosystem

Category: Landscape Context

Key Attribute: Sea ice habitat integrity

Indicator: Amount (km2) of multi-year ice vs. annual ice

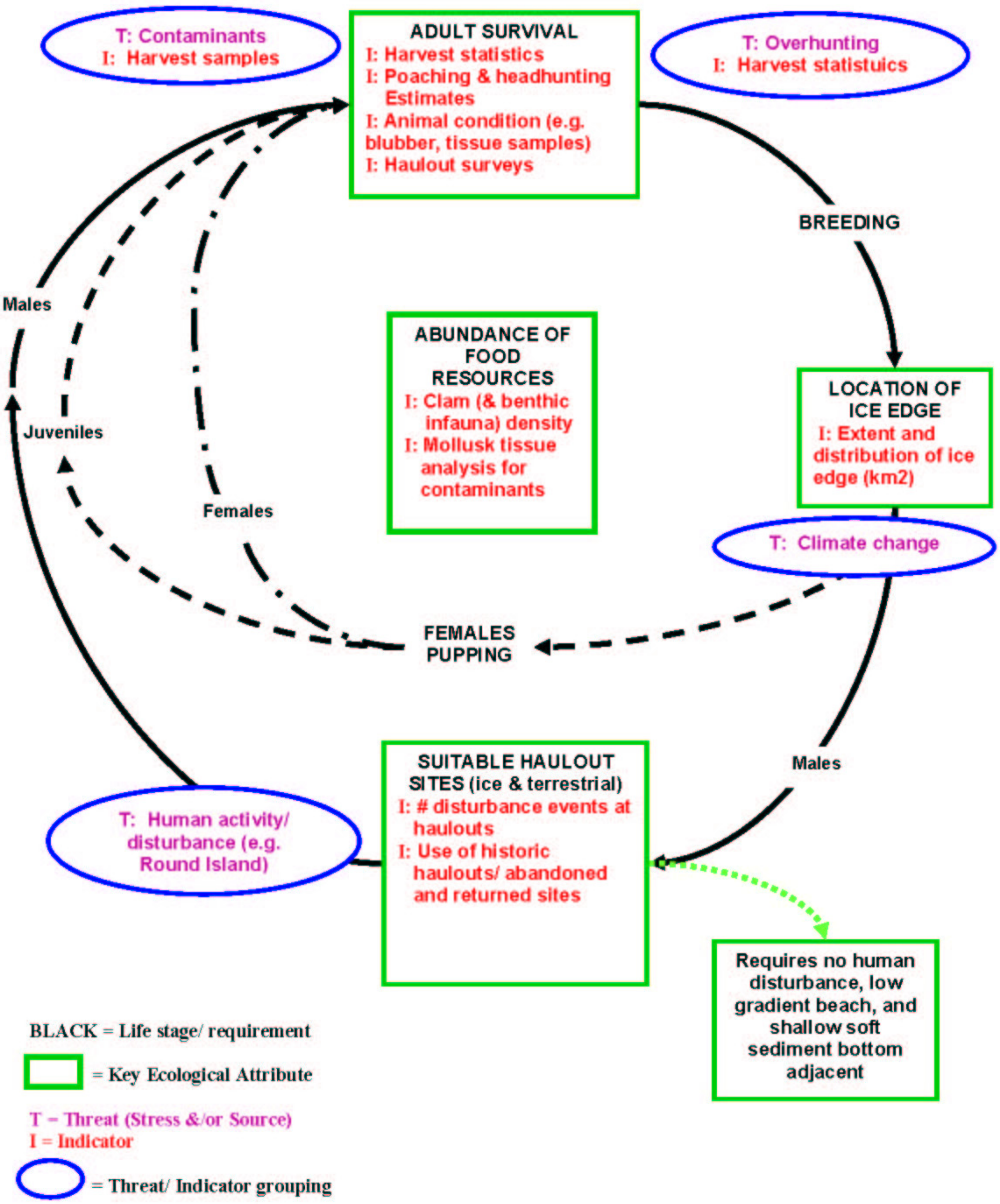
Indicator Ratings:

Poor:
Fair: Declining in thickness and amount of multi-year ice
Good:
Very Good:

Current Rating: Fair
Date of Current Rating:

Desired Rating:
Date for Desired Rating:

Figure A5: Conceptual Model Developed to Identify Key Ecological Attributes and Threats for Bering Sea Ecoregion Pacific Walrus



#	Threats to Bering Sea Ecoregion Sea Ice Ecosystems	Reduced population size (all sea ice spp.)	Loss of polar bear denning sites on land	Reduced sea ice habitat integrity	Degraded animal condition (all sea ice spp.)	-	-	-	-	Threat to System Rank
	Stress Rank	*High*	*Low*	*Very High*	*Medium*	-	-	-	-	
1	Threat	Climate change								Very High
	Contribution	Very High	Low	Very High	Very High					
	Irreversibility	Very High	Very High	Very High	Very High					
	Threat Rank (override)									
	Threat Rank	High	Low	Very High	Medium	-	-	-	-	
2	Threat	DLP killings (polar bears)								Medium
	Contribution	Medium								
	Irreversibility	Medium								
	Threat Rank (override)									
	Threat Rank	Medium	-	-	-	-	-	-	-	
3	Threat	Overhunting								Medium
	Contribution	High								
	Irreversibility	Medium								
	Threat Rank (override)									
	Threat Rank	Medium	-	-	-	-	-	-	-	
4	Threat	Oil spill								Medium

	Contribution	Low			Low					
	Irreversibility	High			High					
	Threat Rank (override)									
	Threat Rank	Medium	-	-	Low	-	-	-	-	
5	Threat	Oil or gas development								Medium
	Contribution	Low	High		Low					
	Irreversibility	Very High	Very High		Very High					
	Threat Rank (override)									
	Threat Rank	Medium	Low	-	Low	-	-	-	-	
6	Threat	Lack of basic management data								High
	Contribution	Very High	Low		Very High					
	Irreversibility	Medium	Medium		Medium					
	Threat Rank (override)									
	Threat Rank	High	-	-	Medium	-	-	-	-	

3.5 Sea Otter

The following resources on sea otters were compiled for the first iteration of this Strategic Action Plan for the Bering Sea:

- Life History, Population Status, Threats to and Research Needs for Bering Sea Ecoregion Sea Otters (Denise Woods, WWF Bering Sea Ecoregion Program)
- Documentation for Viability Table (E5S Planning Tool)
- Conceptual Model Developed to Identify Key Ecological Attributes and Threats for Bering Ecoregion Sea Otters (Randy Hagenstein, TNC Alaska; Evie Witten and Denise Woods, WWF Bering Sea Ecoregion Program) (Figure A6)
- Threats to Bering Sea Ecoregion Sea Otters (Table A5)

The following experts were consulted with regard to Bering Sea Ecoregion sea otters:

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Life history, population status, threats to and research needs for Bering Sea Ecoregion Sea Otters

Introduction

The sea otter (*Enhydra lutris*) is a conspicuous, gregarious member of ice-free but cold temperate and sub-arctic nearshore ecosystems of the North Pacific. Three subspecies are recognized: *E. lutris lutri~~u~~s*, occupying the Kuril I~~l~~sands, the east coast of the Kamchatka Penninsula, and the Commander Islands of Russia; *E. lutris* (*kenyoni*), ranging from Alaska's Aleutian islands to Oregon; and *E. l. nereis*, ranging from northern California to Baja California (Reidman and Estes 1990). The return of sea otters to most of this range from near extinction is one of the great wildlife conservation stories of the 20th century. Sea otters have been considered a "keystone species" (sensu Paine and Vadas 1969) and their complex relationships with the nearshore environment they inhabit are well documented (e.g. Estes and Palmisano 1974; Estes et al. 1978; Duggins et al. 1989). Sea otters are known to effectively limit populations of their invertebrate prey, which in turn promotes the growth of kelp and other macroalgae, upon which otters depend for food and shelter (Estes and VanBlaricom 1985; VanBlaricom 1988).

Life History

Breeding

Sea otters breed year-round, but peak periods of breeding in the northern portion of their range occur from September to November (Kenyon 1969; Garshelis et al. 1984). Females reach sexual maturity at 2-5 years and are capable of pupping annually (Garshelis et al 1984). Males reach sexual maturity at 5 years, but breeding may be delayed for social reasons (Schnieder 1978). Males and females aggregate in separate "male areas" and "female areas". When they attain breeding age, males leave their areas and attempt to establish and defend small breeding territories within female areas. Sea otters are polygynous and males will mate with several females throughout the breeding season; copulation occurs in water. Pups are born throughout the year, however peak pupping occurs from April to June in Prince William Sound (Garshelis et al. 1984). Pups are most frequently born in the water and (rarely) on land (Barabash-Nikiforov et al. 1947; Jameson 1983). Single pups are the norm and are typically attended by the female for 5 to 8 months (Garshelis et al. 1984).

Annual distribution/ migration

Movements of sea otters have not been well studied and methods for monitoring their movements for extended periods were devised only recently. Annual variation in sea otter distribution is correlated with seasonal changes in the kelp surface canopy: in winter and early spring, the kelp canopy is substantially reduced and individuals aggregate in the few protected sites available. In summer and fall, sea otters disperse and may rest further offshore, reflecting the seasonal increase in kelp abundance and offshore kelp distribution (Jameson 1989). Although males generally range farther than females, variability in seasonal home range size may be related more to differences in habitat than sex (Garshelis and Garshelis 1984). Sea otters often have separate feeding and resting sites (Ribic 1982; Garshelis and Garshelis 1984) and the distribution of such sites may also largely delimit the size of their home range. In population segments that are undergoing population range expansion into vacant habitat, regular movements by some individuals may be 80-145 km, spanning about half or more of the geographic range of their population (Ribic 1982).

Natural mortality and survival

In California, annual survival of sea otters is estimated to be 91 percent and 67-71 for adult females and males, respectively, and 77-85 percent and 86-88 percent for female and male juveniles, respectively (Siniff and Ralls 1988). Annual recruitment of juveniles is estimated to be 15-16 percent (Reidman and Estes 1990). Sea otter females live, on average, 15-20 years and males, 10-15 years (Reidman and Estes 1990). In portions of the population range that are limited by food resources, the most frequent proximate cause of death for young-of-the-year and very old animals is starvation, particularly during winter months. The causes of natural mortality in the sea otter population throughout their range are diverse and known causes include: congenital defects, valvular endocarditis, parasitic infections (peritonitis), marine biotoxins, predation (killer whale, shark, bald eagle, brown bear, wolf, and coyote), and anthropogenic causes (oil spills, boat strikes, entanglement, pollutants, and shooting).

Diet and foraging

Sea otters forage in rocky substrate and soft bottom communities, along the bottom as well as within the kelp understory and canopy, particularly in subtidal zones (VanBlaricom 1988; Harrold and Hardin 1986). In Alaska, sea otters usually forage for various species of hard-bodied mollusks and crustaceans (sea urchins, muscles, snails, clams, crabs etc.) at depths between 40 and 100 m (Estes 1980; Newby 1975). Prey items are usually brought to the surface where rocks or other hard tools are used to break open their exoskeletons (Kenyon 1969; Houk and Geibel 1974; Miller 1974). Except for a number of primate species, this tool-using behavior is unique among mammals (Reidman and Estes 1990). In addition to benthic invertebrates, epibenthic fish are consumed (especially in Alaska) and some individuals will occasionally prey on seabirds and ducks (Kenyon 1969).

Diet composition varies with the amount of time an area has been occupied by sea otters: when sea urchins (*Strongylocentrotus polyacanthus*) are abundant (i.e. in recently reoccupied areas such as Attu Island), sea otters feed primarily on them; fish are rarely consumed in such areas (Estes et al. 1982). In contrast, areas where populations of sea otters have been established for long periods (e.g. Amchitka Island) may be devoid of sea urchins (who graze on kelp). Kelp beds in such areas have thus flourished, providing essential nearshore habitat for fish; fish constitute an important part of the sea otter diet in such areas. Estes et al. (1989) suggested that the inclusion of fish in the sea otter's diet resets the equilibrium population size well above that which is attainable on a diet of invertebrates alone.

Habitat requirements
Sea otters occur in areas with widely ranging exposure, substrate types, and community composition. They generally inhabit and forage in shallow coastal waters (35-55m deep; Kenyon 1969) and seldom range more than 1-2 km from shore. However, in some areas of Alaska, waters remain shallow many miles from shore and otters may be found relatively far from shore in large numbers. Substrate type (thus, prey type and density) can influence sea otter densities: areas with extensively fractured or topographically heterogeneous substrates seem capable of supporting higher otter densities than areas with flat and unbroken substrates (Reidman and Estes 1990).

The presence of kelp beds is an important habitat component for sea otters, although large numbers of sea otters occupy areas essentially devoid of kelp (e.g. the Bering Sea and Prince William Sound; Garshelis 1990). The density, aerial extent, and species composition of kelp canopies are known to influence sea otter distribution patterns and territorial boundaries (Benech 1981). In Alaska, surface kelp canopies may occur in both soft sediments and rocky-bottom habitats and may be composed of perennial or annual kelp species. Otters use kelp beds and canopies for foraging and resting (especially during storms; Sandegren et al. 1973) and specific kelp beds are used as habitual rafting sites for groups of otters or individuals (Loughlin 1977). For example, Jameson (1989) found that territorial males sometimes rest in the same specific location in the same kelp bed for many years.

Sea otters generally rest singly or in small groups (called rafts) of two or more individuals, although very large groups of up to 440 individuals are not uncommon, especially among males (Kenyon 1969). In Alaska and Russia, however, it is not uncommon for sea otters to haul out onto land, sometimes in large numbers (Kenyon 1969; Barabash-Nikiforov et al. 1968). Preferred haulout sites are characterized by low-relief, algal-covered rocks that are exposed at low tide (Faurot 1985), although sand or cobble beaches are also used. Haulouts are also characterized by an absence of terrestrial predators and human disturbance (e.g. Amchitka Island, Alaska; Reidman and Estes 1990).

Population Status and Trends

Historically, sea otters occupied the nearshore waters around the North Pacific rim from Hokkaido, Japan through the Kuril Islands, Kamchatka Penninsula, and Commander Islands of Russia; and peninsular and south coastal Alaska, southward to Baja California (Kenyon 1969; Wilson et al. 1991). Although long harvested by coastal Alaska Natives, the species remained abundant throughout its range before the onset of commercial hunting in the mid-1700's. The pre-harvest worldwide population of sea otters has been estimated at 150,000 (Kenyon 1969) to 300,000 individuals (Johnson 1982). Commercial exploitation between 1740 and 1911 (when they received protection under the International Fur Seal Treaty) resulted in the deaths of 500,000 to 1 million sea otters (Kenyon 1969). Many local populations became extinct and the total number of sea otters may have dropped as low as 1,000 to 2,000 animals (Johnson 1982).

Following the end of the commercial harvest, sea otter numbers increased dramatically and they have come to re-occupy most of their historic range (via both natural dispersal and an Alaska Department of Fish and Game reintroduction program during the 1960's; USFWS 1993). The Alaskan population was estimated at 100,000 to 150,000 individuals in 1976 (Calkins and Schneider 1985) and the Russian population was estimated at 12,846-13,846 individuals in 1984-1986 (Reidman and Estes 1990). The Russian population does not appear to be in decline and a current population estimate for *E. l. lutris* is 30,000 (A. Doroff, pers. comm..) Recently, however, a dramatic and unexplained population decline in the Aleutian Islands and other parts of western Alaska has become apparent.

In the Aleutian Island chain, the sea otter population has declined severely and is estimated to about 3% of the carrying capacity as of 2003 (Doroff et al. 2003 and Estes et al. in press). Reduced fertility, redistribution to new sites, disease, toxins, and starvation have been eliminated as causes of the declines, leaving some to conclude that sea otter population declines are caused by increased mortality, possibly as a result of greatly increased predation pressure from killer whales, whose usual prey (whales and sea lions) have become scarce (Estes et al. 1998). Other avenues of inquiry have been to assess the role of disease and potentially marine biotoxins on the observed population decline. In January of 2004, the USFWS proposed listing the Southwest Alaska/ Aleutian Islands population of northern sea otter as threatened under the Endangered Species Act.

<u>Threats</u>

Sea otters have long been harvested by Alaska Natives, who continue to take sea otters for use of hides in clothing and handicraft manufacture. Between 1982 and 1986, approximately 1,049 otters were harvested (Rotterman and Simon-Jackson 1988). There is no evidence that current low harvest levels pose a threat to sea otter status, distribution, or productivity (USFWS 1993). Sea otters may be affected by habitat degradation resulting from the accumulation in benthic foraging areas of bark, woody debris, shells, bones, organic waste and other effluent issuing from coastal or offshore logging and seafood processing activities. Commercial fisheries interactions (prey removal, displacement, and entanglement) and oil spills have been identified as among the principal threats to sea otters (USFWS 1993).

Climate Change

The Bering Sea is experiencing a northward biogeographical shift in response to increasing temperatures and atmospheric forcing. Overland and Stabeno (2004) have observed that mean summer temperatures near the Bering Sea shelf are 2 degrees (C) warmer for 2001-2003 compared with 1995-1997. In the coming decades, this warming trend is expected to have major impacts on the region's arctic species, at all levels of the food web, including sea otters and their prey.

Commercial fisheries interactions

Competition for prey

Sea otters have voracious appetites and can significantly reduce local shellfish stocks. Following the extirpation of sea otters from Alaskan waters, the abundance of shellfish and other prey species presumably increased. Commercial, recreational, and subsistence shellfish fisheries subsequently developed in their absence and re-colonization by otters in these areas has led to competition for the same food resources (USFWS 1993) and, in some cases, the demise of recreational and commercial shellfish fisheries (e.g. Kimker 1985; Garshelis et al. 1986). Urchins are not presently commercially harvested due to lack of profitability, but this could change (V. Sokolov, pers. comm.). The proposed development of mariculture operations to grow clams, mussels, oysters and scallops could also threaten sea otters by displacing them from prime foraging areas and entangling them in fishing gear (Monson and DeGange 1988), or provoking the use of lethal means to exclude them from such areas.

Incidental take/ bycatch

Sea otters are taken incidentally in salmon gillnet fisheries and other fisheries in in the Bering Sea. Although sample sizes are small, data from the observer programs in Prince William Sound and Copper River Flats drift and set gillnet fisheries, and the south Unimak Pass drift gillnet fishery, suggest that incidental mortality of sea otters in these fisheries is low (Wynn 1990; Wynne et al. 1991, 1992).

Oil spills

Sea otters rely strictly on fur for insulation: they lack the layer of blubber common to all other marine mammals. Without blubber, sea otters are particularly susceptible to hypothermia and death as a result of pelage contamination, and thus are at greater risk than any other marine mammal in the event of an oil spill in their present range (Costa and Kooyman 1982; Garshelis 1990; Geraci and St. Aubin 1990). For example, it is estimated that approximately 2,028 to 11,280 sea otters died in Alaska as a result of the Exxon Valdez oil spill of 1989; continuing studies suggest that otters are still affected by oil in their environment in western Prince William Sound (USFWS 1993).

Monitoring

Sea otters, as a species, have been studied most intensively in California (*E. l. nereis*) likely due to this populations listing as threatened under the Endangered Species Act (California (Reidman and Estes 1990). In Alaska, state-wide monitoring of trends in sea otter population abundance through aerial and boat-based surveys, population health and body condition through screening otters for disease and intensive sampling of beach-cast carcasses is conducted by the U. S. Fish and Wildlife Service. The U.S. Geological Survey, Alaska Science Center conducts research on forage and dive behavior, impacts from the Exxon Valdez oil spill on long-term population health, and develops survey methodology. In 1988, the USFWS established a marking, tagging and reporting program designed to assist in monitoring the subsistence and handicraft harvest of sea otters. In cooperation with the National Marine Fisheries Service (NMFS), USFWS has also established a program to record and report the number of otters killed incidental to commercial fisheries.

Research Needs

There is a need to better determine the current numbers of sea otters in Alaskan and Russian waters and to monitor the size, status and trends of those populations. Sea otters are relatively easy to count because they rest on the water surface, often in groups. However, various factors affect the accuracy of such counts, including weather, amount of kelp, and group size and activity of the individuals (Garshelis 1990). Standard methods for aerial and skiff-based surveys have been developed for sea otters in Alaska. The type of habitat, remoteness and distance from shore in which the habitat extends influences the type of method which can be used to assess sea otter abundance. In 2002, the state-wide population estimate for sea otters in Alaska was approximately 71,000.Other research needs include: collection of life history data for modeling and establishment of removal guidelines; continued support for biological sampling program of harvested animals; greater development of the marine mammal stranding program in Alaska, characterization sea otter habitat and monitor habitat status and trends; and determine the effects of sea otters on commercial shellfish fisheries, and vice versa (USFWS 1993).

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Documentation for Viability Table (E5S Planning Tool): Sea Otter

Conservation Target: Sea Otter

Category: Condition

Key Attribute: Population structure & recruitment

Indicator: population counts

Indicator comment: Information on sea otter populations was drawn from the Federal Register proposed rule on listing the Southwest Alaska segment of the northern sea otter population as 'threatened' under the ESA and from USFWS biologist Angie Doroff. Relatively little is known about basic demography and population structure of this population other than the fact that it has suffered severe populations declines of nearly 90% since the mid-1980s.

The indicator ratings were set somewhat arbitrarily as follows:
Very good = at or above the population high of the 1980s estimated at 74,000 animals
Good = >50% of the mid 1980s population
Fair = >25% of the mid 1980s population
Poor = <25% of the mid 1980s population.

Note that these numbers do not include population figures for the Russian coast and Commander Islands. These numbers should be included and the ratings adjusted accordingly in future updates.

Indicator Ratings:

Poor: > 18,500
Fair: 18,500 - 37,000
Good: 37,000 - 74,000
Very Good: >74,000

Current Rating: Poor
Date of Current Rating:

Current rating comment: Based on USFWS research as reported in the Federal Register (vol 69, No 28:6600-6621)

Desired Rating: Good
Date for Desired Rating:

Conservation Target: Sea Otter

Category: Size

Key Attribute: Population size & dynamics

Indicator: Adult/pup ratios

Indicator comment: This indicator was recommended by Angie Doroff, USFWS. The indicator should be a "leading indicator" of population change. For example, a high adult/pup ratio might indicate a population of older animals with little successsful reproduction. At present, we have not filled in the indicator ratings.

This indicator could also be coupled with total population to modify population ratings to reflect potential growing or shrinking trands.

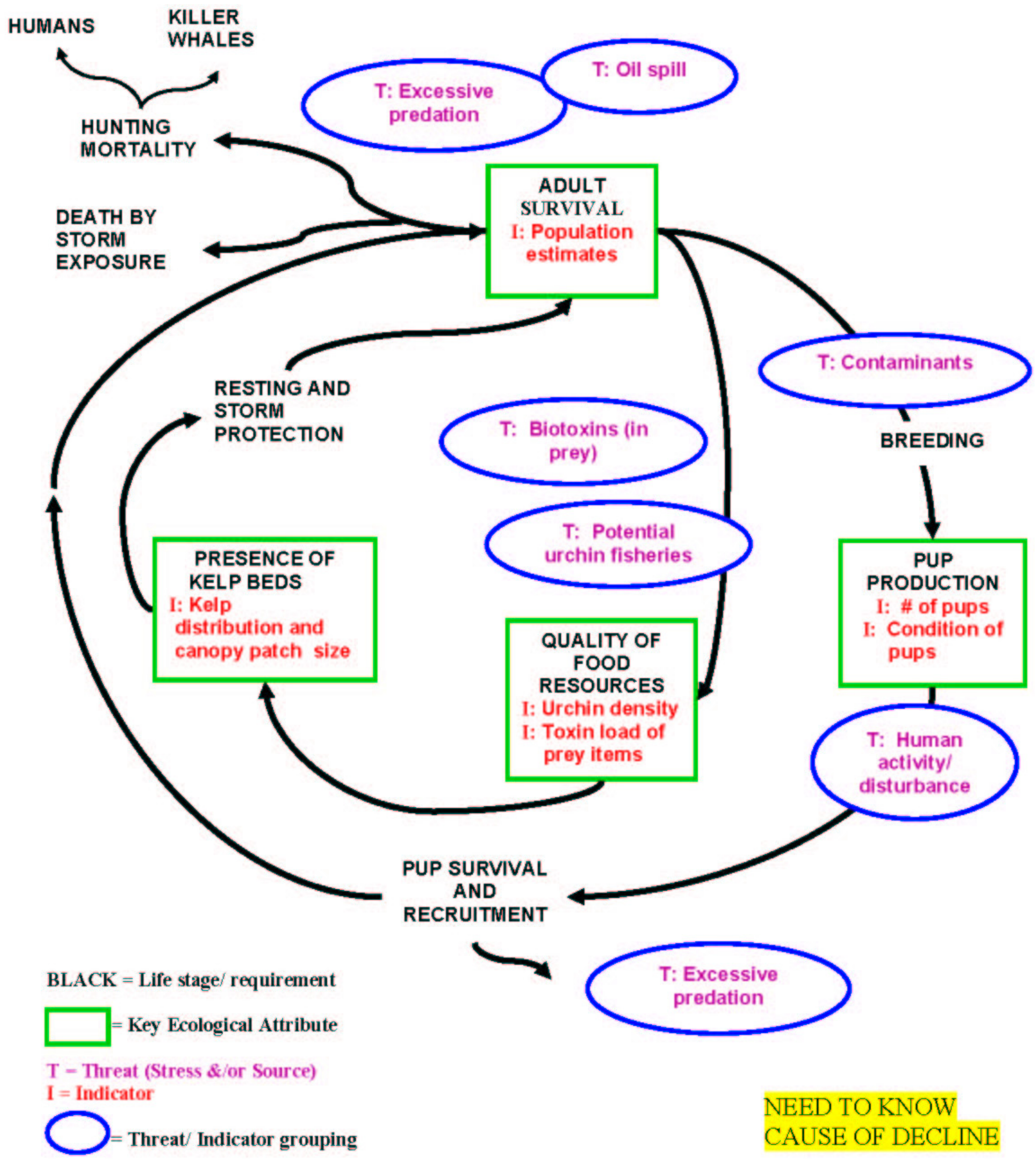
Indicator Ratings:

Poor: tbd
Fair: tbd
Good: tbd
Very Good: tbd

Current Rating:
Date of Current Rating:

Desired Rating:
Date for Desired Rating:

Figure A6: Conceptual Model Developed to Identify Key Ecological Attributes and Threats for Bering Sea Ecoregion Sea Otters



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	THREATS TO BERING SEA ECOREGION SEA OTTERS	Reduced population size	Reduced condition	-	-	-	-	-	-	Threat to System Rank
	Stress Rank	*Very High*	*Medium*	-	-	-	-	-	-	
1	Threat	Lack of basic management data								Very High
	Contribution	Very High	Very High							
	Irreversibility	Medium	Medium							
	Threat Rank (override)									
	Threat Rank	Very High	Medium	-	-	-	-	-	-	
2	Threat	Oil spill								High
	Contribution	Medium	Medium							
	Irreversibility	High	High							
	Threat Rank (override)									
	Threat Rank	High	Low	-	-	-	-	-	-	
3	Threat	Excessive predation								Very High
	Contribution	High								
	Irreversibility	Very High								
	Threat Rank (override)									
	Threat Rank	Very High	-	-	-	-	-	-	-	
4	Threat	Climate change								Very High

	Contribution	High	High							
	Irreversibility	Very High	Very High							
	Threat Rank (override)									
	Threat Rank	Very High	Medium	-	-	-	-	-	-	

3.6 Whales (Orca, Gray, Beluga, Sperm, Right, and Fin)

The following resources on whales were compiled for the first iteration of this Strategic Action Plan for the Bering Sea:

- Documentation for Viability Table (E5S Planning Tool)
- Threats to Bering Sea Ecoregion Whales (Table A6)
- Table A7 (below): Selected whale species- domain(s) occupied and feeding strategy utilized

Species	Domain(s)	Feeding strategy
orca	Shelf, shelf break, oceanic	Toothed; fish and marine mammal eater
beluga	Nearshore	Toothed; fish eater
gray whale	Shelf	Baleen; benthic fauna feeder
sperm whale	Shelf, shelf break, oceanic	Toothed; fish and squid eater
fin whale	Shelf, shelf break, oceanic	Baleen; fish and krill eater
right whale	Shelf, shelf break, oceanic	Baleen; fish and krill eater
humpback whale	Shelf, shelf break, oceanic	Baleen; fish and krill eater

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Documentation for Viability Table (E5S Planning Tool): Whales

Conservation Target: Whales (Beluga)

Category: Size

Key Attribute: Population size & dynamics

Indicator: Beluga population size

Indicator comment: Beluga populations in the eastern Bering and Chukchi Seas are thought to be about 20,000 and stable according to the NOAA Alaska Marine Mammal Stock Assessments, 2003 report.

Indicator Ratings:

Poor:
Fair:
Good: 20,000, stable
Very Good:

Current Rating: Good
Date of Current Rating: 11/15/2003

Current rating comment: NOAA Alaska Marine Mammal Sock Assessments, 2003 report

Desired Rating: Very Good
Date for Desired Rating:

Conservation Target: Whales (Fin)

Category: Size

Key Attribute: Population size & dynamics

Key attribute comment: Prior to extensive commercial whaling, cetacean biomass in the Bering Sea was very high (Estes, Springer et al.). Most cetacean populations are at or near historic lows. Full ecological recovery of the Bering Sea will include robust cetacean populations.

Indicator: Fin whale population size

Indicator comment: North Pacific stocks were estimated at 42,000-45,000 prior to major commercial whaling. In the 1970's, the population was estimated at about 15,000. Recently there have been concentrations seen at the shelf break in the eastern Bering Sea.

Indicator Ratings:

Poor: ESA listing = Endangered
Fair: ESA listing = threatened
Good: Removed from ESA
Very Good: Not "depleted" under MMPA

Current Rating: Poor
Date of Current Rating: 11/15/2003

Current rating comment: NOAA Alaska Marine Mammal Sotck Assessments, 2003 report

Desired Rating: Very Good
Date for Desired Rating:

Conservation Target: Whales (Gray)

Category: Size

Key Attribute: Population size & dynamics

Key attribute comment: Gray whales in the Pacific feed only in the Bering Sea.

Prior to extensive commercial whaling, cetacean biomass in the Bering Sea was very high (Estes, Springer et al.). Most cetacean populations are at or near historic lows. Full ecological recovery of the Bering Sea will include robust cetacean populations.

Indicator: Gray whale population size

Indicator Ratings:

Poor: ESA listing = endangered
Fair: ESA listing = threatened
Good: Removed from ESA
Very Good: Not "depleted" under MMPA

Current Rating: Good
Date of Current Rating: 11/15/1994

Current rating comment: NOAA Alaska Marine Mammal Stock Assessments, 2003 report. Gray whales were removed from the ESA list in 1994. Populations are thought to havce been increasing over the past 2 decades.

Desired Rating: Very Good
Date for Desired Rating:

Conservation Target: Whales (Orca)

Category: Size

Key Attribute: Population size & dynamics

Indicator: Orca population size

Indicator comment: Populations levels and trends are unknown.

Indicator Ratings:

Poor: tbd
Fair: tbd
Good: tbd
Very Good: tbd

Current Rating:
Date of Current Rating: 11/15/2003

Current rating comment: NOAA 2003 Alaska Marine Mammal Stock Assessments report

Desired Rating: Very Good
Date for Desired Rating:

Conservation Target: Whales (Right)

Category: Size

Key Attribute: Population size & dynamics

Key attribute comment: Prior to extensive commercial whaling, cetacean biomass in the Bering Sea was very high (Estes, Springer et al.). Most cetacean populations are at or near historic lows. Full ecological recovery of the Bering Sea will include robust cetacean populations.

Indicator: Right whale population size

Indicator Ratings:

Poor: ESA listing = endangered
Fair: ESA listing = threatened
Good: Removed from ESA
Very Good: Not "depleted" under MMPA

Current Rating: Poor
Date of Current Rating: 11/15/2004

Current rating comment: Among the most endangered great whales. Recently some encouraging sightings in the eastern Bering Sea, including a rare sighting of a juvenile right whale.

Desired Rating: Good
Date for Desired Rating:

Conservation Target: Whales (Sperm)

Category: Size

Key Attribute: Population size & dynamics

Key attribute comment: Prior to extensive commercial whaling, cetacean biomass in the Bering Sea was very high (Estes, Springer et al.). Most cetacean populations are at or near historic lows. Full ecological recovery of the Bering Sea will include robust cetacean populations.

Indicator: Sperm whale population size

Indicator Ratings:

Poor: ESA listing = endangered
Fair: ESA listing = threatened

Good: Removed from ESA
Very Good: Not "depleted" under MMPA

Current Rating: Poor
Date of Current Rating: 11/15/2004

Current rating comment: Overall population estimates and population trends are unknown. Pre-exploitation population in the N. Pacific was 1,260,000. Estimates in the 1970s put the population at 930,000. There are increasing reports of interactions between sperm whales and fisheries (eg, whales stripping fish off longlines)

Desired Rating: Good
Date for Desired Rating:

	Threats to Bering Sea Ecoregion Whales	Altered population size and structure	-	-	-	-	-	-	-	Threat to System Rank
	Stress Rank	*High*	-	-	-	-	-	-	-	
1	Threat	Commercial whaling (historic)								High
	Contribution	Very High								
	Irreversibility	Very High								
	Threat Rank (override)									
	Threat Rank	High	-	-	-	-	-	-	-	
2	Threat	Lack of basic management data								Medium
	Contribution	High								
	Irreversibility	Medium								
	Threat Rank (override)									
	Threat Rank	Medium	-	-	-	-	-	-	-	

3.7 Coral and Sponge Gardens

The following resources on Bering Sea coral and sponge gardens were compiled for the first iteration of this Strategic Action Plan for the Bering Sea:

- Documentation for Viability Table (E5S Planning Tool)
- Conceptual model developed to identify Key Ecological Attributes and Threats for Bering Ecoregion Coral and Sponge Gardens (Randy Hagenstein, TNC Alaska; Evie Witten and Denise Woods, WWF Bering Sea Ecoregion Program) (Figure A7)
- Threats to Bering Sea Ecoregion Coral and Sponge Gardens(Table A8)

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Heikoop, J.M., D.D. Hickmott, M.J. Risk, C.K. Shearer, V. Atudorei. 2002. Hydrogiologia 471: 117-124

Henry, L.A., E.L.R. Kenchington, and A. Silvaggio. 2003. Effects of mechanical experimental disturbance on aspects of colony responses, reproduction, and regeneration in the cold-water octocoral *Gersemia rubiformis.* Canadian Journal of Zoology 81(10): 1691-1701

Koslow, J.A., K Gowlett-Holmes, J.K. Lowry, T. O'Hara, G.C.B. Poore, and A. Williams. 2001. Seamount benthic macrofauna off southern Tasmania: Community structure and impacts of trawling. Marine Ecology Progress Series (213): 111-125

Krieger, K.J., and B.L. Wing. 2002. Megafauna associations with deepwater corals (Primnoa spp.) in the Gulf of Alaska. Hydrobiologia 471: 83-90

McConnaughey, R.A., K.L. Mier, and C.B. Dew. 2000. An examination of chronic trawling effects on soft-bottom benthos of the eastern Bering Sea. ICES Journal of Marine Science 57: 1377-1388.

Rogers, S.G., H.T. Langston, and T.E. Targett. 1986. Anatomical trauma to sponge-coral reef fishes captured by trawling and angling. Fishery 84(3): 697-704

Van Dolah, R.F., P.H. Wendt, and N. Nicholson. 1987. Effects of a research trawl on a hard-bottom assemblage of sponges and corals. Fisheries Research 5(1): 39-54

Documentation for Viability Table (E5S Planning Tool): Coral & Sponge Gardens

Conservation Target: Coral/sponge Gardens

Category: Size

Key Attribute: Size, extent, and architechture of coral/sponge communities

Key attribute comment: Coral and sponge communities provide complex 3-dimensional habitats that are closely associated with juvenile and adult fish, especially juvenile rockfish.

Indicator: amount (pounds) of corals and sponges in trawl bycatch

Indicator comment: Trawl gear accounts for approximately 80-90% of coral/sponge bycatch (NMFS 2003 - PEIS). The break between good and fair was arbitrarily chosen by R. Hagenstein.

Indicator Ratings:

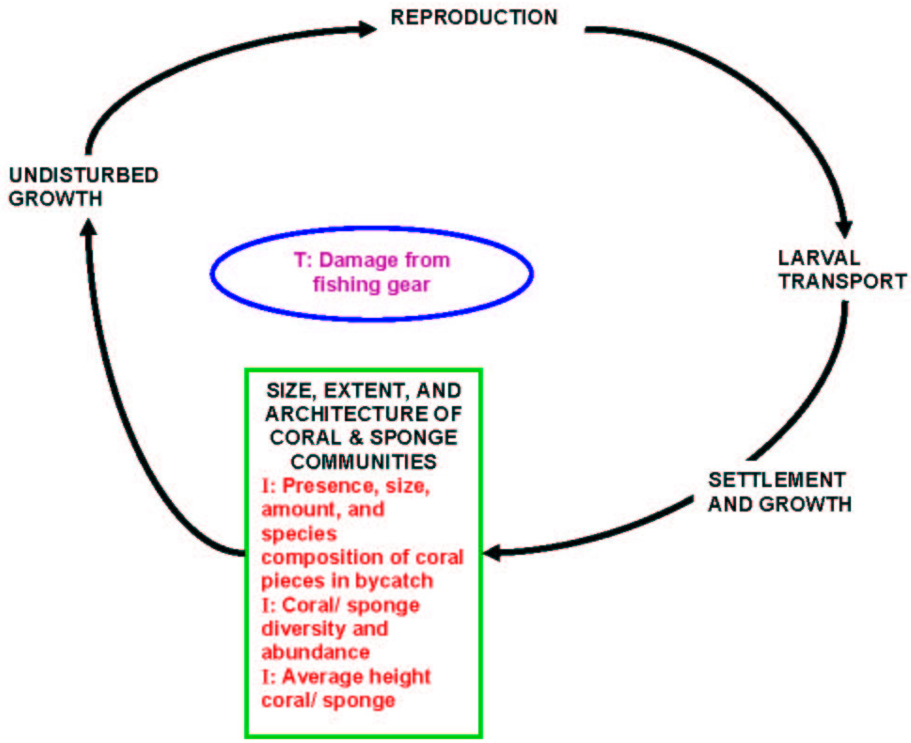
Poor:
Fair: > 500,000 lbs. annually
Good: < 500,000 lbs. annually
Very Good:

Current Rating: Fair
Date of Current Rating: 11/15/2003

Current rating comment: Based on data from NMFS 2003 Programmatice EIS, the average annual bycatch in Bering Sea/Aleutian Islands fisheries was 929,000 lbs. 97% of this bycatch occurred in bottom trawl fisheries.

Desired Rating: Good
Date for Desired Rating: 1/15/2008

Figure A7: Conceptual Model Developed to Identify Key Ecological Attributes and Threats for Bering Sea Ecoregion Coral and Sponge Gardens



PROCESSES THAT GOVERN DISTRIBUTION:

- Nutrients
- Depth, temperature, salinity, etc.
- Low disturbance/damage
- Propagule source
- Substrate texture and structure (including living substrates)

BLACK = Life stage/ requirement

[green box] = Key Ecological Attribute

T = Threat (Stress &/or Source)
I = Indicator

[blue oval] = Threat/ Indicator grouping

	THREATS TO BERING SEA ECOREGION CORAL AND SPONGE GARDENS	Altered size, extent, and architechture of coral/sponge communities	-	-	-	-	-	-	-	Threat to System Rank
	Stress Rank	*High*	-	-	-	-	-	-	-	
1	Threat	Fisheries								High
	Contribution	Very High								
	Irreversibility	Very High								
	Threat Rank (override)									
	Threat Rank	High	-	-	-	-	-	-	-	
2	Threat	Lack of basic management data								Medium
	Contribution	High								
	Irreversibility	Medium								
	Threat Rank (override)									
	Threat Rank	Medium	-	-	-	-	-	-	-	

3.8 Bottom-Dwelling Fish and Crab

The following resources on bottom-dwelling fish and crab were compiled for the first iteration of this Strategic Action Plan for the Bering Sea:

- Documentation for Viability Table (E5S Planning Tool)
- Threats to Bering Sea Ecoregion Bottom-Dwelling Fish and Crab (Table A9)

Select References for Bering Sea Ecoregion Bottom-Dwelling Fish and Crab

Koslow, J.A., K Gowlett-Holmes, J.K. Lowry, T. O'Hara, G.C.B. Poore, and A. Williams. 2001. Seamount benthic macrofauna off southern Tasmania: Community structure and impacts of trawling. Marine Ecology Progress Series (213): 111-125

Krieger, K.J., and B.L. Wing. 2002. Megafauna associations with deepwater corals (Primnoa spp.) in the Gulf of Alaska. Hydrobiologia 471: 83-90

McConnaughey, R.A., K.L. Mier, and C.B. Dew. 2000. An examination of chronic trawling effects on soft-bottom benthos of the eastern Bering Sea. ICES Journal of Marine Science 57: 1377-1388.

Rogers, S.G., H.T. Langston, and T.E. Targett. 1986. Anatomical trauma to sponge-coral reef fishes captured by trawling and angling. Fishery 84(3): 697-704.

Stoner, A.W. and R.H. Titgen. Biological structures and bottom type influence habitat choices made by Alaska flatfishes. 2003. Journal of Experimental Marine Biology and Ecology 292: 43-59.

Documentation for Viability Table (E5S Planning Tool): Bottom Dwelling Fish & Crab

Conservation Target: Bottom Dwelling Fish & Crab

Category: Size

Key Attribute: Population size & dynamics

Indicator: Nearshore species population

Indicator comment: Specific species and indicator ratings need to be defined in a future revision

Indicator Ratings:

Poor: tbd
Fair: tbd
Good: tbd
Very Good: tbd

Current Rating:
Date of Current Rating:

Desired Rating:
Date for Desired Rating:

Conservation Target: Bottom Dwelling Fish & Crab

Category: Size

Key Attribute: Population size & dynamics

Indicator: Shelf break species population

Indicator comment: Specific species and indicator ratings need to be defined in a future revision

Indicator Ratings:

Poor: tbd
Fair: tbd
Good: tbd
Very Good: tbd

Current Rating:
Date of Current Rating:

Desired Rating:
Date for Desired Rating:

Conservation Target: Bottom Dwelling Fish & Crab

Category: Size

Key Attribute: Population size & dynamics

Indicator: Shelf species population

Indicator comment: Specific species and indicator ratings need to be defined in a future revision

Indicator Ratings:

Poor: tbd
Fair: tbd
Good: tbd
Very Good: tbd

Current Rating:
Date of Current Rating:

Desired Rating:
Date for Desired Rating:

	THREATS TO BERING SEA ECOREGION BOTTOM-DWELLING FISH AND CRAB	Reduced populations	Reduced species diversity	Altered tropic structure and dynamics	Reduced habitat integrity	-	-	-	-	Threat to System Rank
	Stress Rank	*High*	*Medium*	*Low*	*Medium*	-	-	-	-	
1	Threat	Overfishing								High
	Contribution	Very High	High	High						
	Irreversibility	Medium	Medium	Medium						
	Threat Rank (override)									
	Threat Rank	High	Low	Low	-	-	-	-	-	
2	Threat	Damage from fishing gear								Medium
	Contribution				High					
	Irreversibility				High					
	Threat Rank (override)									
	Threat Rank	-	-	-	Medium	-	-	-	-	
3	Threat	Climate change								High
	Contribution	High	High	High						
	Irreversibility	Very High	Very High	Very High						
	Threat Rank (override)									
	Threat Rank	High	Medium	Low	-	-	-	-	-	

3.9 Coastal Lagoons and Freshwater Wetland Systems

The following resources on coastal lagoons and freshwater wetland systems were compiled for the first iteration of this Strategic Action Plan for the Bering Sea:

- Documentation for Viability Table (E5S Planning Tool)
- Conceptual model developed to identify Key Ecological Attributes and Threats for Bering Ecoregion Coastal Lagoons and Freshwater Wetland Systems (Randy Hagenstein, TNC Alaska; Evie Witten and Denise Woods, WWF Bering Sea Ecoregion Program) (Figure A8)
- Threats to Bering Sea Ecoregion Coastal Lagoons and Freshwater Wetland Systems (Table A10)

Select References for Bering Sea Ecoregion Coastal Lagoons and Freshwater Wetland Systems

Hall, J. V. 1988. Alaska coastal wetlands survey. Cooperative report, Department of the Interior, U.S. Fish and Wildlife Service, National Wetlands Inventory, Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service, National Marine Pollution Program. U.S. Fish and Wildlife Service Anchorage, Alaska. 36 pp.

Documentation for Viability Table (E5S Planning Tool): Coastal Lagoons and Freshwater Wetland Systems

Conservation Target: Coastal lagoons & freshwater wetland systems

Category: Condition

Key Attribute: Fish nursery function

Indicator: numbers of juvenile fish from sampling

Indicator Ratings:

Poor:
Fair:
Good:
Very Good:

Current Rating:
Date of Current Rating:

Desired Rating:
Date for Desired Rating:

Conservation Target: Coastal lagoons & freshwater wetland systems

Category: Condition

Key Attribute: Migratory bird feeding and resting

Indicator: Fall bird counts

Indicator Ratings:

Poor:
Fair:
Good:
Very Good:

Current Rating:
Date of Current Rating:

Desired Rating:
Date for Desired Rating:

Conservation Target: Coastal lagoons & freshwater wetland systems

Category: Condition

Key Attribute: Waterfowl breeding

Indicator: Breeding bird surveys

Indicator Ratings:

Poor:
Fair:
Good:
Very Good:

Current Rating:
Date of Current Rating:

Desired Rating:
Date for Desired Rating:

Conservation Target: Coastal lagoons & freshwater wetland systems

Category: Size

Key Attribute: Size / extent of characteristic communities / ecosystems

Indicator: Acres lost to facilities, roads, and other development

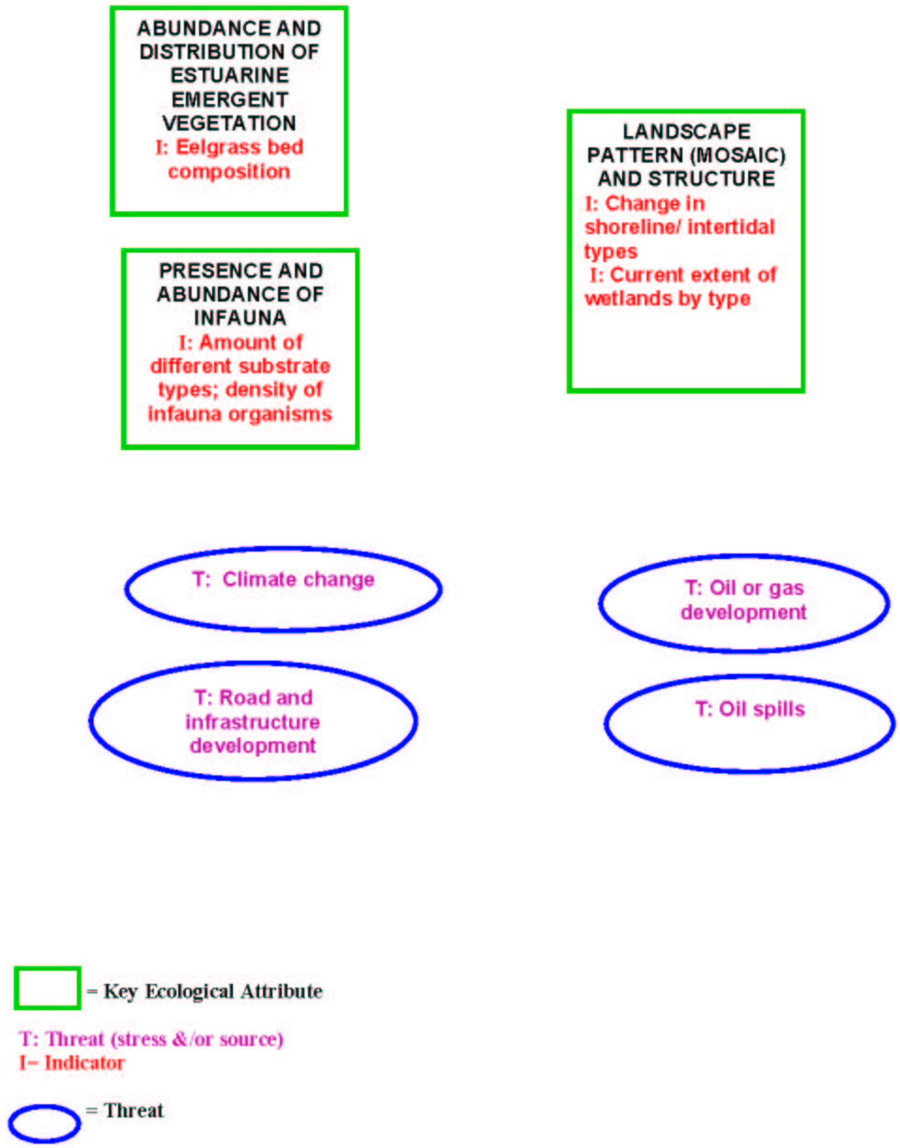
Indicator Ratings:

Poor:
Fair:
Good:
Very Good:

Current Rating:
Date of Current Rating:

Desired Rating:
Date for Desired Rating:

Figure A8: Conceptual Model Developed to Identify Key Ecological Attributes and Threats for Bering Sea Ecoregion Coastal Lagoons and Freshwater Wetland Systems



#	Threats to Bering Sea Ecoregion Coastal Lagoons and Freshwater Wetland Systems		Reduced migratory bird use	Reduced breeding bird use & success	Reduced populations of juvenile fish	Habitat loss	-	-	-	-	Threat to System Rank
1	Coastal lagoons & freshwater wetland systems		*Low*	*Low*	*Low*	*Low*	-	-	-	-	
1	Road & infrastructure development	Contribution	Low	Low	Low	Medium					Low
		Irreversibility	Very High	Very High	Very High	Very High					
		Override									
		Source	Medium	Medium	Medium	High	-	-	-	-	
		Combined Rank	Low	Low	Low	Low	-	-	-	-	
2	Oil spill	Contribution	Medium	Medium	Medium						Low
		Irreversibility	High	High	High						
		Override									
		Source	Medium	Medium	Medium	-	-	-	-	-	
		Combined Rank	Low	Low	Low	-	-	-	-	-	
3	Oil or gas development	Contribution	Medium	Low	Low	Medium					Low
		Irreversibility	Very High	Very High	Very High	Very High					
		Override									
		Source	High	Medium	Medium	High	-	-	-	-	
		Combined Rank	Low	Low	Low	Low	-	-	-	-	

3.10 Maritime Insular Tundra

The following resources on maritime insular tundra ecosystems were compiled for the first iteration of this Strategic Action Plan for the Bering Sea:

- Documentation for Viability Table (E5S Planning Tool)
- Threats to Bering Sea Ecoregion Maritime Insular Tundra Ecosystems (Table A11)

Select References for Bering Sea Ecoregion Insular Maritime Tundra Ecosystems

Barker, M., D. Kautz, and J.D. Swanson. 1992. The effects of reindeer grazing on lichen tundra Nunivak Island, Alaska. American Journal of Botany 79(6 SUPPL): 59

Bevanger, K., and H. Broseth. 2000. Reindeer *Rangifer tarandus* fences as a mortality factor for ptarmigan *Lagopus* spp. Wildlife Biology 6(2): 121-127

Klein, D.R. 1987. Vegetation recovery patterns following overgrazing by reindeer on St. Matthew Island Alaska. Journal of Range Management 40(4): 336-338

Documentation for Viability Table (E5S Planning Tool): Maritime Insular Tundra

Conservation Target: Maritime insular tundra

Category: Condition

Key Attribute: Community composition and structure

Indicator: % of area impacted by grazing measured by plot surveys

Indicator Ratings:

Poor:
Fair:
Good:
Very Good:

Current Rating:
Date of Current Rating:

Desired Rating:
Date for Desired Rating:

Conservation Target: Maritime insular tundra

Category: Condition

Key Attribute: community composition and structure

Indicator: Change in abundance of climate indicator plant species

Indicator Ratings:

Poor:
Fair:
Good:
Very Good:

Current Rating:
Date of Current Rating:

Desired Rating:
Date for Desired Rating:

Conservation Target: Maritime insular tundra

Category: Condition

Key Attribute: Community composition and structure

Indicator: Presence/number of non-native plant species in plot data

Indicator Ratings:

Poor:
Fair:
Good:
Very Good:

Current Rating:
Date of Current Rating:

Desired Rating:
Date for Desired Rating:

Conservation Target: Maritime insular tundra

Category: Size

Key Attribute: Size / extent of characteristic communities / ecosystems

Indicator: Acres lost to facilities, roads, and other development

Indicator Ratings:

Poor:
Fair:
Good:
Very Good:

Current Rating:
Date of Current Rating:

Desired Rating:
Date for Desired Rating:

Threats to Bering Sea Ecoregion Maritime Insular Tundra Ecosystems			Habitat conversion	Altered community composition and structure	-	-	-	-	-	-	Threat to System Rank
2	Maritime insular tundra		*Low*	*Medium*	-	-	-	-	-	-	
1	Road & infrastructure development	Contribution	High								Low
		Irreversibility	Very High								
		Override									
		Source	High	-	-	-	-	-	-	-	
		Combined Rank	Low	-	-	-	-	-	-	-	
2	Overgrazing	Contribution		Very High							Medium
		Irreversibility		Medium							
		Override									
		Source	-	High	-	-	-	-	-	-	
		Combined Rank	-	Medium	-	-	-	-	-	-	
3	Invasive/alien plant species	Contribution		Low							Low
		Irreversibility		High							
		Override									
		Source	-	Medium	-	-	-	-	-	-	
		Combined Rank	-	Low	-	-	-	-	-	-	