UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, MD 20910

JUN 18 2007

Memorandum For: Michael Payne
Chief, Permits, Conservation and Education Division

From: Angela Somma
Chief, Endangered Species Division

Subject: Activities authorized on Steller Sea Lions and Northern Fur Seals Pursuant to the Marine Mammal Protection Act and Section 10(a)(1)(A) of the Endangered Species Act

Enclosed is the National Marine Fisheries Service's (NMFS) Biological Opinion (Opinion), issued under the authority of section 7(a)(2) of the Endangered Species Act of 1973, as amended (ESA), on the NMFS Permits, Conservation and Education Division (Permits Division) proposal to issue thirteen permits for studies on Northern fur seals and Steller sea lions. Seven permits would authorize investigations on threatened and endangered Steller sea lions, while the remaining eight permits would authorize studies on Northern fur seals. We understand that these permits would authorize research activities for three years, while your division undergoes a comprehensive review of its Steller sea lion and Northern fur seal research program, and develops a plan for implementing and coordinating Steller sea lion research activities, and develops a plan for strengthening NMFS' permit decision framework. We understand that upon completion of the program review, NMFS intends to adopt policy and guidance to improve the implementation of their program that would result in a) minimizing intrusive handling and sampling of protected species *except* when a particular study or investigation would be expected to contribute to the conservation and recovery of the species, b) greater rigor in the overall decision process to authorize (or not) research activities, and c) a strategy for reviewing and improving program performance, and ensuring program objectives are met. After the above mentioned plans are developed and the program is modified as warranted, NMFS will issue a supplement to the Programmatic Environmental Impact Statement to evaluate new circumstances or new information relevant to implementation of the proposed action, and NMFS' Permits Division will reinitiate consultation under section 7 of the ESA before issuing any new permits or permit amendments.

The attached document summarizes the best scientific information available on the potential impacts of proposed research activities on Steller sea lions and other listed species within the action area. Our review finds that the proposed activities would have no effect on green sturgeon, and white abalone, and may affect, but are not likely to adversely affect the following listed species and their critical habitat (where designated):

California coastal Chinook salmon, Central Valley spring run Chinook salmon, Lower Columbia River Chinook salmon, Upper Columbia River spring-run Chinook salmon, Puget Sound Chinook salmon, Sacramento River winter-run Chinook salmon, Snake

River fall-run Chinook salmon, Snake River spring/summer-run Chinook salmon, Upper Willamette River Chinook salmon, Columbia River Chinook salmon, Hood Canal summer-run chum salmon, Central California coast coho salmon, Lower Columbia River coho salmon, Southern Oregon and Northern California coast coho salmon, Ozette Lake sockeye salmon, Snake River sockeye salmon, Central California coast steelhead, Puget Sound steelhead, Snake River steelhead, Upper Columbia River steelhead, Southern California steelhead, Middle Columbia River steelhead, Lower Columbia River steelhead, Upper Willamette River steelhead, Northern California steelhead, South-Central California coast steelhead, and California Central Valley steelhead, green sea turtle, loggerhead sea turtle, leatherback sea turtle, olive ridley sea turtle, blue whales, bowhead whales, sperm whales, sei whales, humpback whales, fin whales, whales, northern right whales, and southern resident killer whales, and Guadalupe fur seals.

Seven of the proposed permits authorize the directed take of threatened and endangered Steller sea lions throughout their range. Proposed activities include aerial, vessel, and ground surveys, and the capture and handling of individuals to monitor vital rates and other parameters of an individuals health. After reviewing the current status of the endangered western population of Steller sea lions, the threatened eastern population of Steller sea lions, the environmental baseline for the action area, the effects of the proposed research program, and the cumulative effects, our review finds that the research program, as proposed, is not likely to jeopardize the continued existence of the endangered western of Steller sea lion DPS or the threatened Steller sea lion DPS. Critical habitat for this species has been designated for listed Steller sea lions, however, the proposed action is not expected to affect that area and no destruction or adverse modification of that critical habitat is anticipated.

This concludes consultation on the proposed permits. By regulation we are required to reinitiate formal consultation on these actions if: (1) new information reveals effects of this action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (2) the identified action is subsequently modified in a manner that causes an effect to the listed species that was not considered in the Opinion; or (3) a new species is listed or critical habitat designated that may be affected by the identified action.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, MD 20910

JUN 18 2007

Memorandum For: The Record

From: James Lecky
Director, Office of Protected Resources

Subject: Activities authorized on Steller Sea Lions and Northern Fur Seals Pursuant to the Marine Mammal Protection Act and Section 10(a)(1)(A) of the Endangered Species Act]

Enclosed is the National Marine Fisheries Service's (NMFS) Biological Opinion (Opinion), issued under the authority of section 7(a)(2) of the Endangered Species Act of 1973, as amended (ESA), on the NMFS Permits, Conservation and Education Division (Permits Division) proposal to issue thirteen permits for studies on Northern fur seals and Steller sea lions.

As a result of intraservice consultation, NMFS' Permits Division agreed to limit the implementation and scope of their proposed alternative under the Programmatic Environmental Impact Statement, pending the outcome of a comprehensive program review. We understand that upon completion of the program review, NMFS intends to adopt policy and guidance to improve the implementation of their program that would result in a) minimizing intrusive handling and sampling of protected species *except* when a particular study or investigation would be expected to contribute to the conservation and recovery of the species, b) greater rigor in the overall decision to authorize (or not) research activities, and c) a strategy for reviewing and improving program performance, and ensuring program objectives are met. After the above mentioned plans are developed and the program is modified as warranted, NMFS will issue a supplement to the PEIS to evaluate new circumstances or new information relevant to implementation of the proposed action. At which time, we expect NMFS' Permits Division will reinitiate consultation under section 7 of the ESA before issuing any new permits or permit amendments for research on Steller sea lions or Northern fur seals.

The attached document summarizes the best scientific information available on the potential impacts of proposed research activities on Steller sea lions and other listed species within the action area. Our review finds that the proposed activities would have no effect on green sturgeon, and white abalone, and may affect, but is not likely to adversely affect the following listed species and their critical habitat (where designated):
California coastal Chinook salmon, Central Valley spring run Chinook salmon, Lower Columbia River Chinook salmon, Upper Columbia River spring-run Chinook salmon, Puget Sound Chinook salmon, Sacramento River winter-run Chinook salmon, Snake River fall-run Chinook salmon, Snake River spring/summer-run Chinook salmon, Upper Willamette River Chinook salmon, Columbia River Chinook salmon, Hood Canal summer-run chum salmon, Central California coast coho salmon, Lower Columbia River coho salmon, Southern Oregon and

Northern California coast coho salmon, Ozette Lake sockeye salmon, Snake River sockeye salmon, Central California coast steelhead, Puget Sound steelhead, Snake River steelhead, Upper Columbia River steelhead, Southern California steelhead, Middle Columbia River steelhead, Lower Columbia River steelhead, Upper Willamette River steelhead, Northern California steelhead, South-Central California coast steelhead, and California Central Valley steelhead, green sea turtle, loggerhead sea turtle, leatherback sea turtle, olive ridley sea turtle, blue whales, bowhead whales, sperm whales, sei whales, humpback whales, fin whales, whales, northern right whales, and southern resident killer whales, and Guadalupe fur seals.

Seven of the proposed permits authorize the directed take of threatened and endangered Steller sea lions throughout their range. Proposed activities include aerial, vessel, and ground surveys, and the capture and handling of individuals to monitor vital rates and other parameters of an individuals health. After reviewing the current status of the endangered western population of Steller sea lions, the threatened eastern population of Steller sea lions, the environmental baseline for the action area, the effects of the proposed research program, and the cumulative effects, our review finds that the research program, as proposed, is not likely to jeopardize the continued existence of the endangered western of Steller sea lion DPS or the threatened Steller sea lion DPS. Critical habitat for this species has been designated for listed Steller sea lions, however, the proposed action is not expected to affect that area and no destruction or adverse modification of that critical habitat is anticipated.

This concludes consultation on the proposed permit. By regulation we are required to reinitiate formal consultation on these actions if: (1) new information reveals effects of this action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (2) the identified action is subsequently modified in a manner that causes an effect to the listed species that was not considered in the Opinion; or (3) a new species is listed or critical habitat designated that may be affected by the identified action.

National Marine Fisheries Service
Endangered Species Act Section 7 Consultation
Biological Opinion

Agency:	Permits, Conservation, and Education Division of the Office of Protected Resources, National Marine Fisheries Service
Activities Considered:	Activities authorized on Steller Sea Lions and Northern Fur Seals Pursuant to the Marine Mammal Protection Act and Section 10(a)(1)(A) of the Endangered Species Act
Consultation Conducted By:	Endangered Species Division of the Office of Protected Resources, National Marine Fisheries Service
Approved By:	______________________
Date:	JUN 18 2007

Section 7(a)(2) of the Endangered Species Act of 1973, as amended (ESA; 16 U.S.C. 1539(a)(2)) requires each federal agency to insure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of such species. When a federal agency's action "may affect" a protected species, that agency is required to consult formally with the National Marine Fisheries Service (NMFS) or the U.S. Fish and Wildlife Service, depending upon the endangered species, threatened species, or designated critical habitat that may be affected by the action (50 CFR 402.14(a)). Federal agencies are exempt from this general requirement if they have concluded that an action "may affect, but is not likely to adversely affect" endangered species, threatened species, or designated critical habitat and NMFS or the U.S. Fish and Wildlife Service concur with that conclusion (50 CFR 402.14(b)).

NMFS' Office of Protected Resources' Permits, Conservation, and Education Division (Permits Division) in cooperation with NMFS' Alaska Regional Office, Grants Program (Grants Program), initiated formal consultation with NMFS Office of Protected Resources' Endangered Species Division (Endangered Species Division) on their proposal to disperse funds and authorize research on Steller sea lions and Northern fur seals on lands and in waters of the United States from June 15, 2007 through August 1, 2009. In this consultation, the Permits Division acted as the lead agency and fulfilled consultation responsibilities for the Grants Program (see 50 CFR 402.07).

The Permits Division, as the lead action agency, initiated formal consultation because the Steller sea lion and Northern fur seal research program funds and authorizes actions that allow the directed "take" (harm, harassment, pursuit, capture, and collection) of threatened and endangered Steller sea lions and "may affect" other threatened and endangered species, or their designated critical habitat under NMFS' jurisdiction. This document represents the Endangered

Species Division's biological opinion (Opinion) on the Steller sea lion and Northern fur seal research program's proposal to issue permits for federally funded research on Steller sea lions and Northern fur seals for this three-year period, and whether this research program satisfies NMFS' obligations pursuant to section 7(a)(2) of the ESA of 1973, as amended.

This Opinion is based on our review of: NMFS' draft *Steller Sea Lion and Northern Fur Seal Research Programmatic Environmental Impact Statement* (PEIS); past permits issued by the Permits Division for research activities on Steller sea lions and Northern fur seals, including annual, final and special reports submitted by permit holders as part of the terms of the permit; the recovery plan for threatened and endangered Steller sea lions, stock assessments published pursuant to the MMPA; published and unpublished scientific information on the biology and ecology of threatened and endangered sea lions and fur seals, and other sources of information gathered and evaluated during consultation on the proposed activities. This Opinion has been prepared in accordance with section 7 of the ESA and its implementing regulations.

Consultation History

- The Permits Division requested the Endangered Species Division engage in preliminary, technical assistance discussions pursuant to section 7 of the ESA in August 2006 during the initial stages of focus group meetings and developing the draft PEIS.
- In November 2006, the Permits Division provided the Endangered Species Division preliminary draft chapters of the PEIS for review and comment. The Endangered Species Division responded on December 7, 2006 with a series of questions and comments for the Permits Division's consideration.
- In February 2007, the Permits Division released the draft PEIS for public comment, and on February 16, 2007, the Permits Division requested consultation on the Northern fur seal and Steller sea lion research program, submitting the PEIS as a relevant report supporting their initiation request.
- On March 14, 2007, the Endangered Species Division sent a list of comments and questions to assist the Permit's Division in providing relevant data required by 50 CFR 402.14(c), and for consideration in finalizing the PEIS on the Northern fur seal and Steller sea lion research program.
- On March 20, 2007, staff from the Endangered Species Division met with the staff from the Permits Division and staff from the Alaska Fisheries Science Center to discuss the timeline for finalizing the PEIS and issuing the pending research permits.
- On March 23, and on April 4, 2007, the Endangered Species Division received responses to requests for additional information on the program.
- On April 12, 2007, the Endangered Species Division received a revised chapter of the PEIS (Chapter 5), which contained some new information on the proposed alternative including the possible phased implementation of this alternative, some conceptual ideas for coordinating permit and grant reviews, coordinating and monitoring research activities on Steller sea lion and Northern fur seal, a recommendation that a research implementation plan be developed with the assistance of the Marine Mammal Commission and its Committee of Scientific Advisors or a similar body, and a subchapter

on NMFS' compliance with the Animal Welfare Act (AWA) and reliance on Institutional Animal Care and Use Committee reviews for further clarifying the "humaneness" criterion of the MMPA.

- On May 3, 2007, the Endangered Species Division requested copies of the Permit Division's analysis on each of the thirteen permits proposed for issuance under the PEIS. On May 7, 2007, the Permit's Division responded in part to this request for additional information on the thirteen proposed permits. The Permits Division provided additional information on the permits on May 14, 25, 29, and 30.
- On June 13, 2007, NMFS' Permits Division committed to engaging in a comprehensive program review using independent experts to develop a stronger and clearly articulated decision framework for making permit decisions and a research implementation plan for studies on Steller sea lions.

BIOLOGICAL OPINION

Description of the Proposed Action

In December 2005, NMFS first issued a notice to undertake review of its permits and grants programs (collectively, NMFS' research program) for Steller sea lions and Northern fur seals. In February 2007, NMFS issued a draft PEIS examining 4 alternatives for the implementation of the Northern fur seal and Steller sea lion research program. NMFS identified Alternative 4 as the preferred alternative under the draft PEIS, which allows for the expansion of their program and the full implementation of the recommendations in the species' conservation and recovery plans. According to the PEIS, Alternative 4 is preferred because it would lead to a better understanding of Northern fur seals and Steller sea lions, more informed management decisions, and a promising prospect of recovery (NMFS 2007a).

After conducting a critical examination of the Steller sea lion and Northern fur seal research program, the decision-making process used to authorize research permits, and the general classes of activities the program would authorize, NMFS determined that the program would benefit from a stronger, clearly articulated decision framework that promotes a reasoned way to balance competing interests and competing risks to ensure that research activities authorized under the program would not permit an exemption to the protective restrictions imposed by the Marine Mammal Protection Act and the Endangered Species Act for a particular study or investigation *except* when a particular study or investigation would be expected to contribute to the conservation and recovery of the species. In the interim, NMFS is proposing to issue up to thirteen permits authorizing research activities on Steller sea lions and Northern fur seals, limiting authorized activities to three years, which we describe in detail below. During this time, NMFS will not issue new permits nor would NMFS accept or process amendment requests on the thirteen permits.

The purpose of this limited implementation of NMFS' preferred alternative is to allow sufficient time for NMFS to conduct a more comprehensive review of the Steller sea lion and Northern fur seal research program and (a) develop a plan for implementing and coordinating Steller sea lion research activities, and (b) develop a plan for strengthening NMFS' permit decision framework. Upon completion of the program review NMFS will adopt policy and guidance to improve the implementation of their Steller sea lion and Northern fur seal research program that would result in: a) minimizing intrusive handling and sampling of protected species *except* when a particular study or investigation would be expected to contribute to the conservation and recovery of the species, b) greater rigor in the overall decision to authorize (or not) research activities, and c) a strategy for reviewing and improving program performance, and ensuring program objectives are met. After the above mentioned plans are developed and the program is modified as warranted, NMFS will issue a supplement to the PEIS to evaluate new circumstances or new information relevant to implementation of the proposed action, and NMFS' Permits Division will reinitiate consultation under section 7 of the ESA before issuing any new permits or permit amendments. This Opinion represents the Endangered Species Division's evaluation of whether the proposed limited implementation of the proposed action as modified herein, would satisfy NMFS' obligations pursuant to section (7)(a)(2) of the ESA, as amended.

The program allows NMFS to disburse federal funds and issue permits for research activities on two protected species of pinnipeds, Steller sea lions and Northern fur seals. The program is of a continuing nature; however, NMFS is proposing to authorize and fund research on Steller sea lions and Northern fur seals on land and in the waters of the United States from June 15, 2007 through August 1, 2009, until a comprehensive program review can be conducted and the results of that review incorporated into the program. During this period NMFS' Permits Division would issue up to thirteen permits that allow an exemption to the Marine Mammal Protection Act (MMPA; 16 U.S.C. 1361 et seq.) or the ESA (16 U.S.C. 1531 et seq.). Funding for Northern fur seal and Steller sea lion research is administered by the Grants Program and would be limited to the same period as research permits.

NMFS would fund research as it has in the past using a variety of program and directed funds. In the past the Grants Program has relied upon Steller sea lion Research Initiative, comments from NMFS' scientists and constituency panels, and guidance from NMFS' Assistant Administrator to determine the projects that would receive funding. In issuing funding, the AKR Grants Office required that the grantee provide proof that they obtained the necessary permits and that the activities funded would support the core mission and goals of NMFS. Some grants, however, are directed by Congress with "earmarked" funds. Although the two offices, the Permits Division and the AKR Grants Office, work in concert with each other, permitting decisions are explicitly implemented by statute and regulation and form the foundation upon which grants can be issued. Consequently, most of this Opinion focuses on permitting Northern fur seal and Steller sea lion research.

The purpose of the proposed research program on Steller sea lions and Northern fur seals is to *promote the recovery of the species' populations to levels appropriate to justify removal from ESA listings*, and *to delineate reasonable actions to protect the depleted species under the MMPA* (NMFS 2007a). NMFS awards grants to support research on Steller sea lions and Northern fur seals and issues permits to allow an exemption to the prohibition on "takes" of Steller sea lions and Northern fur seals established under the ESA and MMPA**.** The need for research is rooted in fundamental questions related to understanding the biology and ecology of Steller sea lions and Northern fur seals, including population trends, reproductive and mortality rates, foraging behavior, and energetics, as well as other factors that may be limiting the populations, such as habitat loss or degradation, predation, parasitism, and disease. The need for the proposed action stems from the responsibility of NMFS to implement the ESA and MMPA for species under its jurisdiction and facilitate research to: (1) promote recovery, (2) identify factors limiting the population; (3) identify reasonable actions to minimize impacts of human-induced activities; and (4) implement conservation and management actions.

Alternative 4 in the PEIS represents an expansion in the number and scope of activities that NMFS has authorized in the past. As a result of intraservice consultation, NMFS has agreed to engage in a comprehensive review of the research program before full implementation of its preferred alternative, recognizing that pending the outcome of the program review aspects of the preferred alternative would likely warrant modification, a supplemental PEIS, and reinitiation of section 7 consultation. Until this review is completed, NMFS would not authorize new permits other than the thirteen permits described herein. Specific activities proposed for authorization include:

- Aerial surveys
- Vessel-based surveys and observations
- Land-based surveys and observations including "drive" counts, scat collection, operation and maintenance of remote cameras
- Receipt and use of tissue samples from subsistence harvest and stranded animals
- Collection and use of tissue samples from predation events and carcasses found during other research activities
- Disturbance incidental to research on other species or environmental components
- Pursuit, capture, and restraint by various (physical and chemical) methods on land and in water
- Collection of morphometric measurements (weight, length, girth, blubber thickness)
- Collection of tissue samples (blood, skin, blubber, muscle, teeth, stomach contents, vibrissae, hair and nails, etc.)
- Temporary and permanent marking
- Attachment of various external and internal scientific instruments,
- Collection of body composition measurements (bioelectric impedance analysis, labeled isotopes, metabolic chamber)
- Injection of drugs or chemicals other than for sedation/anesthesia/analgesia (Evans blue dye, labeled isotopes, other biomarkers)
- Remote collection of tissue samples
- Temporary removal from the wild and short-term captivity for research activities
- Maintenance and husbandry of captive animals (temporary and permanent captivity)
- Mortality incidental to research activities

In addition to the applicable statutory and regulatory requirements of permit issuance, the Permits Division is proposing to limit the total amount of incidental mortality resulting from their action to 15 percent of the Potential Biological Removal (PBR) for each stock or Distinct

Population Segment (DPS). As proposed, and until new stock abundance estimates are available, the Permits Division would ensure that their funding and permit activities would not result in the annual incidental mortality of more than 35 individual Steller sea lions from the Western DPS and 295 individual Steller sea lions from the Eastern DPS. Similarly, for Northern fur seals, the Permits Division would ensure that their funding and permit activities would not result in the annual incidental mortality of more than 2,182 individuals from the eastern Pacific stock and 27 individuals from the San Miguel Island stock (see Tables 4.8-8 through 4.8-12, 4.8-20 through 4.8-24, 4.8-32 through 4.8-36, and 4.8-44 through 4.8-48 for a description of NMFS' estimates of mortality risks attributable to various study activities [NMFS 2007c]).

LEGAL FRAMEWORK FOR ISSUING PERMITS

Permits to "take" marine mammal species that are not listed as threatened or endangered under the ESA are issued by NMFS pursuant to the MMPA and NMFS' implementing regulations at 50 CFR 216.31-41. Permits to "take" marine mammal species that are listed as threatened or endangered under the ESA are issued by NMFS pursuant to the ESA, the MMPA, and NMFS' implementing regulations at 50 CFR 222.301-309 and 50 CFR 216.31-41. The Permits Division applies the statutory and regulatory standards of the MMPA and the ESA to determine if a permit can be issued.

The basic policy of the MMPA is that certain species and population stocks of marine mammals are, or may be, in danger of extinction or depletion as a result of man's activities, and such species and populations should not be permitted to diminish beyond the point at which they cease to be a significant functioning element of the ecosystem of which they are a part. The policy and purpose of the ESA are that federal agencies shall seek to conserve endangered species and threatened species and shall utilize their authorities to provide a means whereby the ecosystems upon which endangered and threatened species depend may be conserved, and to provide a program for the conservation of such endangered and threatened species. Both statutes recognize that various species of marine mammals (and with respect to the ESA, other plants and animals) were rendered depleted because of human activities, and in so recognizing provide a means for the protection of these depleted animals. The two statutes are, in this manner, inherently complementary, and are designed such that a request for a permit application that does not satisfy applicable ESA criteria usually would not be considered further under the MMPA and vice versa.

Any permit issued under section 104 of the MMPA for the taking of a marine mammal, at a minimum, must specify:

A. The number and kind of animals which are authorized to be taken or imported,

B. The location and manner (which manner must be determined by the Secretary to be humane) in which they may be taken, or from which they may be imported,

C. The period during which the permit is valid, and

D. Any other terms or conditions which the Secretary deems appropriate.

Before any scientific research permit or permit issued for enhancing the survival or recovery of a species can be issued to allow takes of marine mammals protected by the MMPA, an applicant must demonstrate that the following criteria, listed under 50 CFR 216.34(a), are met:

1. The proposed activity is humane and does not present any unnecessary risks to the health and welfare of marine mammals. "Humane" is defined in the MMPA as that method of taking involving the least possible degree of pain and suffering practicable to the mammal involved.
2. The proposed activity, if it involves endangered or threatened marine mammals, will be conducted consistent with the purposes and policies set forth in section 2 of the ESA;
3. The proposed activity by itself, or in combination with other activities, will not likely have a significant adverse impact on the species or stock.
4. Whether the applicant's expertise, facilities, and resources are adequate to accomplish successfully the objectives and activities stated in the application.
5. If a live animal will be held captive or transported, the applicant's qualifications, facilities, and resources are adequate for the proper care and maintenance of the marine mammal.
6. Any requested import or export will not likely result in the taking of marine mammals or marine mammal parts, beyond those authorized by the permit. The activity must also be consistent with all restrictions set forth at 50 CFR 216.41, 42, and 43. The specific issuance criteria for permits for scientific research and enhancement are found at 50 CFR 216.41(b). Accordingly, for the Office Director to issue a scientific research or enhancement permit, the applicant must also demonstrate that:
    1. The proposed activity must further a *bona fide scientific* or *enhancement purpose*. The MMPA defines *bona fide research* as scientific research the results of which (a) likely would be accepted for publication in a refereed scientific journal, (b) are likely to contribute to the basic knowledge of marine mammal biology or ecology; or (c) are likely to identify, evaluate or resolve conservation problems.
    2. If the lethal taking of marine mammals is proposed:
        - ii. Non-lethal methods for conducting the research are not feasible; and
        - iii. For depleted, endangered, or threatened species, the results will directly benefit that species or stock or will fulfill a critically important research need.
    3. Any permanent removal of a marine mammal from the wild is consistent with quota established by the Office Director.
    4. The proposed research will not likely have significant adverse effects on any other component of the marine ecosystem of which the affected species or stock is a part.
    5. For species or stocks designated or proposed to be designated as depleted, or listed or proposed to be listed as endangered or threatened:

i. The proposed research cannot be accomplished using a species or stock that is not designated or proposed to be designated as depleted, or listed or proposed to be listed as threatened or endangered;

ii. the proposed research, by itself or in combination with other activities will not likely have a long-term direct or indirect adverse impact on the species or stock;

iii. the proposed research will either:

A. Contribute to fulfilling a research need or objective identified in a species recovery or conservation plan, or if there is no conservation or recovery plan in place, a research need or objective identified by the Office Director in stock assessments;

B. Contribute significantly understanding the basic biology or ecology of the species or stock, or to identifying, evaluating, or resolving conservation problems for the species or stock; or

C. Contribute significantly to fulfilling a critically important research need.

6. For proposed enhancement activities:

i. Only living marine mammals and marine mammal parts necessary for enhancement of the survival, recovery, or propagation of the affected species or stock may be taken.

ii. The activity will likely contribute significantly to maintain or increasing distribution or abundance, enhancing health or welfare of the species or stock, or ensuring the survival or recovery of the affected species or stock in the wild;

iii. The activity is consistent with:

A. An approved conservation plan developed under section 115(b) of the MMPA or recovery plan developed under section 4(f) of the ESA for the species or stock; or

B. If there is no conservation or recovery plan, with the Office Director's evaluation for the actions required to enhance the survival or recovery of the species or stock in light of the factors that would be addressed in a conservation or recovery plan.

iv. An enhancement permit may authorize the captive maintenance of a marine mammal from a threatened, endangered, or depleted species or stock only if the Office Director determines that:

A. The proposed captive maintenance will likely contribute directly to the survival or recovery of the species or stock by maintaining a viable gene pool, increasing productivity, providing necessary biological information, or establishing animal reserves required to support directly these objectives; and

B. The expected benefit to the species or stock outweighs the expected benefits of alternatives that do not require removal of marine mammals from the wild.

In determining whether to issue a permit for scientific purposes or to enhance the propagation or survival of an endangered marine mammal, in addition to the requirements of the MMPA, NMFS shall specifically consider the following (50 CFR 222.308(c)):

1. Whether the permit would further a bona fide and necessary or desirable scientific purpose or enhance the propagation or survival of the endangered species, taking into account the benefits anticipated to be derived on behalf of the endangered species;
2. The status of the population of the species and the direct and indirect effects of the proposed action on the population;
3. If a live animal is to be taken, transported, or held in captivity, the applicant's qualifications for the proper care and maintenance of the species and the adequacy of the applicant's facilities;
4. Whether alternative non-endangered species or population stocks can and should be used;
5. Whether the animal was born in captivity or was (or will be) taken from the wild;
6. How the applicant's needs, program, and facilities compare and relate to proposed and ongoing projects and programs;
7. Whether the expertise, facilities, or other resources available to the applicant appear adequate to successfully accomplish the objectives stated in the application; and
8. Opinions or views of scientists or other persons or organizations knowledgeable about the species which is the subject of the application or of other matters germane to the application.

Under the ESA, permits exempting the prohibitions of "take" under section 9 may be granted only if NMFS finds that:

1. The permit was applied for in good faith;
2. The permit, if granted and exercised, will not operate to the disadvantage of the endangered species, and
3. Will be consistent with the purposes and policies set forth in section 2 of the ESA.

Finally, NMFS must ensure that any action authorized, funded, or carried out on Northern fur seals and Steller sea lions is not likely to jeopardize the continued existence of any endangered species or threatened species, or result in the destruction or adverse modification of critical habitat. This is done through section 7 consultation. NMFS has the authority to condition the final permit to ensure it meets the minimal requirements of the MMPA, ESA, and the implementing regulations. Monitoring and reporting is also an important and required condition of the final permit whether authorized under the MMPA or the ESA.

MITIGATION AND CONDITIONS OF PERMITS

Typical Permit Conditions for All Permits

Recently, the Permits Division constructed a permit template to standardize the format of the permits they issue for research on marine mammals and endangered species. The permit template was designed to facilitate consistency between permits issued and to assist new permit analysts in writing permit conditions. This section summarizes some of the relevant terms and conditions in the new permit template that the Permits Division would apply to research permits issued under the proposed action authorizing research on Steller sea lions and Northern fur seals. According to the permit, noncompliance with any of the terms constitutes a violation of the permit and is grounds for permit modification, suspension, or revocation, and for enforcement action.

A. Duration of Permit (Excerpts from the Permits Division's permit template)

1. Only listed Personnel listed may conduct activities authorized by the permit through [*month dd, yyyy (≤5 years)*]. This permit expires on the date indicated and is non-renewable. The permit may be extended by the Director of the Office of Protected Resources pursuant to applicable regulations and the requirements of the MMPA and ESA.
2. Researchers must suspend all permitted activities in the event serious injury[1] or mortality[2] of protected species reaches that specified in the permit and the Permit Holder must contact the Chief, NMFS Permits, Conservation and Education Division within two business days. The Permit Holder must also submit a written incident report, after which the Permits Division may grant authorization to resume permitted activities based on review of the incident report and in consideration of the Terms and Conditions of this permit.
3. If authorized take[3] is exceeded, Researchers must cease all permitted activities and notify the Chief, NMFS Permits, Conservation and Education Division (hereinafter "Permits Division") by phone (301-713-2289) as soon as possible, but no later than within two business days. The Permit Holder must also submit a written incident report as described in Condition E.2. The Permits Division may grant authorization to resume permitted activities based on review of the incident report and in consideration of the Terms and Conditions of this permit.
4. The Permit Holder must terminate all research activities under this permit at the end of each [permit year/field season (e.g., December 31)] and request authorization to resume research for each succeeding year. Re-authorization of permitted activities will be based primarily on the Permits Division's evaluation of the annual report required pursuant to Condition E.3. Reauthorization of this permit may be denied or delayed if the annual report has not been received or approved. Authorization of each year's research does not guarantee or imply that NMFS will authorize subsequent years' activities.

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[1] A serious injury is defined by regulation as any injury that will likely result in mortality.

[2] This permit [*allows for /does not allow for]* unintentional serious injury and mortality caused by the presence or actions of researchers up to the limit in *Table X*. This includes, but is not limited to; deaths of dependant young by starvation following research-related death of a lactating female; deaths resulting from infections related to sampling procedures; and deaths or injuries sustained by animals during capture and handling, or while attempting to avoid researchers or escape capture.

[3] By regulation, a take under the MMPA means to harass, hunt, capture, collect, or kill, or attempt to harass, hunt, capture, collect, or kill any marine mammal. This includes, without limitation, any of the following: The collection of dead animals, or parts thereof; the restraint or detention of a marine mammal, no matter how temporary; tagging a marine mammal; the negligent or intentional operation of an aircraft or vessel, or the doing of any other negligent or intentional act which results in disturbing or molesting a marine mammal; and feeding or attempting to feed a marine mammal in the wild. Under the ESA, a "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to do any of the preceding.

B. <u>Number and Kinds of Protected Species, Locations, and Manner of Taking</u>

1. The tables in the appendix attached to this permit outline the number of protected species, by species and stock authorized to be taken, and the locations, manner and time period in which they may be taken.

2. Researchers must comply with the following listed conditions: (List is Permit or taxonomic group specific and may include additional restrictions on the timing, location, and manner in which activities could be conducted).

3. The Permit Holder must comply with all provisions specified within attachment for biological samples collected, obtained, imported or exported under authority of this permit.

4. Researchers must comply with the following conditions related to methods of capture, supervision, care and transportation (List is Permit specific).

C. <u>Reports</u>

1. Annual reports must be submitted for each year the permit is valid. The annual report must describe the activities conducted during the previous permit year and must follow a defined format. These reports are due 90 days after the field season of the calendar year, or 90 days after the anniversary date of permit issuance/

2. Any papers or publications resulting from the authorized activities must be submitted.

3. Incident reports related to serious injury and mortality events, or exceeding authorized takes, must be submitted to the Chief of the Permits Division within two weeks of the incident. The incident report must include a complete description of the events and identification of steps that will be taken to reduce the potential for additional research related mortality or exceedence of authorized take.

4. A final report must be submitted to the Chief of Permits within 180 days after expiration of the permit, or if the research terminates before the permit expires within 180 days of completing the research. A format is defined for final reports.

D. <u>Notification and Coordination</u>

1. The permit holder is required to notify Assistant Regional Administrators for Protected Resources when research activities would occur within their respective regions. Notification must be made two weeks before initiating field trips/season and must include the location of the intended field study and or survey routes, estimated dates of research, and names and roles of participants.

2. To the maximum extent practical, the Permit Holder must coordinate permitted activities with activities of other Permit Holders conducting the same or similar activities on the same species, in the same locations, or at the same times of year to avoid unnecessary disturbance of animals. The appropriate Regional Office may be contacted at the address listed above for information about coordinating with other Permit Holders.

E. <u>Observers and Inspections</u>

1. NMFS may review activities conducted pursuant to this permit. At the request of NMFS, the Permit Holder must cooperate with any such review by:

   a. Allowing any employee of NOAA or any other person designated by the Direct, NMFS Office of Protected Resources to observe permitted activities; and

   b. Providing any documents or other information relating to the permitted activities

Conditions from Past Permits Issued for Pinniped Research

- If a pregnant female dies as a result of the permitted activities, both the female and the unborn pup shall be counted as permit-related mortalities.

- If a lactating female dies as a result of the permitted activities and her dependent pup can be identified, Researchers must immediately contact the NMFS Regional Stranding Network Coordinator [*insert* *address and phone number*] and proceed as directed. If the SNC determines the pup is not a candidate for rehabilitation, the pup is to be counted as a permit-related mortality.

- When working on rookeries, Researchers shall, to the maximum extent practical, ensure pups do not gather in places or a manner that could lead to their suffocation, crushing, drowning, fluid aspiration, or other serious injury or mortality.
- Researchers shall capture and handle pinnipeds in groups small enough that handling and restraint time for each animal is minimized and all animals can be adequately monitored for signs of adverse reactions that could lead to serious injury or mortality.
- Researchers shall immediately cease attempts to approach, capture, restrain, sample, mark, or otherwise handle pinnipeds if there are indications[4] such acts may be life-threatening or otherwise endanger the health or welfare of the animal. To the extent that it would not further endanger the health or welfare of the animal, Researchers may monitor or treat the symptoms as determined appropriate by the PI, CI, or attending veterinarian (e.g., administer reversal agents or attempt resuscitation).
- To the maximum extent practical without causing further disturbance of marine mammals, Researchers shall monitor study sites following any disturbance (e.g., surveys or sampling activities) to determine if any marine mammals have been killed or injured or pups abandoned. Any observed serious injury to or death of a marine mammal is to be reported as indicated in Condition A.2. Any observed abandonment of a dependent marine mammal pup is to be reported to the NMFS Regional Stranding Network Coordinator [*insert address and phone number*].
- Researchers shall conduct activities in a manner that minimizes the possibility of pup abandonment.
- Researchers shall not conduct any activities on or near pinniped rookeries/colonies.
- Researchers shall not conduct any activities on or near pinniped rookeries/colonies until after the peak of pupping season for all species present, when mother-pup bonds are sufficiently well-established to minimize pup abandonment.
- Researchers shall not conduct any activities on or near pinniped rookeries/colonies until pups are weaned.
- When working on rookeries, Researchers shall, to the maximum extent practical, ensure pups do not gather in places or a manner that could lead to their suffocation, crushing, drowning, fluid aspiration, or other serious injury or mortality.
- Researchers shall take reasonable steps to identify and avoid capture and sampling or – disturbance of pregnant and lactating females.
- Researchers must use disposable instruments (i.e., needles or biopsy punches) to the maximum extent practicable;
- For blood sampling, do not exceed three attempts (needle insertions) per site per animal, and not more than 1.0 ml blood per kg body mass per capture event.

PERMIT AMENDMENTS

NMFS' implementing regulations for the MMPA provide guidance on minor and major permit amendments (50 CFR 216.39). A permit may be amended by the Office Director, in response to, or independent of, a request from the permit holder. A major amendment is defined as any change to the permit specific conditions regarding: (i) The number and species of marine

[4] Indications that permitted activities may endanger an animal's health or welfare include animals showing signs of acute or protracted alarm reaction (such as overexertion, constant muscle tensions, abnormal respiration or heart rate) that may lead to serious injury, capture myopathy, other disease conditions, or death.

mammals that are authorized to be taken, imported, exported, or otherwise affected; (ii) The manner in which these marine mammals may be taken, imported, exported, or otherwise affected, if the proposed change may result in an increased level of take or risk of adverse impact; (iii) The location(s) in which the marine mammals may be taken, from which they may be imported, and to which they may be exported, as applicable, and; (iv) The duration of the permit, if the proposed extension would extend the duration of the permit more than 12 months beyond that established in the original permit. A minor amendment means any amendment that is not a major amendment and generally includes such things as changes in study methods or objectives that don't change the risk of the procedure to the individual animal (e.g., changing tag types without changing the weight, shape, size, hydrodynamics, or attachment method), collecting blood for another purpose than originally described but not change the amount collected or the number of individuals from which blood samples are drawn, and extending the duration of the permit less than or up to a year.

NMFS does not intend to accept or process any requests for permit amendments for Steller sea lion and Northern fur seal research between June 15, 2007 and August 1, 2009. No new permits will be issued for research activities on Steller sea lions or Northern fur seals until NMFS has completed a comprehensive program review, issued a supplemental PEIS, and completed section 7 consultation on the revised program.

Potential Serious Injury and Mortality from Research

The Permits Division and NMFS' Alaska Fisheries Science Center, National Marine Mammal Lab (NMML) constructed tables to compare the risk of potential serious injury and research-related mortalities for various research activities across species and alternatives in the PEIS. NMFS estimated the number of animals potentially exposed to a particular research activity, the proportion they expect would respond to the exposure, and then estimated the mortality rate associated with a particular response (see Tables 1 and 2). NMFS compared these estimates with the number of individual animals they expected researchers would request for various investigations, and calculated the number of individuals that would die each year as a result of their exposure to activities authorized by the research program. Estimates of the proportion of animals likely to respond and die from their exposure are based on two primary sources of information-- observed responses of animals during research activities and the best professional judgment of staff at NMML.

After calculating the number of animals likely to die as a result of research activities, NMFS compared the total research-related mortality for each stock against the stock's calculated PBR value. PBR, a construct of the MMPA, was developed as a mechanism to respond to uncertainty associated with assessing and reducing marine mammal mortality incidental to fisheries. The model relies upon abundance data, incorporates a safety factor to account for uncertainties in the data, and uses known or estimated mortality rates as a basis for making management decisions.

In general, the estimated PBR of a stock defines the maximum number of animals "that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population." In particular, PBR was designed to meet the following management goals of the MMPA (Taylor et al. 2000):

- Healthy populations will remain above their optimum sustainable population level for the next 20 years

- Recovering populations will reach their optimum sustainable population number after 100 years
- Populations at high risk will not be delayed in reaching their optimum sustainable population level by more than 10 percent beyond the predicted time that is based on an absence of human-induced mortality

PBR is calculated as the product of three factors: (1) the minimum population estimate of the stock (N_{min}), (2) one-half the maximum theoretical or estimated net productivity rate of the population at a small size (R_{max}), and (3) a recovery factor (F_R) for the stock. The PBR model is based on the concept that each stock will have a natural ability to expand if it has a positive value for net production (gross reproduction minus natural mortalities). The idea behind PBR is to prevent known human-caused mortalities from creating a net production loss. The PBR calculation contains provisions to account for uncertainty and is designed to protect a larger fraction for net production of depleted and listed stocks through the use of defined recovery factors. Depending upon the status of the stock, the F_R is set between 0.1 and 1.0.

For endangered stocks, it is assumed that an F_R set at 0.1, is sufficient to account for uncertainty in knowledge about the population such that 90 percent of the endangered stock's annual net production is reserved for recovery of the stock. Through a series of extensive simulation modeling, NMFS has calculated that keeping known human-caused mortality at or below PBR calculated with a recovery factor of 0.1 would increase the recovery time of endangered marine mammals by no more than 10 percent (Wade 1998). For threatened and depleted stocks, it is assumed that an F_R set at 0.5 is sufficient to account for uncertainty in knowledge about the population such that 50 percent of the stock's annual net production is reserved for recovery. However, NMFS set F_R at 0.75 for the threatened Eastern DPS of Steller sea lions because the population trend has been increasing for almost 20 years. For non-depleted stocks, F_R is set at 1.0 so that human-caused mortality could account for 100 percent of a stock's annual net production and still not cause a decline in the population.

Since a population's abundance estimate is one of the factors of the product PBR a stock's PBR could change with each new minimum population estimate, which is calculated for most marine mammals on about a two-year cycle. According to the draft PEIS, NMFS intends to limit mortality from research activities at 15 percent of PBR (NMFS 2007a). So as PBR varies, the Permits Division *will calculate the requested and potential incidental mortality, and adjust the permitted take as appropriate, taking into account the total take already authorized in existing permits, to ensure that levels estimated in the PEIS are not exceeded* (NMFS 2007c). In other words, when estimates of population abundance change, as it is published in the most current Stock Assessment Report (SAR) for the stock (see http://www.nmfs.noaa.gov/pr/sars/ for NMFS' SARs), so too would the number of animals that could be seriously injured or killed during research activities (M. Payne, pers. comm., 31 May 2007).

Currently, PBR for the U.S. portion of the western endangered DPS of Steller sea lions is 234 animals, the threatened DPS of Steller sea lions is 2,000 animals, the depleted eastern Pacific stock of Northern fur seals is 15,262 animals, and the San Miguel Island stock of Northern fur seals is 219 animals (Angliss and Outlaw 2007; Carretta et al. 2007). Currently, 15 percent of PBR for research-related mortality represents 35 Steller sea lions from the western endangered DPS, 300 Steller sea lions from the eastern threatened population, 2,289 Northern fur seals from the eastern Pacific stock, and 33 Northern fur seals from the San Miguel Island stock.

Table 1. Estimates of Steller Sea Lions Potentially Exposed and Seriously Injured or Killed by Research Activities (Values below represent the estimates for both the Western DPS and the Eastern DPS of Steller Sea Lions as presented in Tables 4.8-8 through 4.8-12 and 4.8-20 through 4.8-24 of the PEIS [NMFS 2007c]).

Activity	Age Class	Type of effect	Est. proportion affected	Est. mortality rate
Aerial survey	pups	Observed mortality during activity	---	0
		Alert	0.05	0
		Enter water	0	0.001
		Injured during disturbance	0.001	0.05
	non-pups	Observed mortality during activity	---	0
		Alert response	0.05	0.0
		Enter water	0.01	0.0001
		Injured during disturbance	0.0001	0.02
Vessel surveys	pups	Observed mortality during activity	---	0
		Alert response	1	0.0
		Enter water	0	0.001
		Injured during disturbance	0.01	0.05
	non-pups (breeding season)	Observed mortality during activity	---	0
		Alert response	1	0
		Enter water	0.1	0.0001
		Injured during disturbance	0.0001	0.02
	non-pups (non-breeding season)	Observed mortality during activity	---	0
		Alert response	1	0
		Enter water	0.3	0.0001
		Injury during disturbance	0.0001	0.02
On land	pups	Observed mortality during activity	---	0
		Alert response	0.05	0
		Enter water	0	0.001
		Injured during disturbance	0.001	0.05
	non-pups	Observed mortality during activity		0
		Alert response	0.05	0
		Enter water	0.01	0.0001
		Injured during disturbance	0.0001	0.02
On rookeries during breeding season (ground counts, scats, captures)	pups	Observed mortality during activity	---	0
		Alert response	1	0
		Enter water	0.01	0.001
		Injured during disturbance	0.001	0.05
	*Roundups for branding**	Observed mortality during activity	1	.001/.007
	non-pups	Alert response	1	0
		Enter water	0.9	0.0001
		Injured during disturbance	0.0001	0.02
Haulouts, rookeries non-breeding (scats, resights, captures)	pups	Observed mortality during activity		0
		Alert response	1	0
		Enter water	0.9	0.0001
		Injured during disturbance	0.0001	0.02
	non-pups	Observed mortality during activity		0
		Alert response	1	0
		Enter water	0.9	0.0001
		Injured during disturbance	0.0001	0.02
Capture/physical restraint	pups	Observed during activity	---	0
		Unobserved/post-capture	---	0.001
	non-pups	Observed during activity	---	0.002
		Unobserved/post-capture	---	0.0001
Capture/chemical anesthesia (inhalable agent-isoflurane)	pups	Observed during activity	---	0
		Unobserved/post-capture	---	0.001
	non-pups	Observed during activity	---	0.004
		Unobserved/post-capture	---	0.0001

Capture/chemical anesthesia (injectable)	non-pups	Observed during activity	---	0.034
		Unobserved/post-capture	---	0.011
Capture/chemical sedation (injectable [e.g valium])	non-pups	Observed during activity	---	0
		Unobserved/post-capture	---	0.0001
Intentional lethal take or permanent removal	pups	Observed during activity	---	1
	non-pups	Unobserved/post-capture	---	1
Permanent mark/hot branding	pups	Observed during activity	---	0
		Unobserved/post-capture	---	0.002
	non-pups	Observed during activity	---	0
		Unobserved/post-capture	---	0.0001
Low risk procedures	pups	Observed during activity	---	0
		Unobserved/post-capture	---	0.0001
	non-pups	Observed during activity	---	0
		Unobserved/post-capture	---	0.0001
Medium risk procedures	pups	Observed during activity	---	0
		Unobserved/post-capture	---	0.0002
	non-pups	Observed during activity	---	0
		Unobserved/post-capture	---	0.0002
High risk procedures	pups	Observed during activity	---	0
		Unobserved/post-capture	---	0.001
	non-pups	Observed during activity	---	0
		Unobserved/post-capture	---	0.001
Temporary Captivity				
Capture, Transport, holding & release	pups	Observed during activity	---	---
		Unobserved/post-capture	---	---
	non-pups	Observed during activity	---	0
		Unobserved/post-capture	---	0.0001
Chemical sedation (injectable-eg valium)	non-pups	Observed during activity	---	0
		Unobserved/post-capture	---	0.0001
Permanent mark/hot branding	non-pups	Observed during activity	---	0
		Unobserved/post-capture	---	0.0001
Low risk procedures	pups	Observed during activity	---	0
		Unobserved/post-capture	---	0.0001
	non-pups	Observed during activity	---	0
		Unobserved/post-capture	---	0.0001
Medium risk procedures	pups	Observed during activity	---	0
		Unobserved/post-capture	---	0.0002
	non-pups	Observed during activity	---	0
		Unobserved/post-capture	---	0.0002
High risk procedures	pups	Observed during activity	---	0
		Unobserved/post-capture	---	0.001
	non-pups	Observed during activity	---	0
		Unobserved/post-capture	---	0.001

*The estimated risk of mortality during round-ups for branding is the only activity where risk of injury or serious mortality differed among the Western and Eastern DPS of Steller sea lions (The estimated mortality rate is 0.001 for Steller sea lions in the Western DPS, and 0.007 for Steller sea lions in the Eastern DPS). This is discussed in detail in the Effects of the Proposed Activities.

Table 2. Estimates of Northern Fur Seals Potentially Exposed and Seriously Injured or Killed by Research Activities (Values below represent the estimates for both the Eastern Pacific stock and the San Miguel stock of Northern fur seals as presented in Tables 4.8-32 through 4.8-36 and 4.8-44 through 4.8-48 of the PEIS [NMFS 2007c]).

Activity	Age Class	Type of Effect	Est. proportion affected	Est. mortality rate
Aerial survey*	pups	Observed mortality during activity		0
		Alert response	0.01/0	0.0
		Enter water	0.0001/0	0.001
		Injured during disturbance	0.00005/0	0.05
	non-pups	Observed mortality during activity		0
		Alert response	0.01/0	0.0
		Enter water	0.005/0	0.0001
		Injury during disturbance	0.00001/0	0.02
On land (catwalks, tripods, cliffs)	pups	Observed mortality during activity		0
		Alert response	0.05	0.0
		Enter water	0.0001	0.001
		Injured during disturbance	0.00005	0.05
	non-pups	Observed mortality during activity		0
		Alert response	0.05	0.0
		Enter water	0.005	0.0001
		Injured during disturbance	0.00001	0.02
Activities involving pup roundups	pups	Observed mortality during activity		0.00001
		Alert response	1	0.0
		Enter water	0.01	0.001
		Injured during disturbance	0.001	0.05
	non-pups	Observed mortality during activity		0.0
		Alert response	1	0.0
		Enter water	0.8	0.0001
		Injury during disturbance	0.0005	0.02
Activities involving clearing rookery/haulout	pups	Observed mortality during activity		0.00001
		Alert response	1	0.0
		Enter water	0.05	0.0001
		Injured during disturbance	0.0005	0.05
	non-pups	Observed mortality during activity		0.0
		Alert response	1	0.0
		Enter water	0.9	0.0001
		Injured during disturbance	0.0001	0.02
Incidental disturbance during captures in breeding season	pups	Observed mortality during activity		0.0
		Alert response	1	0.0
		Enter water	0.001	0.001
		Injured during disturbance	0.001	0.05
	non-pups	Observed mortality during activity		0.0
		Alert response	1	0.0
		Enter water	0.01	0.0001
		Injury during disturbance	0.001	0.02
Incidental disturbance during captures outside of breeding season	pups	Observed mortality during activity		0.0
		Alert response	1	0.0
		Enter water	0.05	0.0001
		Injured during disturbance	0.0005	0.05
	non-pups	Observed mortality during activity		0.0
		Alert response	1	0.0
		Enter water	0.2	0.0001
		Injured during disturbance	0.0001	0.02
Capture/physical restraint	pups	Observed during activity		0.000
		Unobserved/post-capture		0.001
	non-pups	Observed during activity		0.004
		Unobserved/post-capture		0.0001

Capture/chemical anesthesia (inhalable agent-isoflurane)	non-pups	Observed during activity Unobserved/post-capture	0.004 0.0001
Capture/chemical anesthesia (injectable)	non-pups	Observed during activity Unobserved/post-capture	0.01 0.001
Capture/chemical sedation (injectable-eg valium)**	non-pups	Observed during activity Unobserved/post-capture	0 0.0001

*Estimates of the proportion of Northern fur seals affected by aerial surveys are for the Eastern Pacific stock only. NMFS does not expect any portion of the San Miguel Island stock of Northern fur seals to be affected by aerial surveys, although according to the PEIS 350 non-pups would be exposed to aerial surveys (NMFS 2007c).

*Values for Permanent Marks, Low, Medium and High Risk Procedures, and all procedures for animals held in Temporary Captivity are the same as listed for Steller sea lions and are not repeated here.

Permits Currently Proposed for Authorization Under this Opinion

NMFS' Permits Division is proposing to issue up to thirteen permits for Steller sea lion and Northern fur seal research in June 2007. These permits would authorize research activities through August 1, 2009. Seven permits would authorize investigations on threatened and endangered Steller sea lions, while the remaining eight permits would authorize studies on Northern fur seals. No new permits or permit amendments would be authorized until NMFS has completed a comprehensive program review, adopted new policy and guidance for implementing the research program, conducted a supplemental PEIS, and reinitiated consultation.

Specific study activities currently proposed under the thirteen permits (72 FR 7420) are: aerial surveys (any time of year), vessel surveys (counts and brand re-sighting), ground counts (with incidental scat collection), collection of carcasses and parts of carcasses, behavioral and demographic observations on rookeries, remote monitoring stations on rookeries and haulouts, imaging sea lion/prey interactions with multi-beam sonar, tracking at sea, remote blubber biopsy sampling, and capture and recapture activities. During handling animals would be subjected to the following activities: chemical and/or physical restraint, morphometric measurements [typically includes measurements of length, weight, girth]; the collection of: blood samples; biopsy samples of muscle, blubber, skin, and lesions; fecal loops and culture swabs; milk samples; teeth; vibrissae, hair, or nails. Animals would be marked with temporary or permanent marks such as flipper tags, dye, paint or bleach marks, and/or hot branded. Some captured animals would be fitted with external and surgically implanted scientific instruments such as VHR, SLTDR, UTPR, video system/data logger, sonic tag, and drag/buoyancy blocks, and ARGOS satellite tags. Individuals would be injected with isotopes, Evans blue dye, lavaged and given enemas, put in metabolic chambers for measuring, given ultrasonic imaging and or digital/thermal imaging, and monitored for heart rate, respiration, temperature, and administered post-operative analgesics.

Specifically, NMFS is proposing to issue the following permits under the PEIS this year:

1. *No. 782-1889 to NMFS' Alaska Fisheries Science Center National Marine Mammal Lab (NMML).* NMML requested authorization to measure Steller sea lion population status, vital rates, foraging behavior, and condition in North Pacific Ocean areas including California, Washington, Oregon, and Alaska. Annually in the western DPS, up to 73,000 sea lions may be exposed to aerial surveys, 27,000 to rookery-based activities, and 23,000 to incidental activities. Up to 1,280 could be captured annually, with up to 630 having blood, skin and swab samples collected, 580 hot-branded, and up to 180 blubber and lesion biopsied, tooth and vibrissa removed, be ultrasonically imaged, and subject to stomach intubation or enema. Instruments may be attached on

up to 280 per year, and 880 per year may receive a non-permanent tag or mark. Annually in the eastern DPS, up to 26,000 may be exposed to aerial surveys, and 5,000 to incidental activities. Up to 12 could be captured per year, and have blood, skin, blubber, fecal, and culture samples collected, a tooth and vibrissa removed, hot-brand, tag or non-permanent mark applied, and have an instrument attached. NMML requests authorization for up to 10 research-related mortalities of Steller sea lions per year (not to exceed 5 per year in the western DPS).

2. *No. 358-1888 to the Alaska Department of Fish and Game (ADFG).* The ADFG requested authorization to continue investigating the various hypotheses for the decline or lack of recovery of Steller sea lion in Alaska. The research covers a variety of activities including incidental disturbance during aerial surveys (up to 20,000 individuals per year in the eastern DPS), disturbance of animals on rookeries and haulouts during brand resighting surveys (up to 25,000 individuals annually in the eastern DPS and up to 5,000 individuals annually in the western DPS), and incidental to scat collection, capture for instrument attachment, physiological research and sample collection (up to15,000 individuals in the eastern DPS and 2,000 in the western DPS per year). Up to 800 pups would be hot branded per year for long-term demographic and distribution studies. Up to 280 older animals would be captured per year for physiological assessment, with attachment of scientific instruments to investigate foraging ecology and diving behavior on up to 95 per year. ADFG requests authorization for up to 10 research-related mortalities of Steller sea lions per year (not to exceed 5 per year in the western DPS). Harbor seals, northern fur seals, and California sea lions may be disturbed incidentally during the course of this research due to proximity of isolated individuals to the Steller sea lion study area. Field work will take place during all seasons of the year and throughout the range of Steller sea lions in Alaska (both eastern and western DPS).

3. *No. 881-1893 to the Alaska Sea Life Center (ASLC).* The ASLC requested authorization to characterize the movements, foraging behavior and habitat-associations of northern fur seal pups during their first winter at sea. ASLC proposes to capture and instrument up to 50 northern fur seal pups annually on the Pribilof Islands and Bogoslof Island. Once captured, pups would be physically restrained and sedated for: blood sampling; measurements of body composition (isotope dilution, bioelectric impedance analysis, and ultrasonic imaging of blubber); taking skin, blubber, and muscle biopsies; collecting fecal loops and culture swabs; collecting vibrissae, hair and nails; attachment of flipper tags and marking fur temporarily; and attachment of scientific instruments and placement of internal stomach temperature transmitters. Up to 200 northern fur seals may be captured at sea in the North Pacific and subject to the same list of procedures as above, with the addition that adult females would undergo ultrasonography of the reproductive tract to determine pregnancy. Up to 5,000 fur seals of either sex and any age may be disturbed annually during approaches to the rookery to capture pups, to read flipper tags, and to check previously attached equipment for damage. When possible, fur seals returning to their natal island would be recaptured in subsequent years to remove instruments and to repeat blood collection and measurements of body composition. The ASLC requests authorization for up to four research-related mortalities of fur seals per year.

4. *No. 881-1890 to the ASLC.* The ASLC requested authorization permit to conduct population monitoring and studies on health, nutrition, and foraging behavior of free ranging and temporarily captive Steller sea lions. Research would occur in the Gulf of Alaska and the Aleutian Islands and at the ASLC. The purposes of this research are to provide data on pup and juvenile survival, reproductive rates, diet, epidemiology, endocrinology, immunology, virology, physiology, ontogenetic and annual body condition cycles, foraging behavior, and habitat selection. Individuals may be taken by disturbance associated with capture, remote video studies, scat and carcass collection, and mark resighting (14,000 animals annually); capture, restraint and sampling (610 animals annually); and temporary captivity at ASLC with life history transmitter implantation (30 animals annually). Annually, captured sea lions (640 including those in temporary captivity) will undergo morphometrics measurements, blood and tissue collection, digital imaging, hot-branding, scientific instrument attachment, body condition measurement, whisker sampling, metabolic rate measurement, temporary marking, and x-ray exams. The ASLC requests authorization for up to seven research-related mortalities of Steller sea lions per year. The ASLC also requests authorization to collect an unlimited number of carcasses and hard and soft parts of dead Steller sea lions.

5. *No. 434-1892 to the Oregon Department of Fish and Wildlife (ODFW).* ODFW requested authorization to continue status assessments, and monitor trends in Steller sea lion abundance, ecology, and vital rates in the southern extent of the eastern DPS. Research would occur throughout California, Oregon, and Washington and cover a variety of activities. These activities include incidental disturbance to animals during aerial surveys (500 pups and 1,000 older animals per year), grounds counts and incidental scat collection (2,000 pups and 4,000 older animals per year), as well as captures, sampling, behavioral observations, and monitoring (up to10,000 animals per year). ODFW also proposes to capture and sedate (physically or chemically) up to 200 pups and 10 adults annually for measuring, skin biopsying, flipper tagging or other marking, and hot-branding. In addition to the procedures above, 50 pups and 10 adults annually would have fecal loops and culture swabs collected and 80 pups and 10 adults per year would have scientific instruments attached. ODFW requests authorization for up to 10 research-related mortalities of Steller sea lions per year. Up to 1,000 harbor seals and 5,000 California sea lions may be disturbed annually incidental to this research.

6. *No. 1049-1886 to Kate Wynne.* Ms. Wynne requested authorization to continue studies on the abundance, distribution, and diet of the western DPS of Steller sea lions. Authority is requested to harass animals for aerial surveys (13,000 individuals per year), scat collection (2,000 individuals per year), and land-based (500 individuals per year) and vessel-based (1,000 individuals per year) brand re-sighting activities. Activities would take place throughout the year; however, rookeries would not be approached in June to minimize disturbance during breeding and pupping season. Research would occur in the western and central Gulf of Alaska.

7. *No. 1034-1887 to Dr. Marcus Horning.* Dr. Horning requested authorization to study condition and health status of juvenile Steller sea lions in the western DPS; and, using satellite-linked Life History Transmitters (LHX), will estimate survival rates, and

obtain long-term data on foraging effort and causes of mortality. Over five years, up to 140 juvenile Steller sea lions will be captured, anesthetized, handled and sampled (morphometrics; 3-D photographic imaging; X-ray imaging; ultrasound; deuterium oxide administration; blood, whisker, hair, claw, blubber, and skin sample collections; mucosal swabs; naturally excreted feces), flipper tagged or hot-branded, and external instruments applied. Of those animals, 100 will additionally have internal LHX transmitters surgically implanted. Researchers would implant up to 50 carcasses with the LHX transmitters to assess the effect of the non-independence of two paired tags on the calculation of correction factors. Dr. Horning requests authorization for up to 15 research-related mortalities over five years, not to exceed five in any one year. Dr. Horning also proposes to install remote imaging systems for 3-D photogrammetry at locations in Alaska and Oregon to census animals and monitor body mass, condition, and health trends. Up to 10,500 Steller sea lions may be harassed annually during capture and other activities. California sea lions, harbor seals, and northern elephant seals may also be harassed incidental to activities with Steller sea lions.

8. *No. 715-1883 to the North Pacific Universities Marine Mammal Research Consortium (NPUMMRC).* The NPUMMRC requested authorization to conduct physiological studies on captive northern fur seals to test the hypothesis that changes in food supply or environmental conditions are inducing a state of nutritional stress that is causing changes in survival or reproductive success. Up to 32 fur seal pups from St. Paul Island, AK, would be captured, restrained, and gender determined. Of those 32, up to 16 female pups would have blood samples taken and a veterinary heath exam performed. Of those 16, up to eight pups would be held in temporary enclosures for up to seven days for further health testing (blood sampling, physical exams). Of those eight, six female pups would be transported to the Vancouver Aquarium, Canada, for long-term physiological and nutritional research. During capture operations, up to 185 fur seals may be incidentally disturbed. The NPUMMRC requests up to one research-related mortality over the duration of the permit. While the actual captures will occur in a single year, the NPUMMRC has requested a 5-year permit to allow for flexibility in logistical coordination of the captures.

9. *No. 715-1884 to the NPUMMRC.* The NPUMMRC requested authorization to continue to study the distribution, life history, physiology, and foraging and behavioral ecology of northern fur seals on the Pribilof Islands and Bogoslof Island. Research activities would occur from July to October, annually, and involve harassment of animals for capture, measuring, flipper tagging, coded wire tagging, and blood, skin, blubber and vibrissae sampling (200 pups and 200 older animals per year). The pups would also be injected with tetracycline and be recaptured for age determination. Older animals would also be anesthetized and have a single post-canine tooth removed for aging. The NPUMMRC also requests to capture, measure, and attach scientific instruments to no more than 30 lactating females annually. An additional 5 lactating females per year would be processed as above; however, they would not have scientific instruments attached. Incidental disturbance of up to 1,800 pups and 775 older northern fur seals annually, and 100 Steller sea lions per year is requested. The NPUMMRC requests authorization for up to 10 research-related mortalities of northern fur seals per year. The NPUMMRC would also collect measurements, jaw bones, and teeth from

subsistence hunted animals to assess body size and annual growth increments of northern fur seals.

10. *No. 715-1885 to the NPUMMRC.* The NPUMMRC requested authorization to continue a long-term research program to test various hypotheses for the decline of Steller sea lions in Alaska. The research would result in disturbance of Steller sea lions by the following activities: behavioral and demographic observations (up to 10,000 individuals in the western DPS and 5,000 in the eastern DPS per year), scat collection (up to 40,000 individuals in the western DPS and 15,000 in the eastern DPS per year), collection of carcasses or parts of carcasses (up to 40,000 individuals in the western DPS and 15,000 in the eastern DPS per year), and aerial/boat surveys and camera maintenance (up to 10,000 individuals in the western DPS and 5,000 in the eastern DPS per year). NPUMMRC requests authorization for up to 4 research-related mortalities of Steller sea lions per year. Northern fur seals, California sea lions, harbor seals, Northern elephant seals (*Mirounga angustirostris*), and killer whales may be disturbed incidental to this research. In conjunction with branding conducted by other permit holders the NPUMMRC would also conduct a 2-year study to assess pain and distress associated with hot-branding of Steller sea lions. The study would use 96 pups per year and follow a 2 x2 design: with and without branding, and with and without a post-operative non-steroidal anti-inflammatory analgesic. Pain response would be measured using respiration rate, cortisol concentrations, body temperature, blood pressure, and using behavioral elements including movements and vocalizations.

11. *No. 1118-1881 to the Aleut Community of St. Paul Island.* The Aleut Community of St. Paul Island requested authorization to fulfill their biosampling, disentanglement, and Island sentinel program responsibilities as established under the co-management agreement between NMFS and the Aleut Community. The Aleut Community of St. Paul Island requests authorization for incidental disturbance of up to 550 northern fur seals per year during the collection of biological samples from dead stranded and subsistence hunted marine mammals. These samples would be exported to researchers studying the decline of northern fur seals. Up to 6,500 northern fur seals may be disturbed during disentanglement events. The Island Sentinel program may result in the disturbance of up to 3,400 northern fur seals per year during haulout and rookery observations, monitoring, and remote camera maintenance. Steller sea lions and harbor seals may be disturbed during the course of any of these activities.

12. *No. 1119-1882 to the Aleut Community of St. George Island.* The Aleut Community of St. George Island requested authorization to fulfill their biosampling, disentanglement, and Island sentinel program responsibilities as established under the co-management agreement between NMFS and the Aleut Community. The Aleut Community of St. George Island requests authorization for incidental disturbance of up to 450 northern fur seals per year during the collection of biological samples from dead stranded and subsistence hunted marine mammals. These samples would be exported to researchers studying the decline of northern fur seals. Up to 5,250 northern fur seals may be disturbed during disentanglement events. The Island Sentinel program may result in the disturbance of up to 3,400 northern fur seals per year during haulout and rookery observations, monitoring, and remote camera maintenance. Steller sea lions and harbor seals may be disturbed during the course of any of these activities.

13. *No. 881-1745 to the ASLC*. The ASLC requested authorization to breed captive Steller sea lions at the ASLC, to produce up to four pups, and conduct studies related to gestation, lactation, and pup growth and development. Permit No. 881-1745, issued March 16, 2006 (59 FR 15387), currently allows studies on three adult (one male, two female) captive Steller sea lions held by the ASLC to investigate stress responses, endocrine and immune system function, and seasonal variations in normal biological parameters such as mass and body composition, and conduct of 'research and development' of external tags and attachments for future deployment on free-ranging animals. The purpose of the proposed amendment is to assess physical, metabolic, hormonal, and immunological changes related to gestation, lactation, and pup growth and development. The breeding part of this study may require the transfer of additional captive adult Steller sea lions from facilities in the U.S. or import from facilities in Canada. Offspring produced would be held at the ASLC for long-term physiological studies, or be transferred or exported to other facilities for permanent holding. During gestation the adult animals would be subject to currently permitted sampling procedures, with additional study-specific testing on the samples themselves. Milk samples would be collected from adult females. Offspring produced would be subject to sedation, anesthesia, physical restraint, morphometric measurements, metabolic measurements, collection of urine and feces, blood sampling, and audio and visual recordings (e.g., audio, photographic, video, digital, thermal, radiographic). Offspring would receive training intended to facilitate their voluntarily participation in research activities to minimize the use of physical restraint, sedatives, or anesthetics during sampling. The ASLC requests one research-related mortality of any live-born Steller sea lion during the proposed study. The ASLC proposes that stillborn or spontaneously aborted pups not be considered related to the study or counted against any mortality allowance in their permit.

Approach to the Assessment

NMFS approaches its project specific section 7 analyses through a series of steps. The first step identifies those aspects of proposed actions that are likely to have direct and indirect effects on the physical, chemical, and biotic environment of an action area. As part of this step, we identify the spatial extent of these direct and indirect effects, including changes in the spatial extent over time. The results of this step represent the action area for the consultation. The second step of our analyses identifies the listed resources that are likely to co-occur with these effects in space and time and the nature of that co-occurrence (these represent our exposure analyses). In this step of our analyses, we try to identify the number, age (or life stage, and gender of the individuals that are likely to be exposed to an Action's effects and the populations or subpopulations those individuals represent. Once we identify the listed resources that are likely to be exposed to an action's effects and the nature of that exposure, we examine whether and how those listed resources are likely to respond given their exposure (these represent our response analyses).

The final steps of our analyses—establishing the risks those responses pose to listed resources—are different for listed species and designated critical habitat (these represent our risk analyses). Our jeopardy determinations must be based on an action's effects on the likelihood of survival and recovery of threatened or endangered species as those “species” were listed, which may encompass the biological species, subspecies, or distinction population segments of vertebrate species. Because the survival and recovery of listed species depends on the fate of the populations that comprise them, the viability (probability of extinction or probability of persistence) of listed species depends on the viability of the populations that comprise the species. Similarly, the continued existence of populations are determined by the fate of the individuals that comprise them; populations grow or decline as the individuals that comprise the population live, die, grow, mature, migrate, and reproduce (or fail to do so).

A programmatic review, however, typically analyzes the general environmental consequences of a broad scope of actions or policy alternatives under consideration by an agency program (see NOAA Administrative Order 216-6, May 1999, for guidance on programmatic evaluations conducted pursuant to NEPA). Similarly, interagency (and intra-agency) consultations on programmatic actions (that is, programmatic consultations) focus on the general patterns associated with an agency’s program and the broad scope of actions proposed under the federal agency’s preferred alternative. Subsequent consultations that “tier” off of these programmatic consultations, when warranted, would analyze the project and site specific effects typical of most consultations. Any subsequent section 7 consultations conducted by NMFS personnel would be designed to determine whether and to what degree the specific action under review fits within the general pattern identified in the “parent” or national programmatic consultation, and would determine whether the specific action, is or is not likely to jeopardize the continued existence of endangered and threatened species or result in the destruction or adverse modification of designated critical habitat.

The conceptual model NMFS uses for programmatic consultations focuses on four main elements of an action agency’s program: (1) the decision-making process an action agency proposes to use for specific actions the program will authorize, fund, or carry out; (2) the classes of actions or activities the program would authorize, fund or carry out; (3) the types of intended and unintended consequences that are likely to result from authorized activities; and (4) the mechanisms that improve the program’s implementation over time. We begin our programmatic consultations by recognizing that an agency’s program normally represents the agency’s decision to authorize, fund, or carry out a suite or class of activities that may require specific actions undergo subsequent review and decision-making (or they may not require subsequent review).

An agency’s decision-making process will normally identify certain standards that an action must satisfy before an agency would authorize, fund or carry them out. Generally decision-making involves hard or formal procedures (such as public noticing requirements), soft or flexible information standards (the information an applicant might submit or the information agency personnel would gather and review to evaluate a submittal), and outlines how the agency would decide whether or not to authorize, fund or carry out specific actions. Typically an agency’s decision-making process is shaped to respond to:

a. the statutory and regulatory standards an action must satisfy before the agency would authorize, fund, or carry them out

b. any data and other information the agency must gather and evaluate to satisfy their statutory and regulatory requirements, as well as requirements of the Administrative Procedure Act, National Environmental Policy Act, Information Quality Act, and related administrative statutes (e.g., the Paperwork Reduction Act, Regulatory Flexibility Act, etc.);

c. the agency's obligation to review and analyze the relevant information within the context of applicable standards to ensure that specific actions satisfy all applicable statutory and regulatory requirements;

d. the results of the agency's efforts to monitor specific actions the agency has authorized, funded, or carried out, and the consequences of those decisions;

e. and any other feedback mechanisms an agency has created to insure that a program satisfies its statutory mandates, regulatory requirements, and applicable goals and objectives.

Specifically, in consultation we would ask whether and to what degree the decision-making process can insure that actions taken under the program are not likely to, individually or cumulatively, jeopardize the continued existence of endangered or threatened species or are not likely to result in the destruction or adverse modification of designated critical habitat. An agency can satisfy this requirement when the program contains features that: (1) prevent listed resources from being exposed to actions or their direct or indirect effects; (2) mitigate how listed resources respond to that exposure, when listed resources are exposed to the program's actions and their effects; or (3) mitigate the risks any responses pose to listed individuals, populations, species, or designated critical habitat, when listed resources are likely to be exposed and respond to that exposure. Our programmatic consultation would focus on the evidence available to determine whether and to what degree the agency's decision-making process is likely to prevent exposure, or mitigate responses or the risks any responses would pose listed species or their designated critical habitat.

In examining an agency's decision process, we would examine the classes of actions or activities the program would authorize, fund or carry out. During this step of our assessment, we identify the geographic distribution, timing, and constraints of the different classes of activities that would be authorized, funded or carried out by a program. The area directly and indirectly affected by the class of actions that would be authorized, funded or carried-out by a program represents the *action area* of a programmatic consultation.

The next step of our analyses identifies the listed resources that are likely to co-occur in this geographic area, and the nature of their co-occurrence with the classes of activities authorized, funded or carried out by the program. We use the best scientific and commercial data available to identify the intended and unintended consequences that are likely to result from those activities. This step of our assessment is designed to determine whether and to what degree listed resources under our jurisdiction are likely to be exposed to these different classes of activities that would be authorized, funded or carried out under a program. As part of this step we try to identify the populations and subpopulations, ages (or life stages), and gender of the individuals that are likely to be exposed to an action's effects and the populations or subpopulations those individuals represent. Once we conclude that listed resources are likely to be exposed to the effects of a program's action, we examine the scientific and commercial data available to determine whether and how those listed resources are likely to respond given their exposure.

Similar to a project specific consultation, the next step of our analysis in a programmatic consultation establishes the risks that the responses pose to listed species and their designated critical habitat. A programmatic consultation, however, is necessarily focused on whether and to what degree a program can insure that actions taken under the program are not likely to, individually or cumulatively, jeopardize the continued existence of endangered or threatened species and are not likely to result in the destruction or adverse modification of designated critical habitat. Our description of the probable responses and the risks the program poses to listed resources is at the core of our evaluation, and is informed by the program's decision structure and by the general patterns we observed through prior experience with a program or a class of activities.

When individual listed plants or animals are expected to experience reductions in fitness, we would expect those reductions may also reduce the abundance, reproduction rates, or growth rates (or increase variance in one or more of those rates) of the populations those individuals represent (see Stearns 1992). Reductions in one or more of these variables (or one of the variables we derive from them) is a *necessary* condition for reductions in a population's viability, which is itself a *necessary* condition for reductions in a species viability. On the other hand, when listed plants or animals exposed to an action's effects are *not* expected to experience reductions in fitness, we would *not* expect the action to have adverse consequences on the viability of the populations those individuals represent or the species those populations comprise (for example, see Anderson 2000, Mills and Beatty 1979, and Stearns 1992). If we conclude that listed species are not likely to experience reductions in their fitness, we would conclude our assessment.

If, however, we conclude that listed animals are likely to experience reductions in their fitness, we examine whether the program included sufficient safeguards to ensure that the actions they authorize, fund, or otherwise carry out would prevent reductions in an individual's fitness and thereby reduce the viability of the populations those individuals represent (typically measured using changes in the populations' abundance, reproduction, spatial structure and connectivity, growth rates, or variance in these measures to make inferences about the population's extinction risks). For those species likely to be adversely affected by the activities conducted under a program, we would examine their status and the environment in which the species exists (in this Opinion, the *Environmental Baseline* and *Status of the Species* are examined in the section titled *Listed Resources in the Action Area*), in detail, as a point of reference for determining if changes in population viability are likely, and if, in turn, any changes in population viability would be sufficient to reduce the viability of the species those populations comprise.

Evidence Available for this Consultation

To conduct our analyses we considered the information contained in the PEIS (NMFS 2007a,c), the first batch of permits proposed for issuance under the PEIS (72 FR 7420), past permits issued for Steller sea lion and Northern fur seal research, permit modifications, annual, special, and final reports submitted by permit holders, and NOAA Technical Memorandums and stock assessment reports. Past permits and the reports submitted by permit holders allowed us to identify typical permit conditions that NMFS uses to minimize the effect of the research on the subject pinnipeds, the types of study activities that have been conducted in the past, some of the observed responses of the study subjects, and the extent to which the program (and agency) adapted or learned from the actions that were authorized, funded or carried out.

We supplemented this information using electronic searches of literature published in English or with English abstracts using research platforms in the *Online Computer Library Center's* (OCLC) *First Search, CSA Illumina,* and *ISI Web of Science.* These platforms allow us to cross-search multiple databases for journals, open access resources, books, proceedings, Web sites, doctoral dissertations and master's theses for literature on the biological, ecological, and medical sciences. Particular databases we searched for this consultation included *BasicBiosis, Dissertations, ArticleFirst, Proceedings, Aquatic Sciences and Fisheries Abstracts*. Some of the databases provide access to documents published from the 1960s through present, although references for many scientific journals contained in these databases only date back to the 1970s or later. Through these databases we accessed the major journals dealing with marine mammal biology and ecology (for example *Marine Mammal Science, Journal of Mammalogy, Wildlife Research,* and *Canadian Journal of Zoology*).

For our literature searches, we used paired combinations of the keywords: sea lion, fur seal, pinniped, research, mark, recapture, resight, marking, hot branding, marine mammal, stress, disturbance, potential biological removal, and many others including general descriptions of the activities the program has authorized in the past. We acquired references that, based on a reading of their titles and abstracts, appeared to comply with our keywords. If a reference's title did not allow us to eliminate it as irrelevant to this inquiry, we acquired the reference. We supplemented our electronic searches by searching the literature cited sections and bibliographies of references we retrieved electronically to identify additional papers that had not been captured in our electronic searches.

Collectively, this information provided the basis for our determination as to whether and to what degree listed resources under our jurisdiction are likely to be exposed to the different activities that would be authorized, funded or carried out under the proposed research program, and whether and to what degree NMFS' research program can insure that actions taken under the program are not likely to, individually or cumulatively, jeopardize the continued existence of endangered or threatened species or are not likely to result in the destruction or adverse modification of designated critical habitat.

APPLICATION OF THIS APPROACH IN THIS CONSULTATION

In this consultation, we investigated NMFS' proposal to expand their current research program on Steller sea lions and Northern fur seals, which they implement under the authority of the MMPA and the ESA. The program allows NMFS to authorize and fund prospective applicants to undertake studies (and to carry out NMFS' own studies) on Northern fur seal and Steller sea lion, provided these studies would further a bona fide and necessary or desirable scientific need that would promote the protection and recovery of Steller sea lion and Northern fur seal (16 USC 1374(c)).

The proposed program would exempt certain research activities on threatened and endangered Steller sea lion from the prohibitions of "take" under section 9 of the ESA and from the moratorium imposed by the MMPA. The program also exempts certain activities on Northern fur seals from the moratorium of the MMPA. While only permits issued for studying Steller sea lions would authorize the directed (intentional) take of listed species, research directed at either Steller sea lions or Northern fur seals may produce stressors having incidental consequences on the environment. In turn, these stressors could incidentally affect threatened and endangered species and their designated critical habitat. Thus, our review of the proposed research program evaluated not only the effects of the intentional acts on threatened and endangered Steller sea lions, but also the potential of the research program to incidentally affect other threatened and endangered species and their designated critical habitat.

Figure 1 depicts the conceptual model for this programmatic consultation, and the general model of NMFS' decision-making process for the proposed research program. Upon receipt of an application for a research permit, the Permits Division makes a preliminary determination that an application is complete. After which, the Permits Division makes an initial determination pursuant to the National Environmental Policy Act (NEPA) and publishes a notice of receipt in the Federal Register. During the 30-day (minimum) public comment period, NMFS seeks comments on the application from internal and external reviewers (Terbush 2001). Internal and external reviewers commonly include subject-matter experts, NMFS' Science Centers and Enforcement Offices, other federal agencies, and the Marine Mammal Commission. These advisors may propose minimization measures or raise issues to NMFS' Permits Division and the applicant for consideration. These comments, together with published and unpublished papers, white papers, past permits and the conditions applied to those permits, and information contained within monitoring reports submitted by past permit holders, provides the basis for the decision to authorize, fund, or carry out a study (action), or the basis for the decision not to proceed with an action.

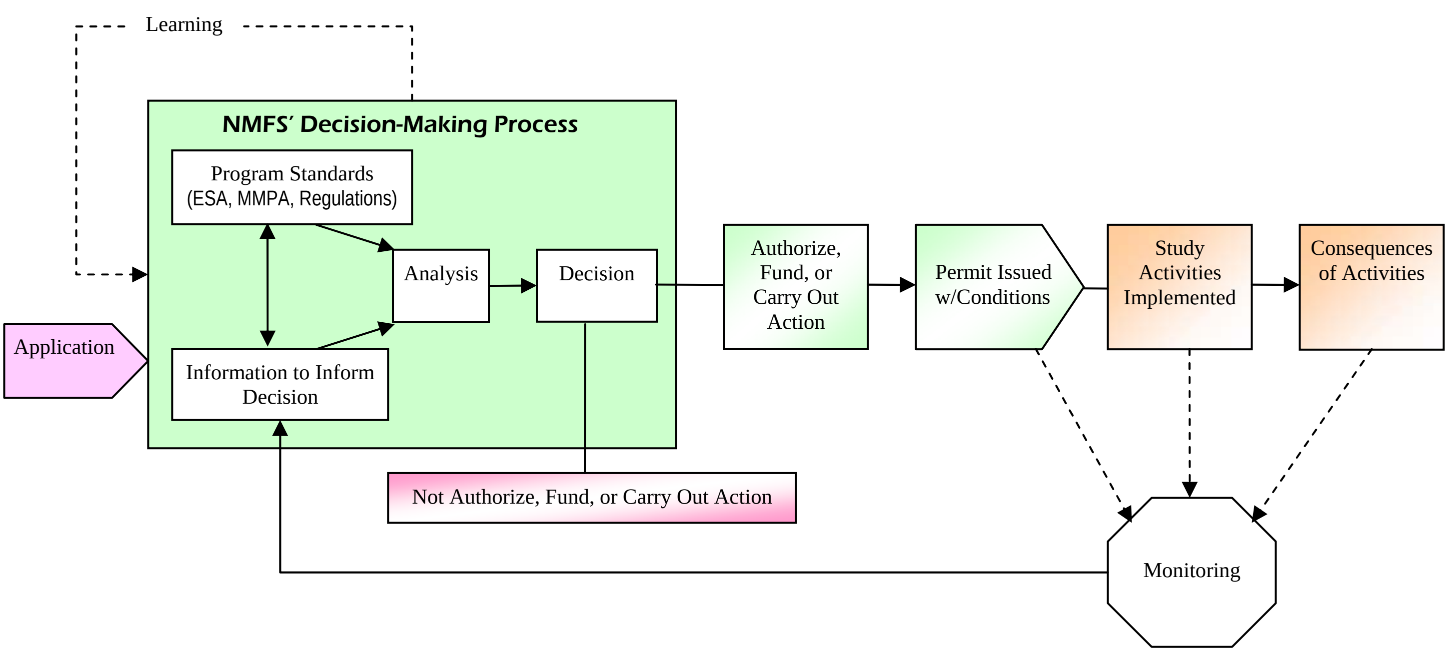


Figure 1. NMFS' Generalized Decision-Making Process for the Research Program

We began our analysis of the proposed research program by examining what constitutes a complete application, and how the Permits Division factors in the substantive decision criteria (otherwise referred to by statute or the implementing regulations as requisite provisions or permit issuance criteria) that must necessarily be satisfied before issuing a permit that would grant an exemption for research activities under the MMPA and the ESA. The permit issuance criteria from the MMPA, ESA, and NMFS' implementing regulations, are listed in Tables 1 through 4 in Attachment A. The first column in each table lists the section of the statute or regulation that identifies the requisite provision or permit issuance criteria. The second column identifies the specific criterion, and column three contains any guidance or statutory definitions intended to clarify attributes of the required criterion. An applicant must demonstrate that they have addressed relevant permit issuance criteria before NMFS would request internal or external comments on the proposed activity (Terbush 2001; M.Payne, pers. comm., April 2007). Accordingly, applicants seeking an exemption for research on non-listed marine mammals must demonstrate that they addressed relevant permit issuance criteria in Tables 1 and 2 of Attachment A, while applicants seeking to conduct research on threatened or endangered marine mammals must demonstrate they addressed relevant permit criteria in Tables 1 through 4 of Attachment A.

According to the PEIS, the intent of the research the Permits Division authorizes is to contribute to the recovery and conservation of listed marine mammals. This statement of intent echoes language of the ESA and the purpose of the MMPA, which is to conserve and protect marine mammals. Section 7 of the ESA, however, requires agencies to insure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of endangered species or threatened species or result in the destruction or adverse modification of critical habitat that has been designated for these species. Given the intended purpose of the proposed research program, a program that is designed to promote the recovery and conservation of endangered or threatened marine mammals, the intended and unintended consequences of permits or funds authorized by such a program should never, individually or cumulatively, jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of designated critical habitat.

A program that is designed to contribute to the recovery and conservation of listed species would be expected to give listed species the full protections of the ESA *except* when a particular study or investigation is likely to contribute to the recovery of the conservation of the species. That is, the program would presume that an activity directed at a listed species is harmful, unless the activity has been demonstrated not to be harmful, rather than assume that an activity is not harmful unless it has been demonstrated to be harmful. Such a program would be expected to apply a decision-making process that would be designed to protect listed resources sufficient to insure that any activities it authorizes will not jeopardize listed species or result in the destruction or adverse modification of critical habitat. (The alternatives, a program that either (a) applies a decision-making process that presumes that any activities it authorizes are not likely to jeopardize listed species unless and until it receives a jeopardy biological opinion or (b) applies a decision-making process that protects listed resources but not sufficient to insure that any activities is authorizes will not jeopardize them, are as likely to contribute to the problems facing endangered or threatened species than promote their recovery and conservation.)

During this consultation, we evaluated the evidence available on the process the Permits Division uses to decide whether or not to issue a permit; the criteria the Permits Division applies in that decision-making process; the data and other information the Permits Division gathers, analyzes, and considers during the decision-making process; and the information the Permits Division gathers about the permits it issues to evaluate the validity of its conclusions to determine whether and to what degree the decision-making process insure that any activities it authorizes are not likely to, individually or cumulatively, jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat that has been designated for them. Specifically, this consultation focused on the decision-making process the Permits Division proposes to apply to the Steller sea lion and Northern fur seal research program for the next ten years (2007-2017).

We concluded that the program does not contain features that would necessarily prevent the exposure of non-targeted (incidentally affected) endangered or threatened species, or their designated critical habitat to authorized activities and their direct and indirect effects. However, our review of the classes of activities typically authorized by the program in the past, and proposed in the draft PEIS did reveal that most non-target threatened or endangered species, and their designated critical habitat under NMFS' jurisdiction and in the action area, are not likely to be adversely affected by the proposed action. Our reasoning for these conclusions is presented in the *Listed Resources in the Action Area* section of this Opinion.

Our assessment revealed that there are several components of the program that would prevent the unnecessary exposure of targeted species, and provide the foundation for ensuring the research program is not likely to authorize activities that would individually or cumulatively, jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat that has been designated for them. Moreover, NMFS is aware that it must necessarily "proceed with sensitivity and careful judgment so that populations under study will not be affected adversely by the studies that are intended to protect them (Animal Care and Use Committee 1998)." At the same time, the decision before NMFS under the Steller sea lion and Northern fur seal research program is whether or not to permit an exemption to the protective restrictions imposed by the MMPA and the ESA for a particular scientific project is inherently complex. First, each scientific research permit must necessarily meet the minimum criteria established by statute and regulation (see Tables 1 though 4, Appendix A). Second, the best scientific and commercial data standard must inform the collection and evaluation of information before the agency decides to authorize or fund a research action; and, third, the intended and unintended consequences of permits or funds authorized by such a program should never, individually or cumulatively, jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of designated critical habitat.

As a matter of practice, during interagency consultation NMFS considers scientific and commercial data "available" if we (i.e., the consulting agency or the action agency), or the applicant (prospective permittee) knows of the data or is in a position to know of the data given the institutional, electronic, and other resources available to them. We will rely on a variety of other biological and ecological information. In consultation NMFS determines which of these are "best" by (1) critically appraising the methods that generated the data (the rigor and power of the study design, the execution and transparency of the study design, the size of the samples produced by the study, the reliability of the measurements taken in the study, the timescale for the study and whether baseline surveys were conducted), and (2) identifying the data that are most representative of the circumstances associated with a consultation. Over the course of this consultation we were interested in learning how the Permits Division evaluates the "best" scientific and commercial data "available" in making their decision to issue or not issue a permit.

We requested examples of how NMFS' Permits Division and Grants Program generally analyzes the requests for funding and permits before them, and we specifically requested their evaluation of the thirteen permits proposed for authorization to supplement the analysis contained within the PEIS. Specifically, we were interested in the Permits Division's reasoned reflection of how requested activities met permit issuance criteria, how empirical studies including graduate studies (like Kucey 2005, and others) that contain information suggesting that endpoints other than mortality (e.g. changes in distribution, resting, feeding, breeding and movement patterns, growth rates, maternal attendance patterns, and other essential behaviors) may be important to the essential behavior patterns of Steller sea lions and how they were weighed against the best professional judgment of seasoned field biologists, and how these influenced the decision to authorize or not authorize a specific permit.

Decisions made under the research program must be wary of two types of errors: (1) Authorizing and funding research on a protected species, when the research would result in harming the species' survival and recovery in the wild; and (2) failing to authorize or fund research that would be useful in promoting the conservation of the species. For example, if NMFS doesn't have a good idea of what the effect of a particular study activity is, we may falsely conclude that it would not reduce the species' likelihood of surviving and recovering in the wild when, in fact, it would (i.e., false acceptance a permit is warranted; see Table 4). Conversely, if we don't understand how a species may respond to research activities, we may erroneously determine a study will adversely affect the species when, in fact, it will not (i.e., falsely reject a permit; see Table 4). If NMFS incorrectly concludes that a particular research project would have no effect on the species when one actually exists, or if we conclude a particular research activity is more valuable than it actually is, we risk allowing research activities to go forward that should not be allowed because they cause undue harm to the species. If we incorrectly conclude an effect of a particular research activity or set of activities when none are likely and subsequently withhold funding or a permit to conduct the activity, we may risk losing important opportunities for research and new information that may lead to improved management of anthropogenic factors affecting the protected species.

Table 3. Potential Results of Decisions under the Research Program

	Permit Decision	
Effect of Permitted Action	Permit Issued	Permit Denied
Would harm survival and recovery	*Decision Erred--False Acceptance*- claim no effect when one exists, leads to under protection of species possibly reducing survival and recovery	Correct Decision
Would provide information that promotes conservation and recovery	Correct Decision	*Decision Erred-False Rejection*- protects a species more than necessary, lost opportunity for meaningful scientific information

Clearly any erroneous decision may be costly to the species, the agency, and stakeholders (Mapstone 1995; NRC 1995; Burgman 2005). With the Steller sea lion and Northern fur seal research program NMFS necessarily must be concerned with both types of decision errors and try to avoid both. Simply, "if not examined explicitly, this asymmetric error structure can bias decisions under the act to the detriment of endangered species…(NRC 1995).” On the one hand, any foregone opportunity for important research that may result when a permit or funding is unnecessarily denied may not always present itself again particularly in light of increasing budgetary constraints faced by most research programs and agencies. As a result, we could lose an important opportunity for identifying and managing threats to the species, and actions that may promote recovery.

However, when the agency designates a species as depleted under the MMPA or lists it as threatened or endangered under the ESA then the agency articulated a clear concern for the species’ status and abundance. A decision framework concerned with the protection of a vulnerable species and avoiding overconfident conclusions that an action does not cause harm would begin by assuming that an activity is harmful until it is demonstrated otherwise. Protection would be more likely if the burden of proof were to show that an activity would not harm rather than would cause harm (NCR 1995). At a minimum, in making a permit decision there must be a long-term benefit (an increased likelihood of better management decisions that would promote recovery resulting from any increased knowledge of the species and its ecology) that overrides any harm to the individuals, the populations they comprise, and the species that the populations comprise. As a result of our intraservice consultation, the Permits Division has concluded that the program would benefit from a stronger, more clearly articulated decision framework that would assist permit analysts in recognizing and evaluating conflicting or competing information, ensure internal consistency, and weigh the consequences of potential decision and investigational (study design) errors. Consequently, NMFS is committed to taking a hard look at their permit decision process and the Steller sea lion and Northern fur seal research program. In the interim, only a limited number of permits would be issued.

As a result of the NMFS commitment to conduct a comprehensive review of the program, our assessment shifted to the permits proposed for authorization. If, based on the information contained within the permits, we expected the activities NMFS is proposing to authorize are not likely to produce potential stressors that would reasonably be expected to act directly on individuals of a listed species or to have direct or indirect consequences on their environment *or* listed resources are not likely to be exposed to the stressors produced by the action, then we concluded that the proposed activities would have “no effect” on those listed resources. If, based on this information, we determined that listed individuals may be exposed to activities authorized by the research program, but (a) the probability of exposure to those stressors is so small that it would not be reasonable to expect exposure to occur, (b) there is no possibility or only a very small possibility that the individual would respond when exposed to the stressor, (c) there is no possibility or only a small probability of a negative response even if an individual does exhibit a respond to their exposure, or (d) there is no possibility or only a small probability that the individual would experience a reduction in individual performance (or fitness), then we concluded that NMFS’ research program is “not likely to adversely affect” those listed resources (see *Listed Resources in the Action Area, Listed Species Not Likely to be Adversely Affected*).

Where we concluded that listed animals were likely to experience reductions in their fitness, we examined whether the program included sufficient safeguards to ensure that the actions they authorize, fund, or otherwise carry out would prevent reductions in an individual’s fitness from reducing the viability of the populations those individuals represent (typically measured using changes in the populations’ abundance, reproduction, spatial structure and connectivity, growth rates, or variance in these measures to make inferences about the population’s extinction risks [see *Species Likely to be Adversely Affected*]). For those species likely to be adversely affected by the activities conducted under the research program, we examined their status and the environment in which the species exists, in detail, as a point of reference for determining if changes in population viability are likely, and if, in turn, changes in population viability would be sufficient to reduce the viability of the species those populations comprise.

Action Area

The action area is defined as all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action (50 CFR 402.02). The action area for this consultation encompasses the land and waters where the research on Northern fur seals and Steller sea lions would be authorized by NMFS. This includes coastal and estuarine waters and limited portions landward of the entire west coast of the United States, from southern California to Alaska, and portions of the United States' Exclusive Economic Zone.

The extent of the action area considered herein is defined by the research activities proposed for authorization in the thirteen permits. While the majority of research activities would focus on animals located on rookeries, haulouts, and in waters surrounding these areas, the action area would include transit routes to the study sites (e.g., boat transiting from various ports along the western seaboard). The action area extends to transit routes because water travel may result in incidental indirect effects on non-target aquatic species, such as whales. The Alaska Sea Life Center, a captive animal facility, is also included in this action area.

Status of the Species and Environmental Baseline

The action area contains a number of threatened and endangered species, and their designated critical habitat (together, listed resources), under NMFS jurisdiction that could be exposed to the activities authorized by the Steller sea lion and Northern fur seal research programs. The following are synopses of the current state of knowledge on the life history, distribution, and population trends of listed species within the action area that NMFS expects could be exposed to activities authorized by the proposed program.

The *Status of the Species* and the *Environmental Baseline*, typically two separate sections in a Biological Opinion, are combined here. By regulation, environmental baselines for biological opinions include the past and present impacts of all state, Federal or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process (50 C.F.R. 402.02). Because the action area for this consultation encompasses the known distribution of the threatened and endangered populations of Steller sea lions, we have combined our summaries of the Status of the Species with the Environmental Baseline. Our summary provides the information on the biology and ecology of Steller sea lions that is necessary to (a) understand the species' status and trend in terms of its risk of extinction, and (b) provide the background necessary to understand information presented in the *Effects of the Action*, and *Cumulative Effects* sections of this biological opinion.

Table 4. Listed Species and Critical Habitat (denoted by asterisk) in the Action Area

Common Name (Distinct Population Segment or Evolutionarily Significant Unit)	Scientific Name	Status
Cetaceans		
Bowhead whale	*Balaena mysticetus*	Endangered
Blue whale	*Balaenoptera musculus*	Endangered
Fin whale	*Balaenoptera physalus*	Endangered
Humpback whale	*Megaptera novaeangliae*	Endangered
Killer Whale (Southern Resident*)	*Orcinus orca*	Endangered
Northern right whale	*Eubalaena japonica*	Endangered
Sei whale	*Balaenoptera borealis*	Endangered
Sperm whale	*Physeter macrocephalus*	Endangered
Pinnipeds		
Guadalupe fur seal	*Arctocephalus townsendi*	Threatened
Steller sea lion (Eastern*)	*Eumetopias jubatus*	Threatened
Steller sea lion (Western*)		Endangered
Marine Turtles		
Green sea turtle	*Chelonia mydas*	Threatened
Leatherback sea turtle *	*Dermochelys coriacea*	Endangered
Loggerhead sea turtle	*Caretta caretta*	Threatened
Olive ridley sea turtle	*Lepidochelys olivacea*	Threatened
Anadromous Fish		
Chinook salmon (California coastal*)	*Oncorhynchus tschawytscha*	Threatened
Chinook salmon (Central Valley spring-run*)		Threatened
Chinook salmon (Lower Columbia River*)		Threatened
Chinook salmon (Upper Columbia River spring-run*)		Endangered
Chinook salmon (Puget Sound*)		Threatened
Chinook salmon (Sacramento River winter-run*)		Endangered
Chinook salmon (Snake River fall-run*)		Threatened
Chinook salmon (Snake River spring/summer-run*)		Threatened
Chinook salmon (Upper Willamette River*)		Threatened
Chum salmon (Columbia River*)	*Oncorhynchus keta*	Threatened
Chum salmon (Hood Canal summer-run*)		Threatened
Coho salmon (Central California coast*)	*Oncorhynchus kisutch*	Endangered
Coho salmon (Lower Columbia River*)		Threatened
Coho salmon (Southern Oregon & N. California coast*)		Threatened
Green sturgeon (Southern)	*Acipenser medirostris*	Threatened
Sockeye salmon (Ozette Lake*)	*Oncorhynchus nerka*	Threatened
Sockeye salmon (Snake River*)		Endangered
Steelhead (Central California coast*)	*Oncorhynchus mykiss*	Threatened
Steelhead (Puget Sound)		Threatened
Steelhead (Snake River*)		Threatened
Steelhead (Upper Columbia River*)		Threatened
Steelhead (Southern California*)		Threatened
Steelhead (Middle Columbia River*)		Threatened
Steelhead (Lower Columbia River*)		Threatened
Steelhead (Upper Willamette River*)		Threatened
Steelhead (Northern California*)		Threatened
Steelhead (South-Central California coast*)		Threatened
Steelhead (California Central Valley*)		Threatened
Marine Invertebrates		
White abalone	*Haliotis sorenseni*	Endangered

Common Name (Distinct Population Segment or Evolutionarily Significant Unit)	Scientific Name	Status
Proposed for Listing		
North Pacific right whale	*Eubalaena japonica*	Proposed Endangered

Although the proposed action would authorize activities that will occur in areas and during times where the listed resources listed in Table 1 are likely to occur, the Endangered Species Division believes that for several species the probability of exposure to the direct or indirect effects of the proposed action, or any interrelated on interdependent actions is so small that it would not be reasonable to expect exposure to occur. In a few instances, we suspect that a small number of individuals of the listed species or a portion of their critical habitat could potentially be exposed to incidental effects of the activities authorized by the research programs. We believe that the proposed activities authorized by the research programs "may affect, but are not likely to adversely affect" these listed resources for one or more of the following reasons: (a) there is no possibility or only a very small possibility that the individual would respond when exposed to the stressor, (b) there is no possibility or only a small probability of a negative response even if an individual does respond to their exposure, or (d) there is no possibility or only a small probability that the individual would experience a reduction in individual performance (or fitness). Where we have reached these conclusions for a particular species, we provide a summary of our reasons for these conclusions in following section, *Listed Species Not Likely to be Adversely Affected.* Where we have concluded a species is likely to be adversely affected by the proposed action, we provide a more detailed summary of their status and trends to provide a foundation for the remainder of our analysis.

LISTED SPECIES NOT LIKELY TO BE ADVERSELY AFFECTED

As we noted previously in the *Approach to the Assessment* these conclusions are based on our evaluation of past permits and the conditions applied to those permits, information contained within monitoring reports submitted by past permit holders, and thirteen permits proposed for issuance under the PEIS (72 FR 7420). Using this information we can broadly characterize the sources and types of potential stressors to expect from the activities authorized by the Northern fur seal and Steller sea lion research programs according whether they will occur on land, in water, or in the air.

Shipboard surveys, vessel transiting between rookeries and haul-outs for the purposes of conducting land-based and sampling of Steller sea lions and Northern fur seals, shipboard sampling, and in-water capture activities using divers are the only in water activities that have been authorized under these programs to date. Vessel operations supporting the research could expose listed species to discharges of chemicals or garbage, ship strikes, and engine and propeller noise. Aerial surveys may expose listed species to visual and auditory disturbances. Most of the activities proposed for authorization however, target individual Northern fur seals and Steller sea lions and are concentrated on land (rookeries and haul-outs). Drive counts of Steller sea lions and Northern fur seals on rookeries and haul-outs, as well as other sources of auditory and visual disturbance (skiff landing, aerial surveys, etc.) may cause these animals to flee into the water surrounding these areas. Consequently, it is possible this could trigger minor disturbances of other listed species in proximity of the haulouts and rookeries.

Anadromous Fish

Pacific Salmon and Steelhead, and their Critical Habitat. Pacific salmon (which includes steelhead) from all ESUs and DPSs occur throughout the action area, and individuals from any ESU may co-occur with a research activity in estuarine and ocean waters. The majority of listed Pacific salmon upon entering estuarine and ocean waters will migrate northward along the west coast, and many will reach the Gulf of Alaska and the Aleutian Peninsula the summer and autumn (Pearcy 1992), where most of the research activities have occurred in the past. The distribution of migrating Pacific salmon smolts is generally influenced by temperature, oceanography, and food availability along the continental shelf, and in late summer and fall they will move to the subartic Pacific where they are widely distributed (Pearcy 1992). Return migrations of adult salmon to natal rivers may not be along the same route as they traveled as smolts (Pearcy 1992). Pacific salmon generally exhibit a wide range of swimming depths, sometimes traveling as deep as 100 meters, and other times traveling at the water's surface (Tanka et al. 2001). Chum salmon fitted with data loggers were recorded making frequent dives from surface waters at depths often between 50 to 100 meters (Tanka et al. 2001). Tanka et al. (2001) showed that the decent phase of recorded vertical movements were generally faster than the vertical rate of ascent. Even though listed Pacific salmon are likely to co-occur with research activities where a few individuals could be exposed to sensory disturbances emanating from the noise of research vessels, shadows cast by the hull, or even minor vessel discharges, we expect that there is only a small probability of such exposure. Nevertheless, if individual Pacific salmon were exposed to these disturbances, we would not expect their exposure to result in anything more than a minor avoidance response that would not result in changes to the individual's fitness.

Critical habitat is designated for each listed ESU of Pacific salmon (see 50 CFR Part 226.210-212 for a complete summary). Some ESUs have had designated critical habitat since the 1990s, but the bulk of the critical habitat was redesignated in 2005. Critical habitat for Central Coast coho salmon and Southern Oregon and Northern California Coast coho salmon is designated to include all river reaches accessible to listed coho within the range of the ESU, except for designated Indian lands. Critical habitat in these ESUs consists of the water, substrate, and adjacent riparian zone of estuarine and riverine reaches. A complete description of counties and hydrological units to which this designation applies is found at 50 CFR 226.10. Critical habitat for 7 ESUs of Pacific salmon in California would not be exposed to the proposed activities.

Critical habitat for twelve ESUs of Pacific salmon in Washington, Oregon, and Idaho is described in detail at 50 CFR 226.12. Within the action area of this consultation critical habitat for these ESUs of Pacific salmon critical habitat are estuarine and nearshore marine areas, including areas contiguous with the shoreline from the line of extreme high water out to a depth no greater than 30 meters relative to mean lower low water. Within these areas, the primary constituent elements are: i) Water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; (ii) Water quality and forage supporting juvenile development; and (iii) Natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks. This includes estuarine, nearshore marine, and offshore marine areas free of obstruction and excessive predation with: water quality quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh and saltwater; natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels; and juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation. While we expect that some research activities may occur within areas designated as critical habitat for the various Pacific salmon ESUs, proposed activities are focused on two species (Steller sea lion and Northern fur seal) and would not result in changes in the conservation value of any primary constituent elements or critical habitat designations.

Based upon the above discussion, we have concluded that the proposed research activities for Northern fur seal and Steller sea lion may affect, but are not likely to adversely affect the following listed Pacific salmon ESUs and their critical habitat:

> California coastal Chinook salmon, Central Valley spring run Chinook salmon, Lower Columbia River Chinook salmon, Upper Columbia River spring-run Chinook salmon, Puget Sound Chinook salmon, Sacramento River winter-run Chinook salmon, Snake River fall-run Chinook salmon, Snake River spring/summer-run Chinook salmon, Upper Willamette River Chinook salmon, Columbia River Chinook salmon, Hood Canal summer-run chum salmon, Central California coast coho salmon, Lower Columbia River coho salmon, Southern Oregon and Northern California coast coho salmon, Ozette Lake sockeye salmon, Snake River sockeye salmon, Central California coast steelhead, Puget Sound steelhead, Snake River steelhead, Upper Columbia River steelhead, Southern California steelhead, Middle Columbia River steelhead, Lower Columbia River steelhead, Upper Willamette River steelhead, Northern California steelhead, South-Central California coast steelhead, and California Central Valley steelhead.

Green Sturgeon. NMFS listed the southern DPS of North American green sturgeon as threatened on April 7, 2006. Sturgeon in this DPS consist of populations in California's coastal and Central Valley, south of the Eel River, with the only known spawning population in the Sacramento River (Adams et al. 2002; NMFS 2005). Green sturgeon disperse widely off the coastal waters of the Pacific Ocean off California. Although evidence is limited, most green sturgeon caught in coastal waters have been found in small numbers near and north of the Sacramento-San Joaquin delta. Adults captured in the Sacramento-San Joaquin delta are benthic feeders on invertebrates including shrimp, mollusks, amphipods, and even small fish (Houston 1988; Moyle et al. 1992). Consequently, the area of greatest concentration of southern green sturgeon is considerably north of San Miguel Island where Northern fur seal research activities are concentrated (no Steller sea lion research activities occur within California). While we have generously included the coast of California in the action area, we expect research activities including the transiting of vessels to San Miguel Island will be localized around San Miguel Island (e.g., ships would depart and return from a Santa Barbara port). Even if coastal vessel surveys were conducted, we do not expect green sturgeon to be exposed to research activities because of the benthic habits of sturgeon they will occur at depths well below where they are likely to be exposed to research activities. As a result, we expect that the proposed action would have no effect on threatened southern green sturgeon.

Sea Turtles and Whales

Green sea turtles, loggerhead sea turtles, leatherback sea turtles, olive ridley sea turtles, blue whales, bowhead whales, sperm whales, sei whales, humpback whales, fin whales, northern right whales, and southern resident killer whales occur within the action area for the proposed action. Observations of several of these species, however, are rare in the action area (occur in low numbers, are observed very infrequently, or are observed in only a small portion of the action area). Species that are particularly rare are: green sea turtles, olive ridley sea turtles, leatherback sea turtles, loggerhead sea turtles, northern right whales, southern resident killer whales, and blue whales. The Endangered Species Division believes that the probability that individuals of these species would be exposed to the direct or indirect effects of the proposed action, or any interrelated on interdependent actions is so small that it would not be reasonable to expect exposure to occur.

Based on the population size and distribution of bowhead whales, humpback whales, fin whales, sei whales, sperm whales, we expect that some individuals of these species, however, could be exposed to incidental effects of the activities authorized by the proposed action. If any listed sea turtle or whale is exposed to research activities under the proposed action, the primary stressor is the disturbance that results from vessel activity. Whales and sea turtles are vulnerable to disturbance from aircraft and vessel noise, collision with a transiting vessel, and ingestion of garbage or exposure to vessel discharges. In the event an individual of one of the listed whales or sea turtles were exposed to vessel activity during Northern fur seal and Steller sea lion research activities, we would not expect their exposure to result in anything more than a minor avoidance response that would not result in changes in individual fitness. Discharges would likely be too small too small and become too diluted to have any detectable effects on listed sea turtles and whales. Based on our review, we believe there is a low likelihood that a research vessel would strike either a whale or a sea turtle. The probability of a collision depends, in part, upon the size and speed of the vessel. Pace and Silber (2005) found that the probability of death or serious injury increased rapidly with increasing vessel speed. Research is typically conducted using a larger research vessel (40-120 feet long) to transport researchers to within about a mile of the study site, and from there they use a small skiff (e.g., an 16 foot inflatable) to transit among rookeries and haul-out study sites. The larger research vessels cruise between 9 and 11 knots, and the speed traveled during resight cruises is usually less than 1 knot (T. Gelatt, pers. comm., 9 April 2007). According to Jensen and Silber 92003) the majority (79 percent) records of vessels striking large whales occurred when the vessel was traveling at speeds of 13 knots or greater. The average speed that resulted in serious injury or death was 18.6 knots. Although, the above information shows that ship strikes are a major threat to listed whales, the number of trips conducted under the proposed action and the speed at which vessels would typically travel suggest that there is a low probability that whales or sea turtles would be struck by research vessels.

Airborne sound from a low-flying helicopter or airplane may be heard by marine mammals and turtles while at the surface or underwater. Noise from aircraft would not cause physical effects but have the potential to affect behaviors. The primary factor that may influence abrupt movements of animals is engine noise, specifically changes in engine noise (Hain et al. 1999). Responses by mammals and turtles could include hasty dives or turns. Whales may also slap the water with flukes or flippers, swim away from the aircraft track. Any behavioral disruptions result from the presence of aircraft or vessels, it is expected to be temporary. Animals are expected to resume their migration, feeding, or other behaviors without consequences to their survival or reproduction. However, if an animal is aware of a vessel and dives or swims away, it may successfully avoid being struck.

Finally, NMFS promulgated regulations at 50 CFR 224.103 that specifically prohibit: (1) the negligent or intentional operation of an aircraft or vessel, or the doing of any other negligent or intentional act which results in disturbing or molesting a marine mammal; (2) feeding or attempting to feed a marine mammal in the wild; and (3) approaching humpback whales in Hawaii and Alaska waters closer than 100 yards (91.4 m). Investigations authorized under the proposed action must comport with these restrictions, which would minimize the potential for the interaction of research vessels and listed whales. Similarly, we expect all discharges, however, would be conducted in accordance with applicable laws, and that such discharges would likely be too small and become too diluted to have any detectable effects on listed sea turtles and whales. As a result, we believe that the proposed research activities on Northern fur seal and Steller sea lion may affect, but are not likely to adversely affect the following listed whales and sea turtles: green sea turtle, loggerhead sea turtle, leatherback sea turtle, olive ridley sea turtle, blue whales, bowhead whales, sperm whales, sei whales, humpback whales, fin whales, whales, northern right whales, and southern resident killer whales.

Green Sea Turtle. The green sea turtle is listed as threatened and endangered (endangered populations are the breeding populations in Florida and Mexico). Green turtles are a circumglobal and highly migratory species that nest mainly in tropical and subtropical regions. The primary green turtle nesting grounds in the eastern Pacific are located in Michoacán, Mexico, and the Galapagos Islands, Ecuador (NMFS and USFWS 1998a). Their non-breeding range is generally tropical, and can extend approximately 500-800 miles from shore in certain regions (Eckert 1993). They appear to prefer waters that usually remain around 20º C in the coldest month; for example, during warm spells (e.g., El Nino), green turtles may be found considerably north of their normal distribution. Stinson (1984) found green turtles to appear most frequently in U.S. coastal waters with temperatures exceeding 18º C. Waters in this temperature range are generally found in the southern portion of the action area (i.e., Central California and south [NOAA 2002]).

Tag returns of eastern Pacific green turtles establish that these turtles travel long distances between foraging and nesting grounds. In fact, 75 percent of tag recoveries from 1982-90 were from turtles that had traveled more than 1,000 kilometers from Michoacán, Mexico. These turtles are found in coastal waters and offshore areas. In a review of sea turtle sighting records from northern Baja California to Alaska, Stinson (1984) determined that the green turtle was the most commonly observed sea turtle on the U.S. Pacific Coast, with 62 percent reported in a band from southern California and southward. Based on their limited distribution within the action area, we expect there is a low probability of exposing green sea turtles to the activities authorized by the proposed action.

Leatherback Sea Turtle. The leatherback turtle is listed as endangered under the ESA throughout its global range. Leatherback turtles are the largest of the marine turtles and can reach 6.5 feet long and 2000 pounds (NMFS and USFWS 1998b). Leatherback sea turtles are widely distributed throughout the oceans of the world. In the Pacific Ocean, they range as far north as Alaska and the Bering Sea and as far south as Chile and New Zealand. In Alaska, leatherback turtles are found as far north as 60º.34 N, 145º.38W and as far west as the Aleutian Islands

(Hodge 1979, Stinson 1984). Leatherback turtles have also been found in the Bering Sea along the coast of Russia (Bannikov et al. 1971).

Leatherbacks are commonly known as pelagic animals, but also forage in coastal waters. In fact, leatherbacks are the most migratory and wide ranging of sea turtle species, exploiting convergence zones and upwelling areas in the open ocean, along continental margins, and in archipelagic waters (Morreale et al. 1994; Eckert 1998; Eckert 1999). In a single year, a leatherback may swim more than 10,000 kilometers (Eckert 1998). To a large extent, the oceanic distribution of leatherback turtles may reflect the distribution and abundance of their macroplanktonic prey, which includes medusae, siphonophores, and salpae in temperate and boreal latitudes (NMFS and USFWS 1998b). Surface feeding has been reported in U.S. waters, especially off the west coast (Eisenberg and Frazier 1983), but foraging may also occur at depth.

Populations of leatherback turtles in the eastern Pacific were estimated to number more than 91,000 adults in 1980 (Spotila 1996), but are now estimated to number less than 3,000 adult and subadult animals (Spotila 2000). Although leatherback sea turtles occur throughout the action area, due to their small numbers we expect there is a low probability of exposing any individual leatherback to the activities authorized by the proposed action.

Loggerhead Sea Turtle. The loggerhead turtle is listed as threatened under the ESA throughout its range, primarily due to direct take, incidental capture in various fisheries, and the alteration and destruction of its habitat. Loggerhead turtles are a cosmopolitan species, found in temperate and subtropical waters and inhabiting pelagic waters, continental shelves, bays, estuaries and lagoons. The species is divided into five populations: the Atlantic Ocean, Pacific Ocean, Indian Ocean, Caribbean Sea and Mediterranean Sea populations. Loggerhead sea turtles in the action area most likely originate from Japanese nesting area. There are no loggerhead nesting sites on the western seaboard of the United States. However, loggerhead turtles and have been reported as far north as Alaska, are occasionally sighted off the coasts of Washington and Oregon, but most records are of juveniles off the coast of California (NMFS & USFWS 1998c).

The population status of the loggerhead nesting colonies in Japan and the surrounding region are not clear. Balazs and Wetherall (1991) speculated that 2,000 to 3,000 female loggerheads may nest annually in all of Japan; however, more recent data suggest that only approximately 1,000 female loggerhead turtles may nest there (Bolten et al. 1996). Nesting beach monitoring at Gamoda (Tokushima Prefecture) has been ongoing since 1954. Surveys at this site showed a marked decline in the number of nests between 1960 and the mid-1970s. Since then, the number of nests has fluctuated, but has been downward since 1985 (Bolten et al. 1996). Although loggerhead sea turtles occur throughout the action area, due to their small numbers we expect there is a low probability of exposing any individual leatherback to the activities authorized by the proposed action.

Olive Ridley Sea Turtle. Olive ridley populations in the Pacific are listed as threatened, except the Mexican nesting population, which is listed as endangered under the ESA. This latter designation was based on the extensive over-harvesting of olive ridleys in Mexico, which caused a severe population decline, although turtle harvests have since been banned in Mexico. Regarded as one of the most abundant sea turtles, olive ridleys were once “superabundant” in the eastern Pacific Ocean, and may have outnumbered all other sea turtles species combined (NMFS & USFWS 1998d). Historically, an estimated 10 million olive ridleys inhabited the waters in the eastern Pacific off Mexico (NMFS and USFWS 1998d). However, human-induced mortality led to declines in this population. Within U.S. territorial waters, however, numbers are considered quite low.

Olive ridleys are the smallest living sea turtle, with an adult carapace length between 60 and 70 cm, and rarely weigh over 50 kg. Most olive ridley turtles lead a primarily pelagic existence (Plotkin et al. 1993), migrating throughout the Pacific, from their nesting grounds in Mexico and Central America to the north Pacific. While olive ridleys generally have a tropical range with a distribution from Baja California, Mexico, to Chile (Silva-Batiz et al. 1996), individuals do occasionally venture north, some as far as the Gulf of Alaska (Hodge and Wing 2000). Consequently, olive ridley sea turtles are expected within the action area, but due to their small numbers we expect there is a low probability of exposing any individual olive ridley to the activities authorized by the proposed action. Nevertheless, if an individual olive ridley were exposed activities authorized by the proposed action, we would not expect their exposure to result in anything more than a minor avoidance response that would not result in a reduction in the individual's fitness.

Bowhead Whale. The bowhead whale is listed as endangered throughout its range. Bowhead whales are one of the few cetaceans that permanently reside in polar waters, seasonally moving with the advance and retreat of the ice edge. There is some evidence that these whales live to be well over 100 years old. The North Pacific contains two populations of bowhead whales, one in the Okhotsk Sea in Russia, and another in the Bering, Chukchi and Beaufort Seas. The latter population has increased steadily since the end of whaling, but the smaller Okhotsk Sea population, which was more heavily exploited in the past, is still at dangerously low numbers. Genetic research has determined that these two North Pacific populations are distinct, and that that movement of individuals between them is rare if it occurs at all (LeDuc et al. 1998).

The Bering, Chukchi and Beaufort Seas population migrates annually from wintering areas (November to March) in the northern Bering Sea through Chukchi Sean in the Spring (March though June), to the Beaufort Sea where they spend much of the summer (mid-May through September) before returning to the Bering Sea in the fall. Most of the year bowhead whales are closely associated with ice front. Current estimates suggest the population numbers about 9,000 animals (Carretta et al. 2006). We expect, based on the distribution of bowhead whales that individuals are likely to be exposed to vessel activity (largely, visual and auditory disturbances) resulting from the proposed action. Nevertheless, if exposed to these types of disturbances, we would not expect their exposure to result in anything more than a minor avoidance response that would not result in changes to the individual's fitness.

Blue Whale. The blue whale is listed as endangered throughout its range. In the North Pacific Ocean, blue whales are found along the coastal shelves of North America and South America (Rice 1974, Donovan 1984). Although the blue whale population has increased off California, they are rare in the Gulf of Alaska and southern Bering Sea where they were once abundant. Nishiwaki (1966) noted the occurrence of blue whales among the Aleutian Islands and in the Gulf of Alaska. However, no blue whales have been sighted in these waters for many years despite several surveys (Leatherwood et al. 1982; Stewart et al. 1987; Forney and Brownell 1996).

The feeding stock of blue whales in California was recently estimated by both line-transect and mark-recapture methods. Barlow (2003) estimated 1,736 (CV=0.23) blue whales off California, Oregon, and Washington based on ship line-transect surveys in 1996 and 2002. Calambokidis et al. (2003) used photographic mark-recapture and estimated the average population as 1,760 (CV=0.32), close to the line-transect estimate. There is some indication that blue whales increased in abundance in California coastal waters in the late 1970s, again in the 1990s, but more recently estimates suggest this population has declined slightly (Caretta et al. 2006). We expect, based on the distribution of blue whales that individuals could be exposed to vessel activity (largely, visual and auditory disturbances) resulting from the proposed action, and that if such exposure occurred it would be most likely to occur in the southern portion of the action area. However, based on their low numbers we expect there is a low likelihood that blue whales would be exposed to the activities authorized by the proposed action. Nevertheless, if exposed to the stressors from the authorized activities, we would not expect their exposure to result in anything more than a minor avoidance response that would not result in changes to the individual's fitness.

Fin Whale. The fin whale is listed as endangered throughout its range. Fin whales were reported as occurring immediately offshore throughout the North Pacific from central Baja California to Japan and as far north as the Chukchi Sea (Rice 1974). Recent observations show aggregations of fin whales year-round in southern/central California, year-round in the Gulf of California, in summer in Oregon, and in summer and autumn in the Shelikof Strait and Gulf of Alaska (Dohl et al. 1983; Brueggeman et al. 1990; Green et al. 1992; Tershy et al. 1993; Forney et al. 1995; McDonald 1994; Barlow 1997). In the Gulf of Alaska, fin whales appear to congregate in the waters around Kodiak Island and south of Prince William Sound. In recent years, small numbers of fin whales have been observed south of the Aleutian Islands (Forney and Brownell 1996), in the Gulf of Alaska (including Shelikof Strait), and in the southeastern Bering Sea (Leatherwood et al. 1982). Fin whale concentrations in the northern areas of the North Pacific and Bering Sea generally form along frontal boundaries, or mixing zones between coastal and oceanic waters, which themselves correspond roughly to the 200-m isobath (the shelf edge). Acoustic data collected from 1995 to 1999 from hydrophone arrays show fin whales vocalizing in Alaskan waters during all seasons, with a peak in occurrence in midwinter.

There is some indication that fin whales have increased in abundance in California coastal waters in the 1990s, but trends are not significant. In the eastern North Pacific the current population size is estimated at between 8,500 and almost 11,000 individuals. About 3,279 individuals are found in off California, Oregon and Washington based on ship surveys in summer and autumn (Barlow and Taylor 2001). We expect, based on the distribution of fin whales that individuals may be exposed to vessel activity (largely, visual and auditory disturbances) resulting from the proposed action. Nevertheless, if exposed to these types of disturbances, we would not expect their exposure to result in anything more than a minor avoidance response that would not result in changes to the individual's fitness.

Humpback Whale. The humpback whale is listed as endangered throughout its range, and there is good evidence for multiple populations in the North Pacific (Johnson and Wolman 1984; Baker et al. 1990). Aerial, vessel, and photo-identification surveys, and genetic analyses indicate that within the U.S. EEZ, there are at least three relatively separate populations that migrate between their respective summer/fall feeding areas and winter/spring calving and mating areas (Calambokidis et al. 2001, Baker et al. 1998): 1) winter/spring populations in coastal Central America and Mexico which migrate to the coast of California to southern British Columbia in summer/fall (Steiger et al. 1991, Calambokidis et al. 1996) - referred to as the eastern North Pacific stock; 2) winter/spring populations of the Hawaiian Islands which migrate to northern

British Columbia/Southeast Alaska and Prince William Sound west to Kodiak (Baker et al. 1990; Perry et al. 1990; Calambokidis et al. 2001) - referred to as the central North Pacific stock; and 3) winter/spring populations of Japan which, based on Discovery Tag information, probably migrate to waters west of the Kodiak Archipelago (the Bering Sea and Aleutian Islands) in summer/fall (Berzin and Rovnin 1966; Nishiwaki 1966; Darling 1991) - referred to as the western North Pacific stock. Winter/spring populations of humpback whales also occur in Mexico's offshore islands; the migratory destination of these whales is not well known (Calambokidis et al. 2001), but Norris et al. (1999) speculate that they may travel to the Bering Sea or Aleutian Islands. This stock structure represents the predominant migration patterns, but there is not a perfect correspondence between the breeding and feeding areas that are paired above. For example, some individuals migrate from Mexico to the Gulf of Alaska and others migrate from Japan to British Columbia. In general, interchange occurs (at low levels) between breeding areas, but fidelity is extremely high among the feeding areas (Calambokidis et al. 2001). Available information suggests that there is considerable overlap between the Western North Pacific and Central North Pacific stocks in the Gulf of Alaska between Kodiak Island and the Shumagin Islands.

The North Pacific currently exceeds 6,000 humpback whales, about 1000 of which are from the California Mexico population and about 400 in the Western North Pacific population (Calambokidis et al. 1997, 2004). We expect, based on the distribution of humpback whales that individuals could be exposed to vessel activity (largely, visual and auditory disturbances) resulting from the proposed action. However, we expect the likelihood that humpback whales would be exposed to the activities authorized by the proposed action is low. Nevertheless, if exposed to these types of disturbances, we would not expect their exposure to result in anything more than a minor avoidance response that would not result in changes to the individual's fitness.

Southern Resident Killer Whale. In general killer whales are one of the most widely distributed cetaceans in the action area. In the North Pacific Ocean, killer whales are often sighted from the eastern Bering Sea to the Aleutian Islands, in the waters of southeastern Alaska and the intercoastal waterways of British Columbia and Washington State, along the coasts of Washington, Oregon, and California, along the Russian coast in the Bering Sea and the Sea of Okhotsk; and on the eastern side of Sakhalin and the Kuril Islands, and the Sea of Japan. Four distinct communities and three distinct forms occur within the action area. However, only the southern resident killer whales are listed as endangered. Southern resident killer whales are fish eaters and live in stable matrilineal pods: the "J" pod, "K" pod, and "L" pod. Their range in the spring, summer, and fall includes the inland waterways of Puget Sound, Strait of Juan de Fuca, and Southern Georgia Strait. They have also been documented in coastal waters off British Columbia, Washington, Oregon, and central California (Krahn et al. 2004a). Southern Residents may have numbered more than 200 whales until perhaps the mid- to late-1800s (Krahn et al. 2004a). This DPS has fluctuated between 71 and 97 individuals in the last 30 years and in 2003 numbered about 80 individuals. We expect, based on the distribution of southern resident killer whales that individuals could be exposed to vessel activity (largely, visual and auditory disturbances) resulting from the proposed action. However, we expect the likelihood that southern resident killer whales would be exposed to the activities authorized by the proposed action is low. Nevertheless, if exposed to disturbances authorized by the proposed action, we would not expect their exposure to result in anything more than a minor avoidance response that would not result in changes to the individual's fitness. Consequently, the action may affect but is not likely to adversely affect endangered killer whales.

Critical habitat for southern resident killer whales is designated as the summer core area in Haro Strait and waters around the San Juan Islands, Puget Sound, and the Strait of Juan de Fuca, which together comprise about 2,560 square miles of marine habitat (71 FR 69054). Although we expect that some research activities may occur within areas designated as critical habitat for killer whales in the southern resident DPS, proposed activities are focused on two species (Steller sea lion and Northern fur seal) and would not result in changes in the conservation value of any primary constituent elements for killer whales. Consequently, we expect the proposed action would have no effect on southern resident killer whale critical habitat.

Northern Right Whale. Only North Pacific right whales occur within the action area for the proposed action. Very little is known of the population size and distribution of right whales in the North Pacific because only about 15 of these animals have been observed in the past 20 years. In 1996, a group of 3 to 4 right whales (which may have included a calf) were observed in the middle shelf of the Bering Sea, west of Bristol Bay and east of the Pribilof Islands (Goddard and Rugh 1998). In June 1998, a lone whale was observed on historic whaling grounds near Albatross Bank off Kodiak Island, Alaska (Waite and Hobbs 1999). Surveys conducted in July of 1997-2000 in Bristol Bay reported observations of lone animals or small groups of right whales in the same area as the 1996 sighting (Hill and DeMaster 1998). Historical whaling records (Maury 1852; Townsend 1935; Scarff 1986) indicate the right whale ranged across the North Pacific above 35ºN latitude. They summered in the North Pacific Ocean and southern Bering Sea from April or May to September, with a peak in sightings in coastal waters of Alaska in June and July (Maury 1852; Townsend 1935; Omura 1958; Klumov 1962; Omura et al. 1969). Recent surveys using bottom-mounted acoustic recorders deployed in the southeastern Bering Sea and the northern Gulf of Alaska indicate that right whales remain in the southeastern Bering Sea from late spring through early autumn (Mellinger et al. 2004; Munger and Hildebrand 2004). No abundance estimate exists for Northern Right whales within the North Pacific. Aerial surveys in 1998, 1999, and 2000 recorded thirteen individual animals, and two were rephotographed (LeDuc et al. 2001). We expect, based on the distribution of northern right whales in the action area that individuals may be exposed to vessel activity (largely, visual and auditory disturbances) resulting from the proposed action. However, we expect the likelihood that right whales would be exposed to the activities authorized by the proposed action is very low due to the very low numbers of right whales within the action area. Nevertheless, if exposed to these types of disturbances, we would not expect their exposure to result in anything more than a minor avoidance response that would not result in changes to the individual's fitness.

Northern Pacific Right Whale- Proposed Endangered. In August 2005 NMFS received a petition to list the Northern Pacific right whale as a separate endangered species from the North right whale stocks on the Atlantic seaboard. On December 27, 2006, after conducting a status review in response to the petition, NMFS concluded right whales in the northern hemisphere exist as two species the North Pacific right whale (*Eubalaena japonica*) and the North Atlantic right whale (*E. glacialis*). The action area for the proposed project only occurs within waters occupied by the North Pacific right whale population. Consequently, according to reasons and evidence presented above that action is not likely to adversely affect individual right whales, by extension, and pursuant to section 7(a)(4) of the ESA, it is the Endangered Species Division's opinion that the action is not likely to jeopardize the continued existence of the proposed endangered Northern Pacific right whale.

Sei Whale. Sei whales are distributed in all of the world's oceans, except the Arctic Ocean. The IWC's Scientific Committee groups all of the sei whales in the entire North Pacific Ocean into one population (Donovan 1991). However, some mark-recapture, catch distribution, and morphological research indicated that more than one population exists; one between 175ºW and 155ºW longitude, and another east of 155º W longitude (Masaki 1976, 1977). During the winter, sei whales are found from 20º to 23º N and during the summer from 35º to 50º N (Masaki 1976, 1977). Horwood (1987) reported that 7.5 to 85 percent of the total North Pacific population of sei whales resides east of 180º longitude. In the North Pacific Ocean, sei whales have been reported primarily south of the Aleutian Islands, in Shelikof Strait and waters surrounding Kodiak Island, in the Gulf of Alaska, inside waters of southeast Alaska, and off the coasts of California, Washington and Oregon (Nasu 1974; Leatherwood et al. 1982; Caretta et al. 2006). Sei whales have been occasionally reported from the Bering Sea and in low numbers on the central Bering Sea shelf (Hill and DeMaster 1998). Masaki (1977) reported sei whales concentrating in the northern and western Bering Sea from July through September, although other researchers question these observations because no other surveys have ever reported sei whales in the northern and western Bering Sea. Horwood (1987) evaluated the Japanese sighting data and concluded that sei whales rarely occur in the Bering Sea.

Sei whale abundance prior to commercial whaling in the North Pacific has been estimated at 42,000 individuals (Tillman 1977). Japanese and Soviet catches of sei whales in the North Pacific and Bering Sea increased from 260 whales in 1962 to over 4,500 in 1968 and 1969, after which the sei whale population declined rapidly (Mizroch et al. 1984). When commercial whaling for sei whales ended in 1974, the population of sei whales in the North Pacific had been reduced to between 7,260 and 12,620 animals (Tillman 1977). Current abundance or trends are not known for sei whales in the North Pacific (Best 1993 in Carretta et al. 2006). We expect, based on the distribution of sei whales in the action area that individuals may be exposed to vessel activity (largely, visual and auditory disturbances) resulting from the proposed action. Nevertheless, if exposed to disturbances from authorized research activities, we would not expect sei whales to exhibit anything more than a minor avoidance response, and that such responses would not result in changes to the individual's fitness.

Sperm Whale. Sperm whales are distributed in all of the world's oceans. There are three discrete population "centers" of sperm whales within the action area: (1) North Pacific stock, which includes Alaska, and the (2) California, Oregon, and Washington stock (Carretta et al. 2006; Angliss and Outlaw 2007). In California, sperm whales occur year round with peak abundance from April through mid-June and from the end of August through mid-November (Rice 1974). They were seen in every season except winter (December through February) in Washington and Oregon (Green et al. 1992). Recent estimates, based on survey data, indicate there are about 1,200 sperm whales along the coasts of California, Oregon, and Washington (Carretta et al. 2006).

In the North Pacific, sperm whales are distributed widely, with the northernmost boundary extending from Cape Navarin to the Pribilof Islands (Omura 1955). Females and young sperm whales usually remain in tropical and temperate waters year-round, while males are thought to move north into the Aleutian Islands, Gulf of Alaska, and the Bering Sea to feed. Sperm whales are rarely found in waters less than 300 m in depth. They are often concentrated around oceanic islands in areas of upwelling, and along the outer continental shelf and mid-ocean waters. Because they inhabit deeper pelagic waters, their distribution does not include the broad continental shelf of the Eastern Bering Sea and these whales generally remain offshore in the eastern Aleutian Islands, Gulf of Alaska, and the Bering Sea. Reliable estimates of the North Pacific (Alaskan) population size are not currently available (Angliss and Outlaw 2007). We expect, based on the distribution of sperm whales in the action area that individuals may be exposed to vessel activity (largely, visual and auditory disturbances) resulting from the proposed action. Nevertheless, if exposed to disturbances from authorized research activities we would not expect sperm whales to exhibit anything more than a minor avoidance response, and that such responses, if they occurred, would not result in changes to the individual's fitness.

Marine Invertebrates

White Abalone. The white abalone is an herbivorous, marine, rocky benthic, broadcast spawning gastropod, and was the first marine invertebrate listed under the ESA (listed as Endangered in 2001). White abalone are found in open low and high relief rock or boulder habitat that is interspersed with sand channels. Their historic range extended from Point Conception, California, USA, to Punta Abreojos, Baja California, Mexico. The middle portion of its range includes Channel Island National Park, where Northern fur seal research activities are concentrated. White abalone are reported to be most abundant between 25-30 m (80-100 ft) depth, making them the deepest occurring abalone species in California. Due to the depths white abalone occupy and because research activities would occur at the water's surface or on San Miguel Island, we do not expect white abalone to be exposed to research activities. As a result, the proposed action would have no effect on endangered white abalone in the action area.

Pinnipeds

Guadalupe Fur Seals. The Guadalupe fur seal is the only member of the genus *Arctocephalus* in the Northern Hemisphere. By 1897, the Guadalupe fur seal was believed to be extinct. We are not aware of any sightings again until a fisherman found slightly more than two dozen at Guadalupe Island in 1926. Prior to commercial sealing during the 19th century, this species ranged from Monterey Bay, California, to the Revillagigedo Islands, Mexico. Archeological evidence suggests that the Guadalupe fur seal was found in the Channel Islands before commercial exploitation reduced the population to near extinction (Walker and Craig 1979).

The capture of two adult males at Guadalupe Island in 1928 established the species' return; however, they were not seen again until 1954. Between 1969 and 1989, there were 48 sightings of Guadalupe fur seals on the southern Channel Islands, including one territorial male that was seen from 1981 to 1990 and a second bull established a territory from 1989 to 1991 (Reeves et al. 1992). Before 1985, there were only two sightings of Guadalupe fur seals from central and northern California (Monterey in 1977 and Princeton Harbor in 1984; Webber and Roletto 1987). Guadalupe fur seals pup and breed, mainly at Isla Guadalupe, Mexico. In 1997, a second rookery was discovered at Isla Benito del Este, Baja California, and a pup was born at San Miguel Island, California (Melin and DeLong 1999). The population is considered to be a single stock because all individuals are recent descendants from one breeding colony at Isla Guadalupe, Mexico. When ashore during the breeding season, Guadalupe fur seals favor rocky habitats near the water's edge and caves at windier sections of coastlines (Reeves et al. 2002).

Two of the thirteen draft permits would allow researchers to conduct Steller sea lion investigations in California. At Point Bennett on the west end of San Miguel Island, the two species—Steller sea lions and Guadalupe fur seals—may overlap. Activities proposed for permitting in California include aerial and vessel surveys, and on-land activities such as ground counts, scat collection, and capture. Since on-land investigations would target Steller sea lions, we would expect that Guadalupe fur seals could be incidentally disturbed by human presence and noise associated with surveys in the event animals are on San Miguel Island during the disturbance. Since the species is considered an "infrequent visitor" to the island as are Steller sea lions (S. Melin to T. Eagle, pers. comm., 18 Jun 2007), and due to their small numbers in the on the Island, we expect there is a low probability of exposing any individual Guadalupe fur seal to the proposed. Nevertheless, if an individual Guadalupe fur seal were exposed activities authorized by the proposed action, we would not expect their exposure to result in anything more than a minor avoidance response that would not result in a reduction in the individual's fitness.

LISTED SPECIES LIKELY TO BE ADVERSELY AFFECTED

Steller Sea Lion

Steller sea lions were listed as threatened under the ESA on November 26, 1990 (55 FR 49204). The listing followed a decline in the United States of about 64 percent over the three decades before the listing. In 1997, the species was split into two separate populations based on demographic and genetic differences (Bickham et al. 1996; Loughlin 1997), the western population was reclassified to endangered while the eastern population remained threatened (62 FR 30772). The eastern (threatened) population includes animals east of Cape Suckling, Alaska (144ºW), while animals in the western (endangered) population are at Cape Suckling and to the west (Loughlin 1997).

Steller sea lions are the only extant species of the genus *Eumetopias*, and are part of the Family Otariidae (Suborder Pinnipedia, Order Carnivora). Although NMFS recognizes two DPSs of Steller sea lions, referred to as "species" under the ESA, there is only one biological species per se. This opinion describes information on the general patterns of life history and behaviors of the biological species, *Eumetopias jubatus,* where it is applicable to both listed "species". Where there are notable differences between the two listed "species", endangered western Steller sea lions and threatened eastern Steller sea lions (e.g. *Status and Trends*), the differences are noted accordingly.

Distribution and Movements

Steller sea lions are distributed along the rim of the North Pacific Ocean from San Miguel Island (Channel Islands) off Southern California to northern Hokkaido, Japan (Loughlin *et al*. 1984; Nowak 2003). Their centers of abundance and distribution are in Gulf of Alaska and the Aleutian Islands, respectively (NMFS 1992). In the Bering Sea, the northernmost major rookery is on Walrus Island in the Pribilof Island group. The northernmost major haul-out is on Hall Island off the northwestern tip of St. Matthew Island. Their distribution also extends northward from the western end of the Aleutian chain to sites along the eastern shore of the Kamchatka Peninsula.

Steller sea lions regularly retreat from the water to land sites, termed haulouts or rookeries. Steller sea lions are also the only otariid that regularly hauls out on sea ice (Rice 1998).

Rookeries are used by adult sea lions for pupping, nursing, and mating during the reproductive season (generally from late May to early July). Haulouts are used by all ages and both genders but are generally not where sea lions reproduce. Steller sea lions exhibit a high level of site fidelity. Presumably, the sites were chosen and continue to be used because they protect sea lions from predators, some measure of protection from severe climate or sea surface conditions, and (perhaps most importantly) are in close proximity to prey resources.

Steller sea lions are not known to make regular migrations but they do move considerable distances. Adult males, in particular, may disperse widely after the breeding season; some at notable distances from their natal rookeries where they held a territory (over 1000 km). Animals marked as pups in the Gulf of Alaska have been sighted in Southeast Alaska and British Columbia, and others marked in British Columbia have been seen at Cape Saint Elias, Alaska. Similarly, animals marked in Oregon, were later seen in northern California, Washington, British Columbia, Southeast Alaska, and the northern Gulf of Alaska (Calkins and Pitcher 1982; Calkins 1986; Loughlin 1997). Raum-Suryan et al. (2002) analyzed resightings of more than 8,000 pups that were branded from 1975 to 1995 on rookeries in Alaska and reported that almost all of the resightings of young-of-the-year were within 500 km of the rookery where the pup was born. Older animals (>11 months and juveniles) have been observed at much greater distances from their natal rookery.

Life history Information

Mating and Reproduction. Steller sea lions have a polygynous reproductive strategy in which a single male may mate with multiple females. As mating occurs on land (or in the surf or intertidal zones), males are able to defend territories and thereby exert at least partial control over access to adult females and mating privileges. The pupping and mating season is relatively short and synchronous, probably due to the strong seasonality of the sea lions' environment and the need to balance aggregation for reproductive purposes with dispersion to exploit distant food resources. In May, adult males compete for rookery territories. In late May adult females arrive at the rookeries, where pregnant females give birth to a single pup. Throughout the range of the Steller sea lion, pregnant females give birth between May 15 and July 15. Timing of parturition generally occurs along a latitudinal gradient with births occur later in the season on rookeries in higher latitudes. Births are generally synchronous on a rookery, with most births occurring within about a 25 day period (Pitcher et al. 2001).

Mating occurs about ten days after the female gives birth, and most males leave the rookery by about mid-August (Gentry 1970). The gestation period is probably about 50 to 51 weeks, but implantation of the blastocyst is delayed until late September or early October (Pitcher and Calkins 1981). Due to delayed implantation, the metabolic demands of a developing fetus are not imposed until well after fertilization. The sex ratio of pups at birth is assumed to be about 1:1 (e.g., York 1994) or biased toward slightly greater production of males (e.g., Pike and Maxwell 1958, NMFS 1992). The sex-ratio for non-pups, however, is biased towards females (Calkins and Pitcher 1982; Trites and Larkin 1992).

Female Steller sea lions reach sexual maturity and first breed between 3 and 8 years of age and the average age of first pregnancy is about 5 years, making the average age at first birth at about 6 years (Pitcher and Calkins 1981). Females normally ovulate and breed annually after maturity although there is a high rate of reproductive failures. The available literature indicates an overall reproductive (birth) rate on the order of 55 percent to 70 percent or greater (Pike and Maxwell 1958, Gentry 1970, Pitcher and Calkins 1981).

Males reach sexual maturity at about the same time as females (i.e., 3-7 years of age, reported in Loughlin et al. 1987), but generally do not reach physical maturity and participate in breeding until about 8 to 10 years of age (Pitcher and Calkins 1981). A sample of 185 territorial males from Marmot, Atkins, Ugamak, Jude, and Chowiet Islands in 1959 included animals 6 to 17 years of age, with 90 percent from 9 to 13 years old (Thorsteinson and Lensink 1962).

Maternal Care and Lactation. A mother and her new pup begin "imprinting" – learning to recognize each other through smell, sound and visual cues (Bartholomew 1959; Gentry 1970; Reidman 1990). Since rookeries are crowded, imprinting is necessarily important to assist a pinniped mother with the difficult challenge in telling her pup apart from other pups in this crowded environment (Reidman 1990). We expect that imprinting is continually reinforced during the perinatal period – the time between birth and the mother Steller sea lion's first feeding trip – as the pair continue to nuzzle and vocalize to each other.

Following parturition, a mother Steller sea lion remains with her pup, fasting for about a week while she protects and feeds her newborn. Gentry (1970) observed that immediately after giving birth, Steller sea lion females would grasp the skin on the back of the neck of their newborn to move the neonate to her side for nursing. Based on observations by Gentry (1970) a new mother will continue attempts to invoke a response from her new pup even when the pup is dead. Gentry (1970) observed eleven mothers with dead pups, remaining with their pups, vocalizing, nuzzling, and picking up and dropping their lifeless pups. One female remained with her lifeless pup for 19 days (Gentry 1970).

Mothers with newborn pups will make their first foraging trip about a week after giving birth, but they remain close to the rookery at first (Merrick and Loughlin 1997; Milette 1999; Pitcher et al. 2001; Milette and Trites 2003; Maniscalco et al. 2006). At first, foraging trips of lactating females lasts less than 24 hours (Gentry 1970; Milette and Trites 2003; Maniscalco et al. 2006). Individual foraging trips of lactating females increase with the pup's age and season (Milette and Trites 2003; Maniscalco et al. 2006). Maniscalco et al. (2006) noted that by fall Steller sea lion mothers on Chiswell Island were at sea, foraging, about 3.3 times longer than they did during summer months. Newborn pups are wholly dependent upon their mother for milk during at least their first three months of life, and observations suggest they continue to be highly dependent upon their mother through their first winter (Scheffer 1945; Porter 1997; Trites et al. 2006). Generally, female Steller sea lion will nurse their offspring until they are 1 to 2 years old (Gentry 1970; Sandegren 1970; Pitcher and Calkins 1981; Calkins and Pitcher 1982; Trites et al. 2006).

Most females remain in a restricted area with their young at first, and a neonate will often stay in the area where they last suckled upon a mother's first departure (Gentry 1970; Merrick 1987). As the pup grows it moves about the rookery more, and can be observed playing with other pups. Sheffer (1945) observed young swimming for at least a short amount of time soon after birth (May and June) when placed in the water by their mothers, and noted that by August "the young were strong swimmers."

Weaning appears to be a gradual process that begins in spring (April-May) when a pup is about 10 to 12 months old (Trites et al. 2006). The transition to nutritional independence may be influenced by the pup's foraging skills, age and gender, the mother's condition and reproductive potential, and environmental conditions (Pitcher et al. 2005; Rehberg 2005; Trites et al. 2006).

Increasing intervals at sea during spring after their first witner suggests that pups are supplementing more of their diet with solid foods at about 10 months of age (Trites et al. 2006). Many pups, however, may not be fully independent as mature females on rookeries in late May and early June are often seen nursing pups and juveniles (Gentry 1970; Sandegren 1970).

Presumably, the length of time a female spends nursing her offspring represents a trade-off between her individual metabolic demands and her progeny's metabolic demands. The more time she spends nursing her progeny, the greater the cost to her future reproductive success, but the greater chance of survival for her offspring (Riedman 1990; Mock and Forbes 1992). In general, maternal investment is often higher in male progeny, particularly in polygynous and sexually dimorphic pinnipeds (Riedman 1990). Based on observations by Porter (1997) and Trites et al. (2006) more male Steller sea lion nursed into their second year than females, and one male was observed still actively nursing until at least 4 years old (when Trites et al. (2006) ceased observations). In Southeast Alaska, during winter months Porter (1997) observed that female Steller sea lion nursing yearlings spent more time foraging than females that were nursing young-of-the-year. While the length of the foraging trip of females nursing male offspring differed only slightly from the length of the foraging trip of females that were nursing female offspring (the differences were not statistically different), male offspring were often more successful at obtaining milk during weaning though persistent behaviors such as biting the lactating female until she allowed access to her teats (Porter 1997).

Trites et al. (2006) suggested that a population that contains a higher proportion of males suckling at older ages may indicate the population is approaching carry capacity as a result of food limitations. Nursing older age progeny would increase the juvenile's chance of survival, but would reduce the lifetime reproductive success of the mature female. A female may still successfully reach parturition when nursing older progeny, but even in times of abundant food she would not likely be able to produce enough milk to sustain both offspring, and would reject one or the other offspring. Presumably, a newborn would face a greater risk of rejection as the yearling represents a larger maternal investment, and yearlings, particularly yearling males, may be more persistent at driving away newborn pups to gain access to the lactating mother (Porter 1997; Trites et al. 2006). While we know of a few instances where females have nursed newborns and yearlings, these females exhibited very short perinatal periods (time onshore after parturition until first foraging) compared to females nursing only one pup (Maniscalco et al. 2006).

Extended nursing periods of male yearlings may be indicative of their higher metabolic demands, but may also indicate nutritional stress (Trites et al. 2006). Comparisons of girth and weight of Steller sea lion aged 1, 7 and 14 in the mid 1980s to the mid 1970s indicate that yearlings were 10.4 percent smaller in girth and weighed 26.9 percent less during the peak of their decline in the mid-1980s (Calkins et al. 1998; Trites and Donnelly 2003). At the same time a female was less likely to be pregnant if she was nursing a pup from the previous year (Pitcher et al. 1998; Trites and Donnelly 2003).

During periods of nutritional stress, pups may be more inclined to attempt milk stealing. Juvenile Steller sea lion may steal milk by non-filial mothers although this behavior is more common in other pinniped species; it has on rare occasion been documented in Steller sea lions (Porter 1997). Porter (1997) observed two cases of milk stealing on Timber Island in Southeast Alaska. One animal was not observed with its mother and was clearly nutritionally stressed. While this female pup was successful in sneaking milk from lactating females on several occasions, the animal eventually died from starvation. A second animal, which was observed with its mother, was also observed stealing milk from another mother-pup pair. Incidentally, Porter (1997) observed the emaciated pup being driven off by the mother and its pup when it was detected stealing milk, and antagonistic behaviors increased as its condition worsened, while the second pup was allowed to suckle without incident.

Social Behavior. Males establish and defend territories during breeding season by displaying threatening behavior and fighting (Gentry 1970). Gentry (1970) found that the intensity of the territorial displays varied with season and as more males established territories on a rookery. However, territorial boundaries were mostly stable throughout the breeding season with males remaining on site from June to mid-July, average time on shore was about 40 days. Males seen arriving on the rookery in mid-July also held territories, but the territorial boundaries varied almost daily and Gentry (1970) did not observe these late arrivals copulating.

Females gathered in large groups, and although aggression between females was observed all year long aggression was greatest just before and just after parturition (Gentry 1970). According to Gentry (1970) female Steller sea lion will often huddle close together, but during parturition they will expand their territory.

Age Distribution. Two life tables have been published with age-specific rates (Table 4.1). The first was from Calkins and Pitcher (1982) and was based on sea lions killed in the late 1970s. York (1994) created a second life table using a Weibull model and the data from Calkins and Pitcher (1982) and Calkins and Goodwin (1988). York's analysis of these two data sets suggests a shift from the 1970s to the 1980s in the mean age of females older than 3 years of age. The shift was about 1.55 years, and provided the basis for her determination that increased juvenile mortality may have been an important proximate factor in the decline of Steller sea lions. That is, such a shift in mean age would occur as the adult population aged without expected replacement by recruitment of young females.

The most apparent limitations of these data and the resulting life tables are 1) the collected sea lions were not from the same locations and the relations between populations at different sites have not been described (e.g., were they experiencing similar trends and were their age structures comparable), 2) the data and estimated vital rates are also time-specific, and do not necessarily apply to the current population, 3) the assumption of a stable age distribution (or distributions) may be faulty even if trends at these different sites were consistent, and 4) the data set is relatively small and does not provide a basis for estimating age-specific survival rates for very young ages (0–2 years of age) or for possibly senescent older animals (say >12 years of age). Until senescence is assessed, longevity for Steller sea lions will be difficult to describe. The data reported in Pitcher and Calkins (1981) indicate that female sea lions may live to 30 years of age. A Weibull function fit to these data (York 1994) indicates, however, that fewer than 5 percent of females live to age 20. The present age distribution may or may not be consistent with these life tables.

Foraging Movements. Foraging patterns can be discerned, in part, simply by observational studies. Observations can be useful for identifying areas that may be important foraging sites (e.g., Kajimura and Loughlin 1988, Fiscus and Baines 1966). The designation of critical habitat was based, in part, on observations that sea lions use those areas extensively for foraging. Similarly, under certain circumstances observations can be used for identifying prey items, particularly those that may be commercially important (e.g., Jameson and Kenyon 1977). In general, however, the power of observational studies is limited to situations where sea lions bring their prey to the surface and the prey can be identified, or where the sea lions can be observed diving repeatedly and the assumption that they are foraging is reasonable.

Prior to the mid 1990s, telemetry work was conducted on adult female (occasionally adult male) Steller sea lions rather than juveniles because of problems with immobilizing younger animals. At least three types of telemetry have been used to study foraging Steller sea lions: very high frequency (VHF), satellite-linked, and stomach telemetry. VHF telemetry can be used to determine presence or absence of an animal and, to some extent, animal location and if it is on land or in the water. Movement patterns between sites that can be monitored manually, remotely, or automatically by VHF receivers. Satellite-linked telemetry is used to determine animal location and, when coupled with time-depth recorders, diving patterns (Pitcher et al. 2005; Loughlin et al. 2003). Satellite-linked telemetry provides an opportunity to collect information on animal location without having to recapture the animal to collect stored data. Underwater capture techniques developed by the Alaska Department of Fish and Game (ADFG) and on-land net captures devised by NMFS in the late 1990s afforded access to younger animals, which was crucial because most data suggested that high mortality rates in sub-adult animals could be responsible for the decline. Before 2000, the physical size of satellite transmitters precluded their attachment to smaller animals without negatively affecting dive performance. Advancements helped to reduce the size of the instruments while increasing the quality of transmitted data (Andrews 1998).

Satellite telemetry studies from 1994-2000 helped establish the range of movement patterns and dive characteristics for animals of different age classes and in different parts of the Steller sea lion's range, from the Gulf of Alaska and Aleutian Islands to Washington (Fadely et al. 2005; Briggs et al. 2005; Pitcher et al. 2005; Raum-Suryan et al. 2002; Loughlin et al. 2003). Also, there were successful efforts to show relationships between SSL movements, dive behavior, and prey fields in both the Kodiak area (Bredesen et al. 2004; Bredesen et al. 2006; Gende and Sigler 2006;) and in southeast Alaska (Sterling et al. 2004). Remote sensing data from satellites were also used to monitor Steller sea lion movements and foraging behavior in and around surface eddies in the Bering Sea and North Pacific.

The time a Steller sea lion can spend underwater and forage depends upon physiological adaptations for diving. The maximum time submerged is largely determined by the speed at which oxygen stores are used (i.e., metabolic rate), how much oxygen is stored in the body, and the demands of movement (Hastie et al. 2004, 2005, 2006). In a study incorporating captive Steller sea lions in the open ocean, researchers used a general linear model to predict oxygen consumption of Steller sea lions in the wild (Horning and Trillmich 1997; Richmond et al. 2006). A mature otarid can store more oxygen than a young otarid due to increased blood volume, muscle myoglobin and body mass and can therefore endure longer deeper dives (Lavigne et al. 1986; Costa 1993; Richmond et al. 2006).

Prey. Stomach contents are generally considered to be the most reliable indication of foraging patterns. Nonetheless, biases may occur from a number of sources. Variable rates of digestion of soft tissues or variable retention of hard tissues (e.g., squid beaks) may result in misrepresentation of prey detection in the stomach. For example, Pitcher (1981) indicated that results from intestinal tracts may not correspond to results from stomachs. Stomach contents generally indicate prey items recently consumed, and may or may not be representative of prey items over a longer period of time. Results also may be biased by the evaluation method (e.g., use of frequency of occurrence may indicate how many animals ingested a prey type, but may not provide a good indicator of the importance of that prey; see Spalding 1964). Analyses of stomach contents have provided a large portion of our information on sea lion foraging (e.g., Calkins and Pitcher 1982, Calkins and Goodwin 1988), but under most conditions, killing for collection of stomach contents is no longer considered appropriate. Stomach and intestinal contents are now available only from dead animals found on beaches or live animals whose stomach contents are collected by lavage, regurgitation, and intestinal contents by enema, and analysis of fatty acid and stable isotope composition of tissues samples (Tollit et al. 2007).

Typically, the importance of any given prey species in marine mammal diet studies is based on some combination of the following two factors: the number of individuals of a particular species represented across all samples (prey number) and the number of samples containing that species across all samples containing prey remains (frequency of occurrence). All of the different methods of diet evaluation in marine mammals have their own set of biases that variably affect estimates of prey volume, weight, number, rank and frequency of occurrence (Sinclair *In prep.*). For example, stomach contents from an individual animal may represent an accumulation of a number of meals over an extended period of time. Certain prey parts such as squid beaks or large fish bones get trapped in stomach folds where they digest very slowly, or accumulate until regurgitated. Therefore, an accumulation of prey parts predictably overestimates the importance of some prey types over others. Regurgitated contents represent a very small portion of the overall diet and primarily that of the largest prey items consumed. By comparison, scat typically represents meals eaten 12-72 hours prior and tend to underestimate the size of prey consumed because small items pass through the digestive tract more readily (and with less erosion) than large items (Sinclair and Zeppelin 2002). Accordingly, diet studies should be interpreted with consideration of the method used to collect prey samples. Fatty acid and stable isotope analyses are being tested to determine whether these techniques may be used to determine weaning status of pups and juveniles. This research gave an indication as to whether or not the animals had converted completely to a diet of fish and helped identify the types of fish consumed by individual sea lions.

Steller sea lions are generalist predators that eat various fish and cephalopods (Pitcher and Fay 1982) and occasionally birds and marine mammals (Daniel and Schneeweiss 1992; Sinclair and Zeppelin 2002). A recent analysis of the Steller sea lions diet compares trends in prey species consumption between summer and winter, when juveniles are first learning to forage on their own (Jones 1981; Brown et al. 2002; Sinclair and Zeppelin 2002). Steller sea lions scats were collected (1990-1998) from 31 rookeries (May-September) and 31 haul out sites (December-April) across the range of the western population resulting in a sample of 3,762 scats with identifiable prey remains. Frequency of occurrence data values combined across years, seasons, and sites indicated walleye pollock (*Theragra chalcogramma*) and Atka mackerel (*Pleurogrammus monopterygius*) as the two dominant prey species, followed by Pacific salmon and Pacific cod. Other primary prey species consistently occurring at frequencies of 5 percent or greater included arrowtooth flounder (*Atheresthes stomias*), Pacific herring, Pacific sand lance, Irish lord (*Hemilepidotus hemilepidotus*), and cephalopods (squid and octopus).

Prior to the early 1990s, the diet of Steller sea lions in the eastern part of their range was not well studied. Steller sea lions in California and Oregon consumed rockfish, hake, flatfish, salmon, herring, skates, cusk eel, lamprey, squid, and octopus (Olesiuk et al. 1990). In British Columbia, principal prey has included hake, Pacific herring, octopus, Pacific cod, rockfish, and salmon

(Trites et al. 2006a). In southeast Alaska, the most commonly identified prey items were pollock, Pacific cod, flatfishes, rockfishes, Pacific herring, salmon, sand lance, skates, squid, and octopus (Calkins and Goodwin 1988; NMFS 2000). All the available data on prey occurrence in stomach contents samples for the eastern and western Steller sea lions populations for the 1950s-1970s and the 1980s have been compiled (Zeppelin et al. 2004; Tollit et al. 2004). For both eastern and western populations, the occurrence of pollock, Pacific cod, and Pacific herring were higher in the 1980s than in the 1950s-1970s, although the data from the 1950s-1970s had both small sample sizes and limited geographic scope, it suggests that there was a shift in the dominant prey species over time and across the range of Steller sea lions.

Size of prey consumed varies, ranging from several centimeters (cm) in length (i.e., sand lance and capelin) to over 60 cm in length (salmon, skates, pollock, and cod). Remains of pollock exceeding 70 cm in length have been recovered in Steller sea lions scats (Schauflerer et al. 2004; Kitts et al. 2004; Ingles et al. 2005; Stansby 1976; Anthony et al. 2000; Payne et al. 1999; Van Pelt et al. 1997).

Prey Quality. An important consideration in evaluating effects of changing diets or prey abundance on Steller sea lions is the quality of the prey. Lipid content, and therefore energy density, varies greatly among Steller sea lions prey species, and within prey species depending upon life history stage, location, and time of year (Schauflerer et al. 2004; Anthony et al. 2000). Atka mackerel and gadids are generally low energy density prey (ranging from about 3 kilojoules/gram [kJ/g] to 6 kJ/g, though few data exist for Atka mackerel), while forage fish such as eulachon, herring, or capelin have generally higher energy contents (up to about 11 kJ/g). Because energy densities are seasonally variable, this is not an absolute relationship. For example, capelin and sand lance declined in lipid content, and therefore energy density, throughout the summer (Hu et al. 2005; Mazzaro et al. 2003). In addition to considerations of prey energy content, vitamins and other metabolites are essential for adequate nutrition (Didier 1999).

To estimate the amount of food required by Steller sea lions in the wild, detailed measurements of metabolic rates and food intake requirements have been made in captivity. However, the studies are of short duration and prey variety is not comparable to what animals in the wild eat. Consequently, the earliest captive feeding studies suggested that they may not be generally representative of field situations (Fadely et al. 1994; Rosen and Trites 2000b), a point that has also been highlighted by researchers conducting the studies (Castellini et al. 2005). A set of captive feeding studies was conducted to address many of these concerns by performing feeding trials throughout the year, and by using mixed diets based on known diet compositions of free-ranging Steller sea lions in different parts of their range (Castellini 2001; Tollit et al. 2007). Preliminary results indicate that Steller sea lions have a tremendous ability to compensate for dietary shifts through physiological adaptations and behavior.

Mellish et al. (2006) summarized the results of studies of juvenile Steller sea lions (one and two years old) that were captured in the wild and held for several months. Some animals were fed an exclusive pollock diet for an average of 54 days and others were fed a mixed diet of several fish species and cephalopods. All animals increased in mass on both diets, indicating that consumption of an exclusive pollock diet was not necessarily a deterrent to growth.

Studies of prey remnants from captive Steller sea lions scats indicate that there are significant differences in digestibility between and within prey species (NMML 1997). Castellini et al.

(2005) examined the energetic requirements of captive Steller sea lions in relation to metabolism, nutritional differences among fish prey species, and hydrodynamics. The results indicate that adding herring to the diet and decreasing the amount of pollock increased the metabolic turnover of protein by 30-50 percent. They also found seasonal differences between the nutritional value of prey samples, with the greatest variability found in herring, and a difference between age classes of pollock. Although captive feeding studies can describe the metabolism of prey once ingested, they do not include components of foraging efficiency, or the cost to the Steller sea lions of acquiring a certain prey type. The net energy gain to an animal from ingesting a particular prey item depends not only upon the energy content of the prey but also on the energetic costs of finding, capturing, handling, and digesting the prey. The energy balance of foraging on any particular prey thus depends on the prey item's individual size, total biomass, availability, behavior, degree of aggregation, temporal and spatial distribution, and other factors.

Population Dynamics

Much of the recent effort to understand the decline of Steller sea lions has been focused on juvenile survival, or has assumed that the most likely proximate explanation is a decrease in juvenile survival rates. This contention is consistent with direct observations and a modeling study, and is consistent with the notion that juvenile animals are less adept at avoiding predators and obtaining sufficient resources (prey) for growth and survival.

The direct observations consist of extremely low resighting rates at Marmot Island of 800 pups tagged and branded at that site in 1987 and 1988 (Chumbley et al. 1997) and observations of relatively few juveniles at Ugamak (Merrick et al. 1987). The low resighting rates do not themselves confirm that the problem was a corresponding drop in juvenile survival, but only that many of the marked animals were lost to the Marmot Island population. Migration to other sites where they were not observed is a possibility, but unlikely given the observations of relatively high site fidelity of animals returning to breed at their natal site. If the "loss" of these animals is viewed in the context of the overall sea lion decline in the central Gulf of Alaska (from 1976 to 1994 the number of non-pups counted at Marmot Island declined by 88.9 percent and by 76.9 percent at the 14 other trend sites in the Gulf; Chumbley et al. 1997), then a significant increase in juvenile mortality is a much more plausible conclusion.

Modeling by York (1994) provides evidence that the observed decline in sea lion abundance in the Gulf of Alaska may have been due to an increase in juvenile mortality. York used the estimated rate of decline between the 1970s and the 1980s, and the observed shift in the mean age of adult females ($\geq$ 3 years of age) to explore the effects of changes in adult reproduction, adult survival, and juvenile survival. While she pointed out that the observed decline did not rule out all other possible explanations, she concluded that the observed decline is most consistent with a decrease in juvenile survival on the order of 10 to 20 percent annually.

Holmes and York (2003) extended earlier analyses of central Gulf of Alaska sea lions through the late 1990s and added an index of juvenile recruitment to the model, which with the effort by Fay (2004) indicated a drop in juvenile survivorship from the 1970s to the 1980s with a slower rate of decline through the 1990s that lead to increase in juvenile and adult survivorship. These analyses showed erosion in birth rates plus pup mortality through one month of age (together, natality rates) that began in the late 1970s and early 1980s (Homes and York 2003; Holmes et al. *In review*). According to models by Wolf et al. (2006), multiple mechanisms likely influenced the decline of the western population including total prey availability could have affected fecundity and pup recruitment.

Status and Trends

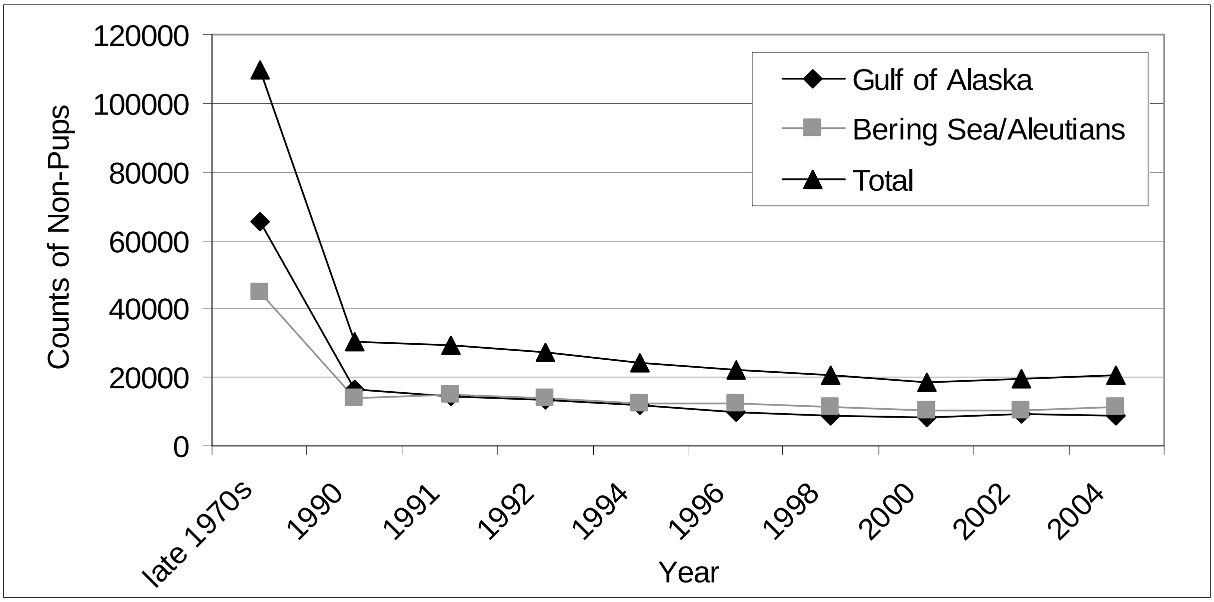
Numbers of Steller sea lions declined dramatically throughout much of the species' range, beginning in the mid- to late 1970s (Braham et al. 1980; Merrick et al. 1987; NMFS 1992, 1995a). For two decades prior to the decline, the estimated total population was 250,000 to 300,000 animals (Kenyon and Rice 1961; Loughlin et al. 1984). By 1989, the population estimate declined by 50-60 percent to about 116,000 animals (NMFS 1992); by 1994, it had collapsed an additional 15 percent. The decline has been restricted to the western population of Steller sea lions which declined by about 5 percent per year during the 1990s.

Western Endangered Population

Between late 1970s and the mid-1990s, counts of the western population of sea lions fell from 109,880 animals to 22,167 animals, a decline of 80 percent (NMFS 1995a). The 1996 count was 27 percent lower than the count in 1990. Fritz and Stinchcomb (2005) estimate that from 1991 to 2000, the number of adults and juvenile sea lions in the western population declined by about 38 percent. Surveys by Fritz and Stinchcomb (2005) indicate that the current number of non-pups in the western population is 29,037. NMFS combined this number with the number of pups in 2004-2005 (9,951) to reach the current minimum population estimate of 38,988 of Steller sea lion in the western U.S. (the western stock); when combined with data on Steller sea lions in Russia the minimum population estimate is 44,780 (Angliss and Outlaw 2007).

Figure 2 depicts the counts of adult and juvenile (non-pups) Steller sea lions at rookeries and haulout trend sites from late 1970s to 2004. Counts of non-pup Steller sea lions at trend sites indicate slight increase in the numbers counted between 2000 and 2002 (about 6 percent), with a similar rate of increase between 2002 and 2004. However, counts of non-pups at trend sites in 2006 indicates numbers declined by 19 percent at some sites in the Western Aleutian Islands since 2004, while numbers counted in the Western Gulf, Eastern Gulf, and the Eastern Aleutians were similar to those counted in 2004 (NMFS 2007b). The 2004 count is still 32.6 percent lower than the 1990 count for this population, and 69 percent lower than in the 1985 count at the at trend sites at Kenai-Kiska (Fritz and Stinchcomb 2005; NMFS 2005). The long-term average decline between 1991 and 2004 is 3.1 percent per year (NMML unpublished data *in* NMFS 2005).

Figure 2. Counts of Steller sea lions (non-pups from the western population) observed at rookery and haul-out trend sites in the Gulf of Alaska & Aleutian Islands (late 1970s to2004[1] [Fritz and Stinchcomb 2005; NMFS 2005]).



[1] Correction factor applied to 2004 count for film format differences (Fritz and Stinchcomb 2005).

Recent regional trends in pup-counts appear to follow the pattern in non-pup counts, with relative stability in the western Gulf of Alaska since 1994, and increases in pup counts in the eastern Aleutian Islands and eastern Gulf of Alaska. However, pup-counts in the central Gulf of Alaska were the lowest on record in 2003-2004, and have declined steadily since 1998 (see table 9 in Finch and Stinchcomb 2005).

A number of population models have been developed for Steller sea lions (e.g., Pascual and Adkison 1994; York et al. 1996; Gerber and VanBlaricom 2001; Holmes and York 2003; Winship and Trites 2006). Several models and field studies indicate that juvenile survival was disproportionately low during the declines in the 1980s (almost 50 percent below the 1976 levels) relative to fecundity and adult survivorship (York 1994; Merrick et al. 1995; Chumbley et al. 1997; Holmes and York 2003). Using a serious of nested models Holmes and York (2003) observed a demographic shift in nature of the declines during the 1990s with adult survivorship at its lowest (20 percent below 1976 levels) with juvenile survivorship and fecundity high. They noted that by the mid to late 1990s adult and juvenile survivorship was slightly depressed (within 5 to 10 percent of 1976 levels), but fecundity was low (Homes and York 2003). While low fecundity affects the continued decline, Holmes and York (2003) suggested that even a small depression in adult and juvenile survivorship at these levels may significantly contribute to population declines. It appears that during the peak of the decline in the 1980s about 15,000 to 20,000 animals a year died (NRC 2003). Mortality from known sources (i.e., fishing, subsistence harvest, predators) accounts for about 4,500 animals per year between 1985 and 1989 (NRC 2003). However, the contribution of some known sources of mortality may be severely underestimated (e.g., shooting). A number of other sources of mortality likely also contributed to the current size of the population but are not included in this estimate including:

nutritional stress, changes in foraging success and prey availability. These are explored briefly in the section titled *Factors Affecting the Species*.

The significant uncertainty in underlying causes that lead to the current status of the Steller sea lion makes prediction of future population variability inherently difficult if not impossible to make with a high level of confidence. Long-term (e.g., 100 year) predictions fail because estimated parameters used in the model are incorrect such as we have failed to include some known or unknown variable acting on the population (or subpopulations), and environmental stochasticity cannot be accurately predicted and incorporated into the model (Hanski 2002). A combination of model approaches allow for comparing significant model parameters and model results. According to several population models the western DPS has significant chance of going extinct within the next 100 years (York et al. 1996; Gerber and VanBlaricom 2003; Winship and Trites 2006), while many individual rookeries (breeding aggregations) however, have a much higher risk of extinction (e.g., western Aleutian island rookeries and Gulf of Alaska; Winship and Trites 2006). York et al. (1996) developed three models corresponding to three spatial scales, suggesting that the median number of adult femailes on each rookery between Kenai-Kiska would decline to less than 50 animals with 80 percent of the rookeries disappearing within 100 years. Gerber and VanBlaricom (2001) used count data from 1965 to 1997 to develop two viability models that evaluated the sensitivity of extinction risk to various levels of stochasticity, spatial scale and density dependence –based on this effort, they estimated a median time to extinction of about 85 years. Winship and Trites (2006) used counts of pups and non-pus from 33 rookeries between 1978 and 2002 to estimate the combination of birth and survival rates operating during the population decline, and projected three possible scenarios—all of which indicated an overall low risk of total extirpation with most rookeries exhibiting high probabilities of going extinct. Goodman (2006) ran three models using Bayesian methods to predict the time to quasi-extinction –reduction to an effect population of 1000 (corresponding to a total population of 4,743 animals) and predicted between 15 percent and 40 percent chance of extinction within the next 100 years.

Results of the population viability models to date indicate that, when treated as a single homogenous population, western Steller sea lion have a high probability of extinction. The prognosis for the species is more optimistic when the 33 rookeries within the DPS are considered distinct, independent populations with independent probabilities of persistence (NMFS 2007c).

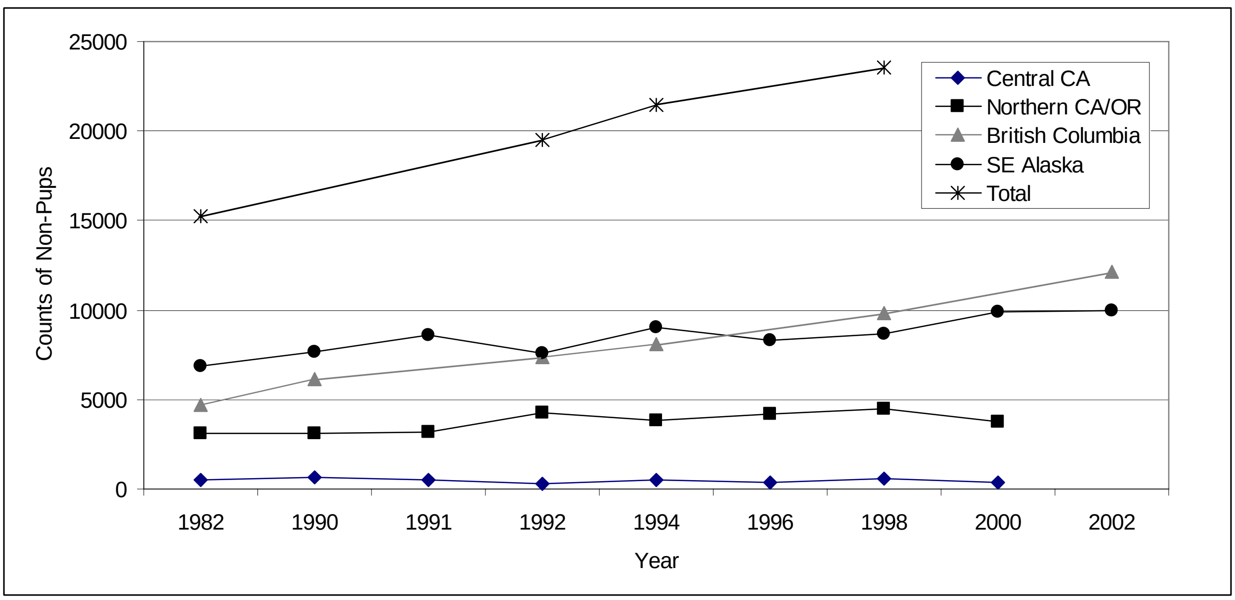
Eastern Threatened Population

The eastern DPS of Steller sea lions includes animals east of Cape Suckling, Alaska (144°W) south to California waters. Trend counts in Oregon were relatively stable in the 1980s, showing a gradual increase in numbers since 1976 (NMFS 2005). Numbers in California, however, have declined to less than 2,000 non-pups, from counts between 1927 and 1947 that were as high as 7,000 non-pups (NMFS 2005). The count from Central California in 2000, reached the second lowest count of 349 non-pups (in 1992 the count was as low as 276 non-pups). In Southeast Alaska, counts of non-pups at trend sites increased by 56 percent from 1979 to 2002 from 6,376 animals to 9,951 (Merrick et al. 1992; Sease et al. 2001; NMFS 2005). Counts of non-pups at British Columbia trend sites increased nearly 260 percent between 1982 and 2002 (NMFS 2005).

Figure 2 depicts the counts of adult and juvenile (non-pups) Steller sea lion at rookeries and haulout trend sites throughout the DPS. Counts from some trend sites were not available in all years. In some years, no counts were available in British Columbia and thus, available counts were not summed in these years for total DPS count. Consequently, only four total data points are illustrated in the Figure 2. For more details on the counts, and use of earlier counts to complete yearly estimates see NMFS 2005.

NOAA Fisheries considers this population stable, and multiplies pup counts by a factor of 4.5 (based on Calkins and Pitcher 1982) to estimate the total population size (NMFS 2005). Pup count data from 2002 from across the range of the eastern population, multiplied by a factor of 4.5 results in a population estimate of 47,885 animals. In 2002, 4,877 pups were counted in Alaska, 3,281 pups were counted in British Columbia, 1,128 pups were counted in Oregon, and 713 counted in California. The current minimum population estimate is 43,728 animals. NMFS calculates this estimate by adding non-pup counts taken in 2002 in Southeast Alaska, to counts of animals in Washington, Oregon and California in 1996, counts of animals in Canada in 1998, and recent pup counts (2002 counts noted previously [NMFS 2005]).

Figure 3. Counts of Steller sea lions (non-pups) observed at U.S. trend sites of the eastern threaten population (NMFS 2005).



Critical Habitat

Critical habitat has been designated for Steller sea lions in California, Oregon, and Alaska (50 CFR 226.202). Steller sea lion critical habitat includes all major rookeries in California, Oregon, and Alaska and major haulouts in Alaska. Steller sea lion critical habitat in Alaska includes a terrestrial zone that extends 0.9 km (3,000 feet) landward from the baseline or point of each major rookery and major haul-out. Critical habitat in Alaska also includes an air zone extending 0.9 km (3,000 feet), measured vertically from sea level, above the terrestrial zone of each major rookery and major haulout. In addition, for major rookeries and major haulouts east of 144^{o} W. longitude, critical habitat includes an aquatic zone that extends 0.9 km (3,000 feet) seaward in State and Federally managed waters from the baseline or basepoint of each major rookery and major haulout. In Alaska's State and Federal managed waters that are west of 144^{o} critical habitat includes an aquatic zone that extends 20 nm (37 km) seaward from the baseline or base point of each major rookery and major haul-out. In California and Oregon, critical habitat includes an air zone extending 0.9 km (3,000 feet), measured vertically from sea level, above areas historically occupied by sea lions at each major rookery. In addition, critical habitat in California and Oregon includes an aquatic zone that extends 0.9 km (3,000 feet) seaward in State and federally managed waters from the baseline or basepoint of each major rookery. Steller sea lion critical habitat also includes three special aquatic foraging areas in Alaska, including the Shelikof Strait area, the Bogoslof area, and the Seguam Pass area. Some of the proposed research may occur in Steller sea lion critical habitat.

Factors Affecting the Status of the Species

The following section summarizes the principal phenomena known to affect the likelihood that Steller sea lion populations will survive and recover in the wild. Some human activities occurred in the past, ended, and no longer appear to affect either sea lion population; other activities have ended, but have had effects on the structure or composition of Steller sea lion populations that continue to hinder their ability to reverse their decline toward extinction. Still other human activities appeared to affect Steller sea lion populations after their decline and continue to affect them.

Predation

Killer whales and sharks prey on Steller sea lions, and given the reduced abundance of sea lions at multiple sites these successful predators may exacerbate the decline in local areas (e.g., Barrett-Lennard *et al*. 1995). Research suggests that the transient (migratory) killer whales may rely on marine mammal prey to a greater extent than *resident* and *offshore* killer whales (Barrett-Lennard *et al*. 1995; Matkin et al. 2002; Heise 2003; Krahn et al. 2004a). According to observations in the Gulf of Alaska, Steller sea lions may be a preferred prey in this region where researches observed 79 percent of the killer whale attacks were on Steller sea lions. In other regions, less than 10 percent of the attacks observed were on Steller sea lions (*see* NPUMMRC 2006).

Although the number of chases or harassment events by a large predator like a killer whale or shark would outnumber the successful kills, evidence suggests losses due to predation may be significant. For instance, the stomach of a dead killer whale that washed ashore in Prince William Sound in the early 1990s contained 14 flipper tags from Steller sea lions. Using survey data and data on the stomach contents of 15 killer whales, Barrett-Lennard et al. (1992) ran Leslie matrix simulations under various assumptions of killer whale predation in relation to changes in Steller sea lion density. As a result, killer whale predation of Steller sea lions did not likely cause the severe decline in Steller sea lions in the 1980s but may exacerbate the decline in some areas. Barrett-Lennard et al. (1992) estimated that some 18 percent of Steller sea lion mortality may be attributed to killer whale predation. Sharks also likely prey on Steller sea lions. While we know of no formal estimates of the numbers of Steller sea lion mortalities attributed to shark predation, Loughlin and York (2000) assume that it is a very low level and have used 2 percent as an estimate of shark induced mortalities. The rate of predation on Steller sea lions from both killer whales and sharks may increase in proximity of large fish processing vessels, where observers have noted killer whales and sea lions aggregating and feeding on discards from the vessels (Loughlin and York 2000).

Mortality due to predation may naturally affect a disproportionate number of juveniles and pups. According to a survey conducted by Heise et al. (2003) more mariners observed killer whale activity during July when pups leave the rookeries. While these observations may be a function of observer activity, research on other pinniped species suggests pups are more frequently killed by killer whales than other age-classes (*see* Lopex and Lopez 1985, Hoelzel 1991, and Baird 1994 *as cited in* Heise et al. 2003). Certain killer whale populations or subpopulations may have adapted to the timing of just such an event. Matkin et al. (2002) suggested that the average (best estimate) weight of Steller sea lion taken by a killer whale is about 160 kg (an animal of this size is likely a juvenile).

Disease

Disease and parasitism are also potential causes of population decline, and evidence is available indicating exposure of animals to diseases and that animals carry parasites. However, we have insufficient evidence at this time to suggest what role, if any, disease or parasitism may impede survival and recovery of Steller sea lion populations. Disease and parasitism are common in all pinniped populations and have been responsible for major die-offs in other species, but such events are usually relatively short-lived and provide more evidence of morbidity or mortality. Burek et al. (2000, 2005) evaluated samples from the period of steepest decline in Steller sea lions populations (1970s to 1990s) and found no evidence of significant exposure of sea lions to several morbilliviruses, but did find exposure to several other viruses, such as phocid herpesviruses, caliciviruses and others. While some of these viruses may contribute to low birth rates and reduce an individual's immunity, the extent to which they have affected Steller sea lion populations is unclear. As such, disease and parasitism remain a concern that requires additional monitoring.

Natural environmental change

Studies of atmospheric and oceanic circulation and physical properties indicate that the Gulf of Alaska and Gulf of Alaska ecosystems shift between at least two types of climatic regimes (Trenberth 1990; Ebbesmeyer et al. 1991; Brodeur and Ware 1992; Beamish 1993; Francis and Hare 1994; Miller et al. 1994; Trenberth and Hurrell 1994, 1995; Ingraham et al. 1998). While these regimes differ in many ways, they can be simply categorized as "warm" and "cold" depending on atmospheric and oceanic temperatures. One factor inducing the shift between regimes is changes in the position of the Aleutian Low Pressure system, which leads to changes in atmospheric temperature, storm tracks, ice cover, and wind direction (Wyllie-Echeverria and Wooster 1998). Indices, such as the Southern Oscillation Index, Pacific Decadal Oscillation, the North Pacific Index and the Aleutian Low Pressure Index, and several lesser-known indices, reflect shifts between regimes. Certain, major shifts are apparent in all indices (e.g., the 1977 regime shift), but not all regime shifts are apparent in all indices. Historical studies suggest that over the last 500 years, the system has oscillated between the two distinct regimes every 10-30 years (Ingraham *et al*. 1998; Benson and Trites 2002).

A well-documented shift from a cold to a warm regime in 1976-77 was associated with dramatic changes in the structure and composition of the invertebrate and fish communities as well as the distribution of individual species in the North Pacific ocean and Bering Sea (Brodeur and Ware 1992; Beamish 1993; Francis and Hare 1994; Miller *et al*. 1994; Hollowed and Wooster 1992, 1995; Wyllie-Echeverria and Wooster 1998). For instance, many groundfish stocks, particularly pollock, Atka mackerel, cod and various flatfish species increased in abundance as a result of strong year-classes spawned in the mid to late 1970s. Many of the long-lived flatfish species (e.g., arrowtooth flounder, Pacific halibut, yellowfin sole, and rock sole) remained in high abundance since then, while other shorter lived groundfish species (pollock, Atka mackerel, and

Pacific cod) have oscillated in abundance. Based on these patterns, researchers have associated "warm" years (and other related environmental conditions, such as southwest winds in April [Wyllie-Echeverria and Wooster 1998]), with the production of strong year-classes of gadids (Hollowed and Wooster 1992, 1995; Wespestad *et al*. 2000).

Increases in many broadly distributed benthic (e.g., arrowtooth flounder, Pacific halibut) and semi-demersal (e.g., pollock and Pacific cod) piscivorous groundfish species since the late 1970s has been associated with either (or both) a decline in abundance (at least in nearshore environments; Anderson et al. 1996) or a change in distribution of short-lived pelagic species such as capelin. Anderson and Piatt (1999) describe an almost complete disappearance of capelin from bays and the nearshore environment of the western and central Gulf of Alaska beginning in the late 1970s and early 1980s, and increases in cod and flatfish. During this time, the prevalence of capelin in the diets of many piscivorous birds and pinnipeds in the Gulf of Alaska also declined (e.g., Merrick et al. 1997). However, Yang et al. (2005) estimated that capelin consumption in 1990 in the Gulf of Alaska by the groundfish species was at least 222,000 t. This suggests that capelin did not disappear from the Gulf of Alaska (since so much was eaten by groundfish), but changed distribution in response to the cooler water conditions. Changes in water temperatures may have reduced the availability of capelin to Steller sea lions in the SE Bering Sea and Gulf of Alaska while increasing the availability of capelin to other piscivores.

Sea lions may have lived through many regime shifts in the few million years that they have existed. What may be different about this most recent shift is the coincident development of extensive fisheries targeting the same prey that sea lions depend on during warm regimes. Fisheries in the Bering Sea and Gulf of Alaska expanded enormously in the 1960s and 1970s. The existence of a strong environmental influence on sea lion trends does not rule out the possibility of significant fisheries-related effects. The cause of the sea lion decline need not be a single factor. To the contrary, strong environmental influences on Gulf of Alaska and Gulf of Alaska ecosystems could increase the sensitivity of sea lions to fisheries or changes in those ecosystems resulting from fisheries.

Impacts of Human Activity on Steller Sea Lions

*Commercial harvest of Steller sea lions***.** In 1959, the Bureau of Commercial Fisheries awarded a contract to a commercial fishing company to develop techniques for harvesting sea lions in Alaskan waters. The two-fold purpose of the contract was to reduce the sea lion herds (because of alleged depredations on salmon and halibut fisheries) and to provide an economical source of protein for fur farms, fish hatcheries, and similar purposes (Thorsteinson and Lensink 1962). In 1959, 630 sea lion bulls were killed in an experimental harvest, but the harvest proved to be uneconomical. Another study was contracted by the Bureau of Indian Affairs of the Department of Interior to analyze the feasibility of a commercial sea lion harvest in Alaska (Little 1964). A total of 45,178 pups of both sexes were killed in the eastern Aleutian Islands and Gulf of Alaska between 1963 and 1972 (Merrick *et al.* 1987). Such harvests may have depressed recruitment in the short term and may have explained declines noted at some sites in the eastern Aleutian Islands or the Gulf of Alaska. These harvests do not appear to explain declines in other regions.

*Subsistence harvest of Steller sea lions***.** The MMPA authorizes the taking of any marine mammal by Alaska Natives for subsistence purposes or for the purpose of creating and selling authentic native articles of handicrafts and clothing, given that it is not done in a wasteful manner (MMPA, Section 101[b]). The ESA also contains provisions that allow for the continued subsistence use of listed species. Both the ESA and the MMPA contain provisions that allow regulation of the subsistence harvest of endangered, threatened, or depleted species, if necessary (NMFS 1995a).

The Alaska Department of Fish and Game has documented subsistence harvest of sea lions since 1992. Estimates by Wolfe and Mishler (1993, 1994, 1995, 1996) indicate a mean annual subsistence take of 448 animals from the western endangered population from 1992 to 1995. Aleut hunters in the Aleutian and Pribilof Islands harvest the majority (79 percent) of sea lions, and about 99 percent of the total statewide harvest comes from the western population (i.e., west of 144° longitude). According to survey data collected by ADFG, the estimated mean annual subsistence harvest from the western stock between 2000 and 2004 was 191 animals per year (Angliss and Outlaw 2007). The highest harvest levels during this period occurred in 2003 and 2004 when an estimated 205 and 204 animals were taken (harvested and struck and lost) respectively. ADFG estimates the mean number of animals harvested statewide is 216 individuals (confidence interval is 147 to 335; Wolfe et al. 2005). This indicates that about 95 percent of subsistence harvest is on individuals from the Western DPS. ADFG estimates age and sex composition of harvested animals only. These estimates suggest that nearly 60 percent of the individuals harvested are adults, with a ratio of 1.8 male for every female harvested, and the remainder are juveniles (Wolfe et al. 2005).

Contaminants. Several studies indicate that organochlorine pollutant residues in the tissues of California sea lions and harbor seals have been associated with reproductive failure (NMFS 1992). These pollutants have also been reported in association with impaired immune systems (Becker *et al*. 1997). A number of studies (Varanasi *et al*. 1992; Lee *et al*. 1996; Krahn 1997; Krahn et al. 2004b) have also indicated relatively high concentrations of organochlorine compounds in Steller sea lions in Alaska, although these levels have not yet been associated with any changes in health or vital rates (see also, Barron et al. 2003).

Low-level mercury exposure is evident in pups and females, but the long-term effect mercury or even methylmercury has on Steller sea lions is unclear (Beckmen et al. 2002). Based on recent data on methylmercury in salmon, Beckmen et al. (2002) suggest that exposure at low levels is cause for concern because methylmercury is a powerful neurotoxicant that acts synergistically with polychlorinated biphenyls. Some Steller sea lions are likely directly exposed to oil, particularly during tanker breaches like the spill from the Exxon Valdez in 1989 and the spill from a Malaysian freighter, Selangdong, in 2004. Exposure or fouling fur (pelage) is not as detrimental to a sea lion as an otter or bird because the blubber is the primary insulation. While, no significant adverse effects of the oil were confirmed following the Exxon spill (Calkins *et al*. 1994) ingestion and exposure of mucosal membranes may have chronic effects on an individual's health (see discussion, next section). At present, there is not enough information to determine what role, if any, exposure to contaminants plays in the health, survival and recovery of Steller sea lion populations.

*Oil and gas or mineral development***.** Previous biological opinions written by NMFS for both the Bering Sea and Aleutian Islands and the Gulf of Alaska analyzed oil and gas or mineral development under the heading of "human development" (NMFS 1993, 1995b). In each case it was noted that human development activities that result in aquatic habitat destruction or the release of contaminants and pathogens (e.g., mineral exploration and extraction, effluent discharges into the marine environment) could directly diminish the health and reproductive success of Steller sea lions or cause them to abandon feeding, breeding, or resting sites. Development and discharge proposals typically undergo ESA section 7 consultation during the federal permitting process.

On October 15, 1993, NMFS completed a biological opinion on the leasing and exploration activities of the Minerals Management Service in the Cook Inlet/Shelikof Strait region (lease sale Number 149). The biological opinion concluded that such activities were not likely to jeopardize the continued existence of any listed or proposed species, nor were they likely to destroy or adversely modify critical habitats (NMFS 1993). In 1995, NMFS conducted another section 7 consultation with the Minerals Management Service and concluded that the lease sale and exploration activities for the proposed oil and gas Lease Sale Number 158, Yakutat, were not likely to jeopardize the continued existence of any listed or proposed species, nor were the activities likely to destroy or adversely modify critical habitats (NMFS 1995b).

We expect oil spills will adversely affect Steller sea lions if they contact individual animals, haulouts, or rookeries when occupied, or large proportions of major prey populations. Potential effects could include: oil exposure, including surface contact and pelage fouling, inhalation of contaminant vapor, and ingestion of oil or oil-contaminated prey. Because the insulation of non-pup sea lions is provided by a thick fat layer rather than pelage whose insulative value could be destroyed by fouling, oil contact is not expected to cause death from hypothermia; however, sensitive tissues (e.g., eyes, nasal passages, mouth, lungs) are likely to be irritated or ulcerated by exposure to oil or hydrocarbon fumes. Oiled individuals probably will experience effects that may interfere with routine activities for a few hours to a few days; movement to clean water areas is expected to relieve most symptoms. Females returning from feeding trips may transfer oil to pups, which probably are more sensitive to oil contact.

The extent to which sea lions avoid areas that have been oiled is not known; individuals observed in Prince William Sound and the Gulf of Alaska after the Exxon Valdez oil spill did not appear to avoid oiled areas (Calkins and Becker 1990). Sea lions were sighted swimming in or near oil slicks, oil was seen near numerous haul-out sites, and oil fouled the rookeries at Seal Rocks and Sugarloaf Island (Calkins *et al*. 1994). All of the sea lions collected in Prince William Sound in October 1989 had high enough levels of metabolites of aromatic hydrocarbons in the bile to confirm exposure and active metabolism at the tissue level. But as noted above, no evidence indicated damage caused to sea lions from toxic effects of the oil (Calkins *et al*. 1994).

Although Alaska is estimated to contain large petroleum resources on its outer continental shelf and in state waters, the only oil produced from Alaska's outer continental shelf to date has come from Cook Inlet south of Anchorage. In the foreseeable future, the kind of extensive oil and gas activities that characterize the outer continental shelf of the central Gulf of Mexico is not likely for the Gulf of Alaska. Little or no oil and gas exploration or production is occurring or likely to occur soon on the Russian outer continental shelf area of the Bering Sea. The National Research Council recently concluded, therefore, that oil and gas activities in the Bering Sea have not significantly affected the Bering Sea ecosystem (NRC 1996).

Entanglement in marine debris. Observations of Steller sea lions entangled in marine debris have been made throughout the Gulf of Alaska and in southeast Alaska (Calkins 1985), typically incidental to other sea lion studies. Two categories of debris, closed plastic packing bands and net material, accounted for the majority of entanglements. Loughlin *et al*. (1984) surveyed numerous rookeries and haul-out sites to evaluate the nature and magnitude of entanglement in debris on Steller sea lions in the Aleutian Islands. Of 30,117 animals counted (15,957 adults; 14,160 pups) only 11 adults showed evidence of entanglement with debris, specifically, net or twine, not packing bands or other materials. Entanglement rates of pups and juveniles appear to be even lower than those observed for adults (Loughlin and Nelson 1986). It is possible that pups were too young during the survey to have encountered debris in the water or that pups and juveniles were unable to swim to shore once entangled and died at sea. Trites and Larkin (1992) assumed that mortalities from entanglement in marine debris were not a major factor in the observed declines of Steller sea lions and estimated that perhaps fewer than 100 animals are killed each year. Current estimates of annual mortality related to entanglement in fishing gear are addressed in the next section of this Opinion.

Incidental take of Steller sea lions in fisheries. Steller sea lions have been caught incidentally in foreign commercial trawl fisheries in the Gulf of Alaska and Gulf of Alaska since those fisheries developed in the 1950s (Loughlin and Nelson 1986; Perez and Loughlin 1991). Alverson (1992) suggested that from 1960 to 1990, incidental take may have accounted for over 50,000 animals, or almost 40 percent of his estimated total mortality due to various fishery and subsistence activities. Perez and Loughlin (1991) reviewed fisheries and observer data and reported that from 1973 to 1988, sea lions comprised 87 percent (over 3,000) of the marine mammal incidental take reported by observers. They extrapolated the take rate to unobserved fishing activities and suggested that the incidental take during 1978 to 1988 was over 6,500 animals. Using the average observed incidental rates during 1973 to 1977 they also estimated that an additional 14,830 animals were incidentally taken in the trawl fisheries in Alaska during 1966 to 1977. Finally, they concluded that incidental take was a contributing cause of the population decline of Steller sea lions in Alaska, accounting for a decline of 16 percent in the Gulf of Alaska and 6 percent in the Gulf of Alaska. However, because the actual decline has exceeded 80 percent since 1960, fishery related mortality of Steller sea lions does not appear to be the only factor contributing to their decline.

Western Endangered Distinct Population Segment

Serious injury and mortality of western Steller sea lions occurred in trawl, longline, and drift gillnet fisheries for cod, Atka mackerel, flatfish (e.g., flounder, halibut, and others), pollock, and salmon. The combined mortality estimates result in an estimated mean annual mortality rate of 24.6 (CV = 0.60) sea lions from the western stock (Angliss and Outlaw 2007). This estimate is derived from observer data and self-reported data from fishers, and includes estimates of mortality from entanglement from fishing gear. NMFS estimates the mean annual mortality rate from commercially regulated fisheries based on observer data from 1990 through 2004; with the most recent 5 years of available data used to estimates when more than 5 years of data are available for a particular fishery (see Angliss and Outlaw 2007 for more detailed information). In total, the current estimated annual mortality rate attributable to the fisheries is 24.2. NMFS estimated mean annual mortality from stranding from entanglement in fishing gear is 0.4 and is based on strandings data from 1999 to 2003. Estimates of both data sets are extrapolated to account for coverage and bias, with estimates from observer data providing the bulk of data. However, NMFS is aware that several fisheries interact with this population but has no observers assigned to these fisheries. Consequently, NMFS considers the estimated mortality attributable to commercial fisheries in Alaska a minimal amount of mortality that likely occurs (Angliss and Outlaw 2007).

Satellite tracking studies suggest that Steller sea lions rarely go beyond the U.S. EEZ into international waters. Given that the high-seas gillnet fisheries have ended and other net fisheries in international waters are minimal, the probability that significant numbers of Steller sea lions are taken incidentally in commercial fisheries in international waters is low. NMFS has concluded that the number of Steller sea lions taken incidental to commercial fisheries in international waters is insignificant (NMFS 2005).

Eastern Threatened Distinct Population Segment

The current estimate of incidental mortality of Steller sea lions in the eastern population attributed to commercial and tribal fisheries is 3 animals per year (Angliss and Outlaw 2007). This estimate is derived from observer data and self-reported data from fishers and includes estimates of mortality from entanglement from fishing gear (standing data).

Intentional take of Steller sea lions in fisheries. Historically, Steller sea lions and other pinnipeds were seen as nuisances to the fishing industry and management agencies because they damaged catch and fishing gear and were thought to compete for fish (Mathisen 1959). Sea lion numbers were reduced through bounty programs, controlled hunts, and indiscriminate shooting. Steller sea lions were also killed for bait in the crab fishery. Government sanctioned control measures and harvests stopped in 1972 with the introduction of the MMPA.

The total number of sea lions killed since the early part of this century is unknown. Alverson (1992) suggested that intentional take may have reached or exceeded 34,000 animals from 1960 to 1990. Fishermen were seen killing adult animals at rookeries, haul-out sites, and in the water near boats. The loss of that many animals would have an appreciable effect on the population dynamics of sea lions, but the effect would not account for the total decline of the western population. The effect was likely concentrated in areas closer to fishing communities and less important in more isolated areas (e.g., central and western Aleutian Islands).

Sea lion populations appear to be growing slowly in southeast Alaska, where considerable commercial fishing occurs. Expanded observer coverage in the domestic groundfish fishery after 1989 and increased public awareness of the potential economic and conservation impacts of continued sea lion declines have probably reduced the amount of shooting. Nevertheless, anecdotal reports of shootings continue and a small number of prosecutions have occurred or are occurring. Recently, British Columbia outlawed the shooting of Steller sea lions in and around the commercial farming operations. An estimated 45 animals were killed each year between 1999 and 2003 in an effort to control predation at fish farm operations in British Columbia. However, British Columbia has not authorized this activity since 2004 (*see* NMFS 2005).

Competition with Commercial Fisheries. Numerous fisheries are conducted in Federal and State waters off Alaska that may adversely affect Steller sea lions. Commercial fisheries for groundfish (including fisheries for Atka mackerel, walleye pollock, and Pacific cod), herring, crab, shrimp, and Pacific salmon interact with Steller sea lions in a wide variety of ways, including operational conflicts (e.g., incidental kill, gear conflicts, sea lion removal of catch) and biological conflicts (e.g., competition for prey). The potential biological effects of these fisheries on listed Steller sea lions, particularly the endangered western population, have been the subject of extensive debate since the mid-1990s. Some authors have argued that the fisheries may adversely affect Steller sea lions by (a) competing with sea lions for prey, particularly, walleye pollock, and (b) affecting the structure of the fish community in ways that reduce the availability of alternative prey (see for example Alaska Sea Grant 1993, NRC 1996). Other authors have argued that Steller sea lions may be harmed by diets that are dominated by walleye pollock (Rosen and Trites 2000). Still others suggest that the fisheries are not the primary cause of the Steller sea lion's decline and, instead, point to environmental changes (the regime shift that was discussed previously) and increased predation (primarily by killer whales) as the causative agents (for example, see Saulitis et al. 2000).

The debate over the effects of federal fisheries on listed Steller sea lions escalated between the late 1990s and 2001 in several legal challenges on the biological opinions NOAA Fisheries issued, pursuant to section 7 of the ESA, on the effects of the groundfish fisheries on Steller sea lions (NMFS 1998, 2000, 2001). Ultimately, in response to a biological opinion that found the groundfish fisheries jeopardized the continued existence of Steller sea lions, Congress allocated $2 million for the National Academy of sciences to review the issue of the fishery affect on the status of Steller sea lions (the full statement of the task is found on page 2 of NRC 2003). The committee commissioned with this task could not find conclusive evidence for either the justification of or the overturning of the "reasonable and prudent measures" that NMFS established for these fisheries (NRC 2003). While no global reduction of prey biomass from fisheries removal was detected during the period of steepest declines of Steller sea lions, localized depletion of some prey stocks may suggest at least a portion of the decline, in combination with several other factors discussed in this section.

In comparison with federal authorized fisheries, the size of the State of Alaska commercial groundfish fisheries are generally small and are expected to have less impacts on listed species with respect to competition for prey and long term ecosystem impacts. There is a reasonable expectation that the State will expand their management of groundfish fisheries within State waters given their recent proposals that have been reviewed by NMFS (e.g., Aleutian Islands pollock and Pacific cod). The crab fishery is one of the biggest fisheries managed by the state, but is not likely to directly compete for prey with either Steller sea lions or other listed species.

The patterns of Steller sea lion decline are variable (e.g., York et al. 1996), and a review of localized fishing effort with Steller sea lion trends indicates fishing effort is correlated with these trends (Dillingham et al. 2005). In particular, Dillingham et al. (2005) found walleye pollock density (and longline fishing effort) showed a consistent and statistically significant inverse relationship with the rate change in Steller sea lion trend sites. Although the rate of change observed by Dillingham et al. (2005) confirms that fishing adversely affected the population, the size of the effect detected cannot alone explain the severe decline in the early 1980s.

Nevertheless, the fisheries appear to have had some adverse effect on Steller sea lions in the past and we expect these impacts to continue. We have evidence that Alaska's herring fisheries, in particular, compete with Steller sea lions and other listed species. Steller sea lions appear to be attracted to the dense aggregations of herring that occur along some sections of the coast during the herring's short, spawning period. Because the timing of herring spawning varies, fishery managers have learned to depend on the presence of Steller sea lions to determine when herring spawning is imminent. Steller sea lions have been observed in the middle of these fishing areas and have been observed leaving the spawning grounds shortly after the herring finish spawning (fishery biologists survey the biomass of the spawning deposits by SCUBA, but wait until the sea lions leave the area for safety reasons).

In general, state and federal groundfish fisheries reduce the abundance or alter the distribution of several prey species that include walleye pollock and cod. The groundfish fisheries may cause dense schools of prey species to scatter which could affect the foraging behavior of marine mammals and seabirds that target aggregated prey. Repeatedly causing fish schools to scatter and reducing their density would also reduce the value of the foraging areas to Steller sea lions by increasing the amount of time and energy and sea lion would have to expend to feed on the same number of fish. The reductions of biomass at larger spatial scales would exacerbate the effects of small-scale depletions caused by fishing; because the spawning biomass in the entire ecosystem is about half of what it would be without fishing, there are fewer spawning-aged fish to replenish areas where fishing has occurred.

Based on available data, we would expect several groundfish fisheries, particularly the pollock and cod fisheries, to compete with foraging Steller sea lions, contribute to their nutritional stress, and may appreciably reduce the value of the marine portions of critical habitat that has been designated for Steller sea lions. The fisheries may reduce the abundance of prey within these marine foraging areas and would alter the distribution of groundfish prey in ways that would reduce the effectiveness of foraging sea lions. The reduction in the abundance of prey species and the alteration of their distribution could effectively keep the carrying capacity of critical habitat for Steller sea lions below the current population size.

Sport and Subsistence/Tribal Fisheries. Relative to commercial fisheries, we expect that sport and tribal/subsistence fisheries have an incremental effect on listed Steller sea lions. For perspective, Alaska's sport fishery harvests about 1 percent (4,000 mt) and subsistence fishery harvests 2 percent (8,000 mt) of the annual State of Alaska total fish harvests, while the commercial fisheries accounted for 97 percent (900,000 mt) of the annual harvest in 1998. The actual effect these fisheries have on Steller sea lions is likely incremental, particularly in comparison to commercial fisheries. Impacts are likely limited to minor removals of the potential foraging base, but in such small volumes that we expect only incremental adverse effects, if any. However, we expect any increases would continue in relatively low amounts in the future. The nature of these fisheries is slow removal rates and dispersed catch. Other effects from these activities may include general human disturbance as more fishers recreate in remote areas that are occupied by Steller sea lions. In general, sport and subsistence fisheries are expected to continue into the foreseeable future throughout the action area and may increase in the future as tourism and population increases.

Research. Steller sea lions have been the subject of scientific research for more than 60 years (Steller 1751; Scheffer 1945). More than 600 papers have been published on Steller sea lions; most of which were published in the past 15 years since the species was listed (Hunter and Trites 2001). In many cases, Steller sea lions have been captured, wounded, or killed for scientific studies (Thorsteinson and Lensink 1962; Calkins and Pitcher 1982; Calkins and Goodwin 1988; Calkins *et al*. 1994)

- In 1959, 630 sea lion bulls were killed in an experimental, commercial harvest. Life history information (age, size, reproductive condition, food habits) was collected.
- Between 1975 and 1978, researchers shot 250 sea lions in nearshore waters and on rookeries and hauling areas of the Gulf of Alaska. Stomachs were removed and examined for food content, reproductive organs were preserved for examination, blood samples were taken for disease and parasite studies, body measurements were recorded

for growth studies, skulls were retained for age determination, tissue samples were preserved for elemental analysis and pelage samples were taken for molt studies.

- In 1985 and 1986, researchers killed 178 sea lions in the Gulf of Alaska and southeastern Alaska to compare food habits, reproductive parameters, growth and condition, and diseases, with the same parameters from animals which were collected in the 1970s. The study was designed to address the problem of declining numbers of sea lions in the North Pacific and particularly in the Gulf of Alaska.
- In 1989, following the Exxon Valdez oil spill, sixteen Steller sea lions were killed as part of the Natural Resources Damage Assessment study.

Since 1956, Steller sea lions have been counted by airplanes, boats, and on foot. By the late 1990s, research activities began to focus on the status and trend of Steller sea lions in the western portion of their range; once the western population of Steller sea lions was identified and reclassified as endangered, research activities began to focus on interactions between the sea lions and commercial fisheries in the Aleutian Islands, Bering Sea, and Gulf of Alaska. In 1995, 7,500 Steller sea lions were disturbed during research activities, but no mortalities were reported. Research activities conducted in 1996 followed a similar pattern, although one mortality was reported. In 1997, researchers approached more than 31,000 Steller sea lions, and disturbed another14,550 individuals. Researchers captured 137 Steller sea lions, tagged 121 individuals, and did not detect or report any mortalities. In 1998, 48,000 Steller sea lions were disturbed by similar investigations, 384 pups were captured, tagged, and branded, and no mortalities were reported.

The controversy fueled by NOAA Fisheries' reasonable and prudent measure under the November 2000 biological opinion on the impacts of the fishery on Steller sea lions (discussed previously), led to a significant increase in resources "to produce the science and data to keep the fisheries open while protecting the sea lion population (Senate Report 106-404 see Ferrero and Fritz 2002)." Federal funding for Steller sea lion research activities in 2001 represented an increase of more than $38 million over the previous year. With this increase in funding came an influx of new requests for authorization to study endangered and threatened Steller sea lion populations, pursuant to section 10 of the ESA and the MMPA. Prior to the increase in federal funding NMFS authorized two permits for research on Steller sea lions, and with the increase in funds available for research projects requests for research permits increased at four-fold.

According to the Permits Division, in 2000 investigators disturbed 2,976 animals. The Permits Division described these disturbances as *level B* harassment[5] and 63 animals were exposed to research activities that qualified as *level A* harassment under the MMPA. Numbers of animals disturbed by research activities rose in 2001, to 23,207 animals that experienced level B harassment, with a concomitant increase in animals experiencing disturbance characterized as level A harassment. In 2002, the number of Steller sea lions experiencing level A harassment

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[5] The 1994 Amendments to the MMPA define harassment as "Any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild (Level A harassment); or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing a disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering (Level B harassment)."

was 426 while 28,898 animals experienced level B harassment. The numbers of Steller sea lions harassed by research activities increased nearly two-fold between 2002 and 2004, with an increase of almost fifteen times the number harassed in 2004 compared to reported numbers in 2000.

Steller sea lions are also harassed during research on other marine mammals. Presently, nine permits issued by the Permits Division authorize the incidental disturbance of Steller sea lions during directed research on other marine mammals. In total the nine permits authorize the incidental disturbance of 5,250 Steller sea lions in the western endangered DPS, and 33,050 individuals from the threatened DPS. These permits are for directed research on killer whales, and other cetaceans, in Alaska, California, Washington, California, and Oregon. Research activities authorized under these permits are directed at other species, but may occur in the vicinity of, and result in harassment of Steller sea lions. For the most part, these activities likely cause displays of agitation in Steller sea lions and in some cases may cause Steller sea lions to temporarily move away from researchers.

Effects of the Proposed Activities

The *Description of the Proposed Action* summarizes the Steller sea lion and Northern fur seal research program, the legal framework for authorizing and funding these activities, and the thirteen research permits proposed for authorization. The *Status of the Species and the Environmental Baseline* identifies the endangered and threatened species, their designated critical habitat, and any species proposed for listing that occurs within the action area for the research program and the activities proposed under the thirteen permits. The *Status of the Species and the Environmental Baseline* section provides a summary of the species that are not likely to be adversely affected by the proposed action, and summarizes the status of Steller sea lions, which are likely to be adversely affected by the proposed research activities, and the past and present consequences of a variety of human activities (i.e., *the Environmental Baseline*) in the action area. In this section, we review the effects of the activities NMFS' Permits Division would authorize under the proposed permits and whether the activities are likely to cause individuals to experience reductions in their fitness, or reduce the viability of the populations those individuals represent (as measured in changes in the populations' abundance, reproduction, spatial structure and connectivity, growth rates, or variance in these measures to make inferences about the population's extinction risk.

Serious Injury and Mortality

As mentioned in the *Description of the Proposed Action* of this Opinion, NMFS is proposing to limit the total amount of incidental mortality resulting from their action to 15 percent of the PBR for each stock or DPS. As proposed in the PEIS, and until new stock abundance estimates are available, the Permits Division would ensure that their funding and permit activities would not result in the annual incidental mortality of more than 35 individual Steller sea lions from the Western DPS and 295 individual Steller sea lions from the Eastern DPS (see Tables 4.8-8 through 4.8-12, and 4.8-20 through 4.8-24 for a description of NMFS' estimates of mortality risks attributable to various study activities [NMFS 2007c], also summarized in Table 1 of this Opinion). NMFS has predicted the number of Steller sea lions that are likely to die as a result of the activities authorized under the thirteen permits using the estimated risk of serious injury and mortality presented in Table 1. As a result, NMFS Permits Division predicts that the proposed activities would not approach 15 percent of PBR for the eastern DPS of Steller sea lions, and would reach 15 percent of PBR for the western DPS of Steller sea lions. The estimated number of animals that would die in each Steller sea lion DPS are noted in Table 5. According to the proposed research permits research-related mortality in the eastern threatened population would be less than 2 percent of PBR.

Table 5. Estimated Number of Steller Sea Lions Killed by Research Activities in each DPS.

Permit Applicant	Western DPS	Eastern DPS
NMML 782-1889	9	1
Wynne (UAF) 1049-1886	3	---
ADFG 358-1888	3	16
Horning (OSU) 1034-1887	4	2
NPUMMRC 715-1885	4	2
ASLC 881-1890	12	---
ODFW 434-1892	---	8
NMML 782-1702		12
TOTAL Research Mortalities	35	33

In comparison with the current 4-year average of mortalities attributed to subsistence harvest, direct mortalities attributed to the fisheries, and the number of animals that would be killed during research each year for the next three years means that PBR would be exceeded by 17 animals in the U.S. portion of the western DPS. In the past four years, however, the actual number of animals killed or injured during subsistence harvest activities has increased such that the most recent estimate was that a total of 204 were taken in 2004 (upper 95 percent confidence level is 316 animals (Wolfe et al. 2005)). When we compare this with a back-calculated 95 percent confidence level for the fishery mortality using the CV=0.60 as reported by Angliss and Outlaw (2007), and assume an additional 2 taken by illegal harvest (based on the last number prosecuted), PBR for this stock is exceeded by nearly 200 animals. In comparison, the calculated PBR for the threatened stock of Steller sea lions is not approached even with the level of mortality attributed to the Steller sea lion and Northern fur seal research program (table 6).

Table 6. Estimated Mortality from Direct Human-Caused Sources (Wolfe et al. 2005; Angliss and Outlaw 2007).

Threat	Western DPS Steller Sea Lions		Eastern DPS Steller Sea Lions	
	Estimated Take	Upper Estimate	Estimated Take	Upper Estimate
Current PBR	*234*		*2,000*	
Fisheries	-25	-54	-3	-7
Subsistence Harvest	-191	-316	-2	-19
Proposed Research	-35	-35	-33	-33
Other Mortality	---	-2	-2	-50
TOTAL	-17	-173	1960	1891

Mortality is not a parameter in the calculation of PBR; rather PBR is a parameter against which the mortality resulting from various human activities is compared. PBR was designed primarily to assist the agency in managing human-caused mortality resulting from fisheries, when human-caused mortality is the primary causal agent for a depleted marine mammal's decline. According to Appendix C of the final PEIS, a "very low level of human-caused mortality, when analyzed by a PBR approach, indicates that human-caused mortality and serious injury is not the cause of the decline......(NMFS 2007c)." Inherent in this statement and this use of PBR are a few important caveats that merit examination-- only known threats of *direct* human-caused mortality are considered in evaluating whether a particular stock's PBR is exceeded, so that *indirect* human-caused effects on a species (whether resulting in immediate mortality or sublethal effects, when summed result in mortality, such as global climate changes, altered food webs, and chronic exposure to contaminants) are not quantified (and in many cases are not quantifiable) factors that can be easily compared against a stock's PBR level; even where human-caused mortality may be quantified, such as illegal shooting of Steller sea lions, if we have no information on the rate at which it occurs, it may not be considered against the total PBR level. For the endangered western DPS of Steller sea lions, ecosystem change, induced in part by both fishery harvest and climate change, is believed to be the leading causal agent in the decline of this species. Unlike the eastern threatened DPS, and despite the recent slowed decline in some areas in 2002 and 2005, the average decline for 1991 to 2004 is 3.1 percent per year (Angliss and Outlaw 2007).

Nevertheless, the calculated PBR is based on achieving a 0.90 probability that there would be no more than a 10 percent increase in time to recovery. Figure 9 (panel C) in Wade (1998) shows that for a pinniped population with a low coefficient of variation, as is the case for Steller sea lions, a 0.10 recovery factor performs better than the generic standard instead resulting in a 90 percent probability that the time to recovery is delayed by 5 percent or less. For the estimated level of direct human-caused mortality of 251 Steller sea lions (see the first column of estimated take for the western DPS in Table 6), a comparison with Figure 9 (panel c) in Wade (1998) reveals that there is about a 95 percent probability that the time to recovery is delayed by 6 percent. If research related mortalities were doubled (70 animals die from research) then there would be about a 7 percent delay in time to recovery. In comparison there is a 10 percent delay in time to recovery, when we assume that the upper confidence limit of takes is more representative of the actual direct mortalities on the stock (outlined in Table 6). Proposed research takes added into this scenario increases time to recovery by about a year.

PBR, as a management approach is simple, and is based on little data, but it does not take into account the complexity of population dynamics. The preceding discussion does, however, support the assertion that the effect of research related mortalities is not driving the decline in the endangered Steller sea lion DPS and relative to other stressors working on the population, research related mortalities, even when we double the number attributed to research would be minor in comparison to other sources of human-caused mortality. As a management tool for the research program, a comparison with the PBR for a stock is informative but must be used with caution as a tool for deciding when to issue (or not) a permit or any other action on an declining endangered species. For this reason, we expect that this approach may be visited in greater detail as NMFS proceeds with the review of its program.

At a minimum, the Permits Office should vet their estimates of serious injury and mortality risk, as these estimates are sensitive to underlying assumptions and influence the total number of mortalities attributed to the proposed permits, which are compared against the calculated PBR. In particular, we are concerned whether the estimates were derived using the best available scientific and commercial data, where it was available. Most of the estimates reflect NMFS' best professional judgment, which for all intents and purposes is a reasonable proxy by section 7 standards in the absence of more rigorous data. However, this highlights two things in particular: if NMFS does not have better data on the effects of the activities it needs to do more to evaluate the effects of its actions and the activities it authorizes. Secondly, we are concerned that in some instances NMFS' Permits Division and NMML did not consider relevant data where it was available, including graduate studies (e.g., Kucey 2005 and Scordino 2006), and did not account for reporting and monitoring differences between researchers where it occurred. For instance, the Steller sea lion mortality estimates for roundups associated with branding are the only activity where the estimated mortality rate differs between the eastern and the western DPS (see Table 1, which contains a summary of the estimates provided in Tables 4.8-8 through 4.8-12 and Tables 4.8-20 through 4.8-24 in the final PEIS [NMFS 2007c]).

NMFS used an estimated risk of mortality for roundups for branding of 0.001 for the western endangered population of Steller sea lions, and an estimated risk of mortality of 0.007 for the eastern threatened population of Steller sea lions. The former estimate, according to the final PEIS, is based on 2 reported mortalities in branding 1,449 individuals as observed and reported by NMML for their activities between 2000 through 2005. The latter mortality rate of 0.007, however, is based on pooled (reported) data from all branding efforts in both the eastern and the western DPS (NMML and ADFG, unpublished data). If the data were compiled for the eastern population only, then the eastern population would have an observed mortality rate of 0.009 per pup branded. It is unclear to us, why NMFS would pool brand mortality data only to apply the pooled data to the threatened DPS. We recognize that it could be asserted that there may be geographical differences to suggest branding or other activities pose different risks according to where the activity is conducted. For instance it could be asserted that topographical differences between the two regions (DPSs) increase the risk of pup mortality during brand roundups. If this were the case then we would expect such geographical differences would also be considered in calculating risks of disturbance from aerial surveys and other disturbances since topography will also influence site acoustics. However, NMFS has not asserted different mortality rates are reasonable or expected for any other activity other than branding roundups. Nor is there enough data to suggest topographical features are in fact the underlying cause of the different observed mortalities. We are aware, however, that there is (or was) a difference between the way researchers accounted for research-related mortalities in this permit period, such that these differences likely contributed to at least a portion of the different observed mortality.

Even so, since threatened and endangered Steller sea lions are from the same biological species, we would expect the pup's tendency to huddle and pile up on each other would be the same in both regions. Most of the mortality during branding roundups to date has been the result of corralling pups in areas where they pile on top of each other and the individual pups on the bottom of the pile asphyxiate. We know of no reason why this biological response to disturbance would differ among animals in the western DPS from those in the eastern DPS. Consequently, we would combine all data from all Steller sea lion branding operations across both the threatened and endangered DPS to derive a pooled estimate of the risk of mortality from branding. When we do this the estimated risk for roundups for branding using pooled observations is 0.006 per pup. Using this estimated risk of mortality for roundups associated with branding changes the predicted number of animals that would die in the western DPS to 37 animals (three deaths attributed to branding compared to one death attributed to branding in permit 782-1889). The use of mortality estimates to evaluate and predict research related mortality is a positive step in this program, but the estimates warrant careful screening and vetting with all the stakeholders, as well as careful comparison against published and unpublished studies where they exist. We examine some of underlying assumptions in these tables and the effects of the proposed activities in more detail in the following sections.

ACTIVITIES AUTHORIZED UNDER THE PROPOSED PERMITS

The narratives that follow examine classes of activities authorized under the program in the past, and proposed for authorization in the thirteen permits. Where we had specific details of the procedure as it had been conducted in the past or would be conducted in the future, we attempted to characterize the procedure with sufficient detail to understand the duration, frequency, and intensity of the activity to which individuals would likely be exposed. We framed our exposure analysis in this manner, using past information, information from the PEIS, and the proposed permits.

Four general categories describe an animal's potential response to disturbance: no response, behavioral responses, sublethal responses, and lethal responses. For the most part, in field studies no response means the observer could not detect a response or the response was not apparent because they could not distinguish between an animal's normal range of responses and its response to the stimulus. Whenever possible, we distinguish the behavioral reactions and responses to stimuli such as reflect responses and alert responses that reflect awareness or avoidance of the stimulus, from sublethal responses that encompass the full range of observable symptoms of acute or chronic stress in individual animals that disable but do not kill the individual animal. Signs of anxiety and stress that manifest changes in respiration, decreased foraging activity, reduced body condition, growth rates, and fecundity are all sublethal responses. However, there is considerable overlap in categories and an initial behavioral response to a particular stressor may in a matter of minutes, hours, or days manifest sublethal responses that elicit physiological or neurological changes in an individual's condition. In turn, certain sublethal responses can culminate in an individual's death (e.g., exertional myopathy; St. Aubin and Dierauf 2001).

Not all stress is negative, however. Stress responses are common natural occurrences, some innate stress responses can include fasting in prey-poor or environmentally stochastic environments, signal need to flee from predators and so on. These responses are important for maximizing fitness under adverse circumstances; however, there are trade-offs with such responses. In this Opinion, we examine the range of stress responses induced by permitted research activities, and the trade-offs that result for the individuals and the populations they comprise. The vast majority of the following discussion focuses on the effects of directed research on Steller sea lions.

Effects of Aerial and Vessel Surveys

According to the "risk-disturbance hypothesis", an animal's responses to a disturbance like airplane or watercraft noise would vary according to the perceived risk posed by the stimulus (Frid and Dill 2002). That is, an animal's response would increase in severity with perceived risk posed by the stimulus (Frid and Dill 2002). Relative to the other research activities, we expect that individuals will generally not react as severely to aircraft and vessel traffic as they would to researchers landing and presence on rookeries and haulouts. We expect this is particularly true provided researchers: observe standard protocols for flying over rookeries and haul out sites at slow air speeds (100-150 knots), approach without banking, maintain altitudes greater than 150 m, and limit the time the craft is within the hearing range of the animals in the aggregation; and no vessel would be within close proximity to a rookery or haulout for this activity for more than 2-3 days at a time.

Even so, the antecedent condition of an animal and a suite of environmental circumstances may influence the response of an individual and aggregation of animals. The disturbance effects may range from no response to initiating the flight response in an aggregation (i.e., a stampede). Studies have shown disturbance from aircraft and vessel traffic has highly variable effects on Steller sea lions that are hauled out (Calkins and Pitcher 1982). Response may range from no reaction at all to the immediate and complete evacuation of haulout (Calkins and Pitcher 1982). The flight response in pinnipeds has been described as “unrelenting and reckless” such that animals that are chased before capture (or which flee in response to the presence of researchers or low-flying aircraft) are placed at risk of injury not only from the excessive metabolic heat generated from the flight itself, but also from a variety of potentially dangerous situations encountered in their escape attempts (Sweeney 1990). In two separate instances, captive sea lions jumping from elevations of 4-5 feet landed on their chest areas, rupturing the brachiocephalic vein located in the left shoulder area (Sweeney 1990). The hemorrhage resulting from this injury was fatal for one animal and severely debilitating in the other. Jaw fractures, which could impede feeding, are also a common result of the flight response. In the wild, when sea lions are frightened off rookeries during the breeding and pupping season, animals may be injured as they run over each other or slide or crash into cliff facings or underwater rocks in their haste to escape, and pups may be trampled or abandoned.

Frid and Dill (2002) argue that an animal’s response to human-caused disturbance is analogous to their response to a predator, such that they will make optimal fleeing decisions that balance the benefit of avoiding capture against the cost of abandoning the resource patch. In review of studies across taxa, Frid and Dill (2002) found that, in general, the probability of fleeing increases when the disturbance approaches more directly and when the cost of fleeing is lower than the perceived cost of staying. Results varied among studies as to whether speed and the size of the disturbance (i.e., size of the perceived predator) influenced flight responses (Frid and Dill 2002). In some instances, sea lions have temporarily abandoned haulouts after repeated disturbance (Thorsteinson and Lensink 1962; Kucey 2005), but in other situations they have continued using areas after repeated and severe harassment. Kenyon (1962) noted permanent abandonment of areas in the Pribilof Islands that were subjected to repeated disturbance. A major sea lion rookery at Cape Sarichef was abandoned after the construction of a light house at that site, but the sea lions used the site as a haulout after the light house was no longer inhabited by humans.

Whether or how much wild animals habituate to repeated disturbance is an area of considerable debate. Some argue that habituation, at best, occurs only partially in most animals because the fitness cost of underestimating the risk (not responding to a perceived threat) potentially outweighs the cost of responding to a stimulus through flight (see Frid and Dill 2002 for a review). Consequently, Frid and Dill (2002) expect that animals would be inclined to maximize fitness by overestimating perceived risks, not underestimating them.

All extraneous variables being equal, we would expect that the relative risk perceived by sea lions would be greater when personnel are on the ground as opposed to conducting air or vessel surveys. Recent studies by a graduate student at the University of British Columbia, confirm this assumption. Kucey (2005) recorded disturbance events from aircraft, birds, sea lions, humans, boats, and researchers collecting scat across 8 sites used by Steller sea lions in the summer and 6 sites used in the winter/spring season. Kucey (2005) observed more than 1,000 disturbance events of which slightly more than 40 percent caused animals to leave the site. She found that scat collection disturbances caused all animals to enter the water when researchers went ashore, whereas she recorded about 5 percent of the animals leaving the haulout sites in response to aircraft disturbance (n=20). Boat disturbance, however, evoked greater responses than aerial disturbances with more than 15 percent of the animals leaving the haulout in response to watercraft (n=36). Kucey (2005) observed that the nature of the vessel approach (i.e., speed, noise, fumes, combined with other variables like weather) influenced the magnitude of the response.

In submitting reports required under the permits, researchers generally report observing only a small percentage (less than 1 percent) of sea lions responding to the approaching survey planes. For example, during aerial surveys of the eastern population conducted in 2004, researchers reported counting 17,000 Steller sea lions from the plane of which only 147 responded to the activity. Unfortunately, researchers did not report the magnitude or type of the response. Presumably, given the distance at which researchers are observing animal responses the most likely response witnessed is that of an animal leaving the haulout site and entering water. Other types of agitation may also occur in response to such disturbance events such as increased vocalizations, and agitated movements (Kucey 2005). However, unless someone is monitoring a flight survey from a blind on the ground or a nearby vessel, it would be difficult for researchers to detect the response of pinnipeds to aircraft noise, particularly since the aircraft is in the area for very short duration (less than 5 minutes according to applicants).

NMFS is proposing to authorize the disturbance of virtually every member of the eastern and western population of Steller sea lions numerous times. Combined, the first batch of permits NMFS intends to issue under the PEIS would authorize the exposure of about 22,000 Steller sea lion pups and 50,000 Steller sea lions juveniles and adults from the western population to aerial surveys during breeding season. This amounts to 2.2 exposure events for every newborn (based on current pup estimates) and 1.7 exposure events for every non-pup, or roughly one exposure event per month through June and July. Every other year a new cohort of pups would be exposed to 3 aerial surveys in the same two-month period. Outside of the pupping season, individuals of all age classes would be exposed to another one to two aerial surveys under the first batch of permits, so that in total each animals is likely to be exposed to the noise of aircraft about 3 to 5 times per year from research activities alone.

According to NMFS' PEIS, about 5 percent of the exposed animals would exhibit an "alert" response to aerial survey disturbance. This means that some 6,000 animals would respond (or 2,000 animals might respond three times) by exhibiting signs of increased awareness of the disturbance, including moving towards the water or increased vocalization. No pups are expected to enter the water, whereas 1 percent of the non-pups are expected to enter the water (see Table 1 and 2 in the *Description of the Proposed Action* section of this Opinion).

While monitoring human disturbance at Steller sea lion land sites (mostly haulouts), Kucey (2005) observed over 50 disturbance events resulting from exposure to aircraft, of which 33 percent of these exposure events resulted in animals entering water. Kucey (2005) noted that about 5 percent of the animals on the haulout sites entered water during these events. Animals may be disproportionately prone to disturbance while on haul-outs, particularly where the dominant age-class is young of the year or second year animals (Porter 1997). Animals on rookeries on the other hand, may be prone to hold-fast to their location for a number of reasons:

first, many animals on a rookery during pupping season will be young pups only weeks to a couple months old whose swimming ability is not as strongly developed; second, mothers of newborns may remain on the rookery to protect their young; thirdly the conditioning of animals can influence the likelihood and severity of a response to disturbances. Additionally, environmental factors, such as the acoustics of a site, and weather may influence the severity of the response of individuals exposed to disturbances from aircraft.

The permits would also allow the exposure of up to 41,000 animals from the western population to watercraft twelve times per year, and up to 17,000 animals from the eastern population twelve times per year. Using Kucey's (2005) observation rate of about 15 percent of the Steller sea lions fleeing in response to vessels, we estimate about 6,000 animals would exhibit this more severe response up to 12 times per year. Using the estimated mortality rate in Table 1 as presented in the PEIS, this means that roughly 6 animals will die during every disturbance event. In comparison, the Permits Division and NMML estimate that less than 3 animals die from this activity in total each year.

It is unclear to us, and several permit analysts how NMML applied the mortality tables to derive this estimate. It would appear that NMML staff worked with permit applicants to revise the overall requested number of takes, and to adjust the expected ratio of animals that would likely be exposed by age class to various activities. However, the underlying assumptions made in the calculations were not clearly articulated. The overall estimated number of animals that the research program predicts would be exposed to an activity and would likely respond by serious injury and mortality is highly sensitive to these underlying assumptions. Changes in the underlying assumptions determine whether the total predicted mortality remained below 15 percent of PBR or not. NMFS has not conducted a sensitivity analysis on the mortality estimates, but doing so is important to understanding the magnitude of change that could result from changes in input parameters (e.g., how would changes proportion of pups to non-pups affect the likelihood the model would predict an animal may die when exposed to a particular activity?). At the same time it is important to understand the sensitivity of the mortality tables to different views of the way the species and the ecosystem works. As a decision tool, the mortality tables must be transparent, and the output must be replicable to be meaningful and credible as a decision tool upon which NMFS relies upon for making reasoned evaluations of the effects of the activities. It is not clear to us that mortality estimates, and the manner in which they were applied, are sufficiently transparent and clear that permit analysts can apply these tables to future decisions. We expect that NMFS will carefully examine the utility of the serious injury and mortality estimates in making future decisions to authorize research on Northern fur seals and Steller sea lions.

In general, based on our review of the applications some individuals within a population and within aggregations may be exposed a significantly greater number of times to various survey activities (e.g., individuals that occupy regularly monitored trend sites) and other individuals may rarely, if ever, be exposed to survey activities. Unfortunately, we cannot evaluate the spatial distribution of effects to ascertain what aggregations will have the highest exposure rates, although, it seems that this information should be easily discernable. Only recently, however, has NMFS' Permits Division encouraged applicants to submit requests for activities and takes according to the DPS in which they would be working. Applicants in the past frequently requested to conduct their studies throughout the range of animals in both DPSs such that it was impossible to segregate effects according to the population in which they would occur. While this problem has been addressed, the analysis conducted in this Opinion and thus also in making permit decisions, continues to be hampered by a lack of geographical resolution which can lead to an over estimation of takes expected to occur in some areas and an underestimation of takes that may occur in other areas. That is, although researchers should be able to identify what rookeries and haulouts they would sample, this resolution is not available for our consideration.

Nonetheless, from our analysis there is little evidence to suggest that aerial surveys conducted carefully and in a manner directed according to the permits, would initiate site wide evacuations or stampedes. The vast majority of individuals at a site will likely show no observable response to overhead flights, but for the individuals that do respond to the disturbance stimulus by fleeing there are likely some trade-offs involved in the altered behavior. Animals resting at haulouts that shift to a flight response would increase their metabolic demand. Over time and with repeated disturbance events, individuals may not only die from exposure but may exhibit sublethal responses such as changes in body condition which could influence an individual's lifetime reproductive success (see Frid and Dill 2002), and others may temporarily abandon sites. Over the long-term, sublethal responses to chronic disturbances may have more significant adverse effects on the population than a small number of immediate deaths. Dectecting the long-term effect of altering the resting behavior of a long-lived species could take decades (Constantine et al. 2004 in Kucey 2005). Unfortunately, the response of Steller sea lions to chronic disturbances has not received much attention, despite that some rookery and haulout sites have been studied for other reasons for more than 20 years.

Some trend sites likely receive repeated exposure to survey disturbances, however, we know of no systematic evaluation of the localized effect of prolonged and repeated exposure to aerial or vessel surveys on Steller sea lions in Alaska or elsewhere. Nor do we know what proportion of the total population these sites represent, and consequently what proportion of the population is routinely exposed to disturbance from aerial or vessel surveys. Given the amount of uncertainty that surrounds our exposure assessment (in particular, the lack of information on the spatial distribution of effects), our best estimate is that nearly every animal in the western population and eastern population will be exposed to aerial surveys about two to three times each year, recognizing that the actual exposure would likely differ according to where surveys effort is concentrated such that some animals may be exposed more often than others.

Effects of Ground Counts and Scat Collection

From what we could discern from the draft permits and mortality assessments, more than 70,000 animals would be exposed to ground activities including ground counts, scat collection and other types of harassment. Equally allocated among individuals, this amounts to roughly two such exposures per animals within the entire western population. The reality is that some may never be exposed to these activities, and others may be exposed to disturbance significantly more times. As described there is no way for us to know the likely number of exposure events for a given rookery or haulout, nor is it entirely clear what specific rookeries or haulouts would be disturbed more than others. We expect that the relative risk perceived by animals of disturbance on the ground is far greater that that of distant activities like aerial surveys and to a lesser extent vessel disturbance, and the more times a single site is exposed, the greater chance an animal may have of injury, but more importantly the greater chance that an animal may abandon a site. This response is not necessarily trivial, but has not been discussed in detail by the Permits Division and cannot be assessed with the information provided to us.

Kucey (2005) conducted observations on ten sites in British Columbia used by Steller sea lions, primarily for hauling out and one rookery. Kucey (2005) observed Steller sea lion use of the sites for about 1 to 2 weeks before researchers landed on the site for scat collection, and continued to observe Steller sea lion sites for 1 to 2 weeks post disturbance. Kucey (2005) recorded more than 1,000 disturbance events at the sites, which included a number of predetermined disturbance events to collect scats, and the branding of pups at the rookery. Researchers were present on haulout sites during scat collection for about two hours, whereas during branding researchers occupied the rookery for about 6 hours. Kucey (2005) observed that scat collection disturbance resulted in all animals entering the water (fleeing the site) as researchers went ashore. Three of the sites that she monitored never recovered to predisturbance levels, and those that did recover returned to predisturbance levels about 4 days after the disturbance. Her study, however, could not detect whether the sites were reoccupied by the same or new individuals (such that individuals were unaware of the previous disturbance event). Notably, one of the sites that did not return to predisturbance numbers was the rookery site where branding occurred.

In comparison, NMFS estimated that about 90 percent (Table 1) of the animals on the site would enter the water. When we compared the proportion affected, using the same predicted mortality rate, the difference is trivial. Both values result in a predicted mortality rate of 2 animals from ground counts that would disturb 18,000 non-pups. The difference is notable for other reasons, perhaps the most influential of which is that disturbance related responses such as site abandonment, is not accounted for in the overall decision to authorize a permit. The consequences of this oversight, however, are potentially significant. Ground counts that disturb rookeries could lead to indirect pup mortality, in the event pups are abandoned or mother's return trips are delayed.

Since Steller sea lions generally give birth between mid-May through mid-July, with the highest frequency of births occurring mid-June. The permits authorize ground counts to begin in June each year. Many of the pups on a rookery would be a few days to six weeks old, depending on the timing of the ground count and the births in the aggregation. Because the motor skills of pups at this age are not as well developed as in older pups, the newborn pups would likely be unable to move out of the way and may get trampled or knocked into the water as adults flee researchers. Young pups are not particularly strong swimmers and are usually unable to climb the rocky cliffs common to many rookeries. Even pups who are successful at climbing back onshore may suffer subsequent hypothermia and respiratory complications as a result of aspirating water while being tossed about in intertidal waves.

If researchers have not identified which mothers are in attendance and which are at sea, there is no way to determine whether a pup has been abandoned as the result of the disturbance unless they remain to monitor the rookery for several days. Foraging trips of lactating females may last several days or more (Brandon 2000). Even if mother-pup pairs have been identified, if researchers do not monitor a rookery after the disturbance until all the adult females that entered the water return to their pups, it will not be possible to determine if pups have been abandoned as a result of the disturbance. Fostering is very rare in Steller sea lions, thus the majority of abandoned pups will starve to death. Further, if pups (or adults) were injured during a stampede, they may not die from their injuries immediately. Death may not occur for several days, or weeks, in the case of infections or hemorrhages resulting from injuries, or injuries that affect an animal's ability to forage.

Steller sea lions in Alaska demonstrate site fidelity with respect to rookeries. The arrivals of males and pre-parturant females are closely timed and predictable from one year to the next. Large males of reproductive age are usually the first to arrive, establishing territories by aggressive competition with other males. Presumably, the holders of the "best" territories gain access to more females, and are therefore more successful at mating. When adult animals are displaced from the rookery during breeding season at least some animals will likely have to re-establish their territories. As a result, each disturbance that displaces animals from their territories increases the likelihood of aggressive interactions and the possibility of injury. Adult male Steller sea lions have large canines and powerful jaws and are capable of inflicting serious puncture and laceration wounds on opponents. These wounds may become infected. In addition, other sea lions on the rookery, including pups, may be injured during these aggressive competitions among males. Along with the possibility of physical trauma, the heightened aggressive interactions can result in secondary disease manifestations (Sweeney 1990).

The incidence and probability of stampedes in response to ground disturbance by researchers is not known. We suspect that the relative risk is greater with these ground disturbances than surveys conducted at a distance (e.g., aerial surveys). The magnitude of the disturbance effects on the animals may be affected by the number of personnel who come ashore, the amount of time the rookery or haulout is occupied by researchers (which usually means the amount of time the animals remain in the water or the pups are separated from their mothers), the frequency of these disturbances (both between and within years), the number of times an individual animal is exposed to the research activity, and the timing of the disturbance (with respect to breeding, pupping, etc.). Many of these factors are not known, and cannot be quantified for the purpose of derived a predicted number that would die. This, however, does not make them unimportant to the overall risk an activity poses an individual and the populations they comprise.

We do not expect each member of either population would be disturbed equally from these events, but the lack of spatial information on the activities prohibits careful qualitative consideration of the exposure events and predicting what proportion of the population is routinely affected by these disturbances. Based on the information contained within the PEIS and the applications it is impossible for us to describe whether some rookeries or haulouts would be exposed substantially more often to disturbances than other sites. Evidence suggests than in some cases, these disturbances lead to the entire evacuation of site by Steller sea lions (Kucey 2005). When all or a large portion of animals evacuate a site we expect the risk of serious injury and mortality would increase, as well as sublethal responses such as increased territorial aggressions, increased energy expenditure, and even site abandonment or pup abandonment. Unfortunately, we lack sufficient information to suggest how many animals would experience lethal and serious sublethal responses to these types of activities.

General Effects of Capture and Restraint

Chase, capture, and handling is generally very stressful on a wild animal, and in some instances can lead to detrimental responses (Fowler 1978; St. Aubin and Dierauf 2001). Each restraint incident has some effect on the behavior, life, or activities of an animal. A variety of somatic, psychological, and behavioral stressors can be associated with capture and restraint of wild animals. These include strange sounds, sights, and odors, the effects of chemicals or drugs, apprehension (which may manifest in behavioral signs of anxiety, fright, or terror), and territorial or hierarchical upsets associated with displacement of animals by researchers who come onto rookeries and haulouts. Distressed animals can incur contusions, concussions, lacerations, nerve injuries, hematomas, and fractures in their attempts to avoid capture or escape restraint (Fowler 1978). The stress response can change an animal's reaction to many drugs, including those commonly used for chemical restraint, which can lead to lethal consequences. The annual reports from the current and previous permits held by NMML and ADFG indicate that some animals showing distress and/or adverse reactions to drugs or handling that were not immediately released, subsequently died. Continuous stimulation of the adrenal cortex, as from stress associated with chronic disturbance or repeated capture, can cause muscle weakness, weight loss, increased susceptibility to bacterial infections, and poor wound healing, and can lead to behavioral changes including increased aggressive and antisocial tendencies (Fowler 1986).

Capture myopathy is a possible consequence of the stress associated with chase, capture, and handling in numerous mammal species (Fowler 1978), and results from increased muscular exertion and overstimulation of the nervous system. General indications of the condition may be assessed by gross observation, blood chemistry, gross pathology, and histological examination. Capture myopathy is characterized by degeneration and necrosis of striated and cardiac muscles and develop relatively quickly, within a few hours, or may enter a subacute phase developing a 7 to 14 days after capture and handling. It has been observed in animals that exert themselves maximally and those that remain relatively quiet, and occurs with either physical or chemical restraint. Fear, anxiety, overexertion, repeated handling, and constant muscle tensions such as may occur in protracted alarm reaction are among the factors that predispose an animal to this disease. A variety of factors may function in concert or individually. The muscle necrosis is likely due to acidemia resulting from a build up of lactic acid following profound muscle exertion: once necrosis has occurred, the prognosis for recovery is not favorable. The number of times an animal is captured, the method(s) of restraint, as well as the age and general condition of the animal are all factors that will affect an animal's response to capture.

Effects of Chemical Immobilization (General Anesthesia/Sedation)

A fairly high mortality rate caused by anesthesia has been reported in otariids (Gage 1993). Delivery of anesthesia in pinnipeds can be complicated by their particular anatomical and physiological specializations to the marine environment and by the logistics of working with wild animals. Determining the proper dose is dependent on a fairly accurate assessment of the animal's weight and condition, as miscalculation of an animal's weight can lead to an overdose, which can have lethal consequences (Fowler 1986). The typical induction time for most chemical restraint agents is 10 to 20 minutes following intramuscular injection. As a result, darting can be dangerous because it can spook an animal into the water before the immobilization has taken affect, which can result in drowning. In February 1993, under Permit No. 771 (64), an adult female darted with Telazol died[6]. Within 5 minutes she had rolled over into the surf and appeared unable to swim. By the time the researchers reached the animal she was not breathing and was given Dopram (a respiratory stimulant). She resumed breathing and began moving her head side to side and moving her foreflippers slightly. When these movements on the part of the animal began to interfere with the researcher's efforts to collect samples and attach a transmitter, the animal's head was covered in an attempt to calm her. By

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[6] Memorandum for the Record from R.L. Merrick, dated 10 March 1993, RE: Steller sea lion mortalities during field work, February 1993. Permit No. 771(64).

the time attachment of the transmitter was nearly completed it was noted that the female had been still for about a minute. Upon removing the rain jacket it was discovered that her pupils were dilated and she had no blink reflex. Attempts at resuscitation were unsuccessful and it was believed that the animal's immersion in sea water after darting may have triggered the dive response (breath holding, decreased heart rate, and reduced peripheral blood flow) and/or she may have aspirated sea water. It was also suggested that covering the animal's head may have contributed to her death by making her condition difficult to monitor and/or by pushing her back into the dive reflex.

The safest injection site for projectile syringes (darts) are in the deep muscle areas of the hind limbs (Scott and Ayars 1980). However, the blubber layer on pinnipeds can make delivery of an injectable drug into the muscle, where needed for proper absorption and distribution, difficult. In addition, inadvertent injection of drugs into the blubber frequently results in aseptic necrosis, sometimes leading to large abscesses (Geraci and Sweeney 1986). Injections into the chest cavity or stomach region can result in puncture of the lungs or stomach, which may kill the animal. In February 1993, under Permit No. 771(64), issued to NMML, a pup that was accidentally darted with Telazol when it unexpectedly moved in front of the target adult animal died, apparently as a result of inadvertent intravenous injection of a drug intended for intramuscular administration in a larger animal[7]. According to the report, the dart struck on the left flank, about 5 inches forward of the hip and about 2 inches off the spine, which apparently, as indicated by necropsy, entered the kidney, effectively causing an intravenous injection. Necropsy also revealed slight trauma to the kidney. The pup had also regurgitated approximately a liter or more of milk following the darting and may have aspirated some, which could have contributed to the death.

Hyperthermia (over-heating) can occur in animals under anesthesia because the blubber layer can make heat dissipation a problem, even at ambient temperatures that are comfortable for the researchers: otariids over 25 kg tend to become hyperthermic during anesthesia (Gage 1993). Hypothermia can also occur in sedated animals, during anesthesia or post-recovery, as many drugs can affect thermoregulation. In hypothermia, the reduction in body temperature reduces tissue metabolism, while hyperthermia increases it. Both of these can have implications for the animal's reaction to any drugs administered, as well as any pathological conditions that may exist.

In one study about 10 percent of animals induced with Telazol (tiletamine-zolazepam) or gas were observed to become apneic (stop breathing) within five minutes of induction (Gage 1993). Tiletamine is a cyclohexamine, which is a dissociative anesthetic that induces catatonia. It also has an analgesic effect through its action on the spinal cord, but it does not block visceral pain. Both hyperthermia and hypothermia are possible consequences of immobilization with tiletamine, depending on ambient temperatures. Respiratory depression is also possible, as is hypersalivation, which can lead to choking or aspiration of fluid.

There is an excitatory phase seen with tiletamine characterized by occasional muscle spasms resembling seizures, due to spinal reflex firings, which can be minimized by using tiletamine in combination with diazepam. Zolazepam is a benzodiazepine, or antianxiety drug, that has a

[7] Memorandum for the Record from R.L. Merrick, dated 10 March 1993, RE: Steller sea lion mortalities during field work, February 1993. Permit No. 771(64)

sedative effect and is a skeletal muscle relaxant. Zolazepam slightly depresses cardiovascular function. Both tiletamine and zolazepam are excreted in the kidneys and are contraindicated in animals with severe renal or hepatic disease.

The safety of these drugs is adversely affected in animals that are ill, stressed, or which have suffered from physical exertion (e.g. have been chased) prior to administration of the drug. There is no antidote (reversal agent) for tiletamine. Diazepam, which is a benzodiazepine similar to zolazepam, is metabolized slowly, with clinical effects typically disappearing within 60 to 90 minutes (Fowler 1986). There is a reversal agent for zolazepam, flumazenil. However, because zolazepam is used in combination with tiletamine to reduce the effects of the excitatory phase, reversing the effects of zolazepam in the absence of a reversal agent for tiletamine could result in convulsions and other side effects.

Inhalation anesthetics such as isoflurane gas are used to induce anesthesia in animals that can be manually restrained, and are commonly used to augment analgesia or increase the depth of anesthesia in animals previously immobilized by injectable agents. Prolonging immobilization by administering repeated doses of injectable agents is associated with a high risk of mortality, and an additional dose of Telazol should never be given (Gage 1993)[8]. Isoflurane, a halogenated ether with potent anesthetic action (Stedman's Medical Dictionary 2000), is an inhaled general anesthetic that induces reversible depression of the central nervous system, resulting in unconsciousness, analgesia, voluntary muscular relaxation, and suppression of reflex activity (Fowler 1986). Isoflurane is especially useful for short procedures in which rapid recovery and few aftereffects are desirable. The effects of inhalation anesthetics increase predictably with increased dose, unlike injectable agents, which tend to be unpredictable and idiosyncratic among animals (Fowler 1986). In general, captive animals have been observed to fully recover from anesthesia with isoflurane after 8 hours (Gage 1993). Isoflurane gas appears to have the best recovery characteristics, and be safe and reliable, in otariids (Haulena and Heath 2001).

According to the PEIS, a non-pup has a 3.4 percent chance of dying during darting. However, of three non-pups that died from darting during the 1990-1996 field season, the fate of 27 percent were unknown because they entered the water and another 15 percent presumably were sedated by the Telazol, but were inaccessible to the researchers, and 22 percent were not sedated by the Telazol. Given that the fate of the more than 40 percent of the non-pups was unclear, we cannot assume that only 3.4 died from this activity but expect that the actual number of animals that died was somewhere between 4 and 40 percent of the animals darted with projectile syringes of Telazol during the 1990-1996 field season. Thus, we believe this capture method has a higher risk of mortality than any other capture methods, particularly for the non-pup age class. Under the proposed permits more than 140 adult animals could be captured using darted injectable syringes of Telazol. Since these animals could be captured using any number of methods, if we assumed only a subset were captured using Telazol then an estimated 7 animals might die assuming a risk of mortality of 0.34. A risk of mortality (or struck and lost with unknown fates) of 40 percent would suggest that more than 50 animals could die from darting Telazol as a capture method.

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[8] Note that several of the animals that died under previous permits issued to ADFG were given repeat injections of medetomidine and/or ketamine, the injectable agents used to immobilize them. See annual reports for Permits No. 771 and 965.

Effects of morphological measurements

Morphometric measurements are used to monitor changes in the health of the sea lions and monk seals and complement other physiological measurements taken as part of other procedures. These procedures consist of simple measurements that capture an animal's length, girth, and weight and are not likely to adversely affect the health or survival of an animal. Risks are largely incidental to capture and restraint, as described previously.

Effects of blood collection (venipuncture)

The risks of blood collection are largely incidental to capture and restraint, as described above. However, multiple attempts to obtain a blood sample are not only stressful and cause some degree of pain, they can result in damage to the vein, clotting, and abscess. Removing a volume of blood too large relative to the animal's mass and ability to replace what was taken can result in fatigue, anemia, weakened immunity, and problems with clotting.

Effects of skin and blubber biopsy

Biopsy samples can produce wounds that, as with any wound, have the potential for infection, particularly given the unsanitary environment of the rookeries. An otherwise healthy animal should be able to heal and recover from a properly performed procedure, but animals with compromised immune systems may develop major complications. This procedure may cause more than momentary pain.

Effects of muscle biopsy

The small diameter of the wound, combined with the depth of the biopsy, would create a wound that would tend to close on the surface prior to deep tissue healing. This increases the chances of abscess formation, particularly if the biopsy needle or dart was not properly sterilized. Biopsy wounds, as with any wounds including those acquired during intra-species aggressive interactions, may become contaminated despite use of sterile equipment. Therefore, leaving the wound open to drain should an abscess form, rather than suturing closed, is preferable. As with skin and blubber biopsies, unhealthy animals or those with compromised immune systems may develop major complications from such an infection.

Effects of ultrasound

This procedure, by itself, poses no risk of injury to an animal. However, there is the possibility for adverse affects from the need for capture and restraint, as described above.

Effects of fecal loops and skin or mucousal swabs

The potential adverse affects relate primarily to the risks of capture and restraint, as described above. In addition, there is the slight potential to introduce or spread infection if the loops and swabs are not used properly. There is the potential for perforation, and subsequent infection, when fecal loops are inserted into the rectum. There is the possibility for damage to the cornea of the eye if ocular swabbing is done incorrectly. When performed by a qualified, experienced person using commonly accepted standards of good practice, these risks are likely negligible.

Effects of tooth extraction

The potential adverse effects of tooth extractions relate to the risks of capture, anesthesia, and the possibility of infection following extraction. The procedure may result in more than momentary pain, which could temporarily interfere with the animal's ability to forage.

Effects of collecting vibrissae, hair, and nails

Clipping whiskers, hair and nails is not likely to result in any pain. The effects on the animal of clipping a whisker, toenail or patch of hair are probably largely incidental to the effects of capture and restraint described above. However, the pulling of a whisker may cause more than momentary pain due to the highly sensitive nature of this sensory organ. The area of the snout where the vibrissae follicles are located is highly vascularized and ennervated to enable a sea lion to use its vibrissae in search of food even at very cold temperatures (Gee 1998). Even so, the adverse effects on the animal of pulling a whisker are probably largely incidental to the effects of capture and restraint described above.

General effects of marking (e.g., flipper tags and branding)

Marking devices can be divided into temporary, semi-permanent, and permanent. In general, the use of natural marks and individual appearance requires familiarity with the subject animals, which typically means many hours of personal observation. When the use of natural marks to identify individual animals is not suitable or practical for achieving study objectives, there are a variety of methods for marking animals available.

Temporary marks: Paints, bleaches, and dyes have been used successfully to temporarily mark Steller sea lions and other pinnipeds. The duration of the mark depends on, among other things, the type of paint or dye used, and the season applied, because all pinnipeds molt (shed their coats) annually. As a result, paints and dyes can be used to identify individuals for weeks to months. Paint marks can be applied remotely using a paint gun that fires pellets filled with pigment that burst on impact and leave a spot on the animal's fur. This method does not allow use of alphanumeric characters and is therefore not practical when other than the crudest of marks are needed. In addition, it may be very difficult to get the paint to adhere to the fur of sea lions. If animals can be captured and restrained, bleaches and dyes can be used to make unique alphanumeric marks on their fur. This method likely involves more stress to the animal than remote marking, and may cause incidental disturbance of conspecifics. However, the marks can be made large enough to be easily read from a distance, making it unnecessary to recapture the animal for identification, or cause additional disturbance to conspecifics. A variation on painting or dying the animal's fur is to capture animals and glue (using epoxy) a colored tag to their fur. This tag would fall off when the animal molts, and could have unique alphanumeric information written on it that could be read if researchers could get close enough or recapture the animal. Attaching a scientific instrument that emits a unique signal to the fur is also a method of temporary marking that has been used in a variety of species, including Steller sea lions.

Semi-permanent marks: There are numerous plastic, aluminum, and plated-steel tags available in a variety of colors, sizes, and identifying symbols that can be affixed to animals to allow identification of individuals. All of these techniques require capture and restraint of the animal. Plastic cattle ear tags have been used for many years to mark numerous pinniped species, including Steller sea lions. The tags are attached through the flippers. While these tags may remain attached for the life of the animal, they can and do pull out. In addition, they can become faded or otherwise difficult to read over time. These plastic tags cannot necessarily be read from as great a distance as large paint or dye marks, thus recapture of animals may be required for positive identification of individuals. However, when the study objectives require identification of individuals for longer than a few months or a season, or when animals will need to be recaptured for other reasons, plastic tags are the alternative of choice for many researchers. Another method of identifying individual animals is to attach scientific instruments, such as VHF and satellite transmitters, that broadcast signals on unique frequencies and allow tracking of animals or remote monitoring of their movement and activities. In pinnipeds, these tags are glued to the fur, or affixed to plastic tags that are attached through the flippers. These are considered temporary (if glued to fur) or semi-permanent (if affixed to flipper tags) because they will fall off when the animal molts or can be lost when the flipper tag pulls out. In addition, the life of the tag is limited by the battery capacity, which, in turn, is limited by the size of the tag.

As described above, flipper tags are best considered semi-permanent markers as they can and do pull out because sea lions use their foreflippers in both aquatic and terrestrial locomotion. In addition to the effects of capture and restraint as described above, it is likely that affixing these tags to the flippers of sea lions causes more than momentary pain. When the tag is affixed there is the potential for infection at the wound site, particularly because the environment on the rookery is not aseptic and because the activity of the animal may prolong or prevent healing by producing repetitive stress on the wound. There is also the potential for infection when a tag pulls out of the flipper, for whatever reason. In moving about on a rookery or haulout, or swimming, tags can be torn from the flipper by abrasion on the substrate or by hydrodynamic pressure (Fowler 1986). There is no information on long-term tag retention or average retention rates in the annual reports from NMFS' permits holders who use these tags on Steller sea lions. There is also no quantitative information on the rate of infection caused by flipper tagging. Both applicants report that tag-related mortality does not add significantly to natural mortality. However, Merrick et al. (1996) report that flipper tags can become difficult to read as the colors and markings on them fade over time and that they are not readily visible from any distance, partially because the gregarious nature of sea lions causes them to group together and obscure the flippers.

Permanent marks: When study objectives require recognition of individual animals for more than a season or a few years, temporary or semi-permanent marks must be re-applied, or a permanent mark can be used. As discussed above, applying both temporary and semi-permanent marks usually requires capture and restraint of the animal, and leads to disturbance of a significant number of animals in the area. Given that each capture event is stressful, and has the potential to injure the animal, when the objective is only to have animals that can be individually recognized from a distance, it is more advantageous to apply a permanent mark from the start. Using permanent marks is also favored over re-applying temporary marks when the interval between capture events is longer than the duration of the temporary mark.

Hot brands have been used for many years to permanently mark domestic livestock and some species of wildlife, including Steller sea lions and other pinnipeds. Cryobranding, or freeze branding has also been used successfully to permanently mark numerous species, including white-tail dear, fish, horses, and harbor seals. Tattoos have also been used to permanently identify domestic animals (e.g., cattle, dogs, horses) and wildlife (e.g., rabbits, polar bears, deer). Cryobranding or freeze branding is considered by some to be more acceptable for use in marking wildlife because, when done correctly, there is virtually no chance of infection (Scott and Ayars

1980). These other techniques may result in less pain for the animal being branded. For instance, no pain reactions were observed in cetaceans during the freeze-branding procedures (Needham 1993). Nevertheless, the practicality of hot-branding as a means of permanently marking pinnipeds in the wild has been demonstrated in several studies, and as such it remains the preferred method for permanently marking pinnipeds (McMahon et al. 2006).

There has been insufficient resight effort of the more than 16,000 sea lions branded by ADFG and NMML since 1975 to validate the merits of hot-branding versus the potential for adverse impacts to individual sea lions. Short-term observations of rookeries after branding, indicates that some delayed mortality is likely. Of 1,000 pups branded in the late 1980s, 2 dead marked pups were found a week after branding (Merrick et al. 1996). On Marmot Island in 1987, 400 pups were marked (some branded and others tagged only) with only 50 percent observed alive several months later. The observed mortality of marked verses unmarked animals was only slightly higher (1.5 percent for marked animals and 1.4 percent for unmarked animals [Merrick et al. 1996]). More recent short-term observations of branded pups on Ugamak Island yielded the same mortality estimate of 1.5 percent for marked animals, which is lower than observed "natural" mortality rates for this age class (Fritz and Gelatt, pers. comm., 1 Mar 2006).

In addition to the possible adverse effects of disturbing a rookery, as described above, the branding activity itself has the potential for adverse effects. To achieve the desired scarring, the burns must be second-degree, although third-degree burns are possible if the branding is done improperly. As a result, hot branding produces an acute burn wound involving a varying thickness of the skin and underlying tissue. This procedure, when performed correctly, produces second-degree burns (i.e., burns that penetrate the entire outer layer of the skin and into the inner skin layer, characterized by formation of blisters, swelling, and fluids seeping from the burned area). The forge used by NMFS' scientists by is approximately 5 cm wide by 8 cm high (Merrick et al.1996). For a one-week old pup measuring 95 cm standard length and 65 cm axillary girth, the total area affected is less than 2 percent of the animal's skin surface.

The degree of trauma caused by a brand will depend on a variety of factors including the temperature of the branding iron, the pressure with which the brand is applied, the time for which the iron is applied, the position of the brand, the condition, immunological status and behavior of the animal during and after the branding event, and infection rates and types (Gales 2000). Because it is difficult to control for many of these variables in the field, a wide range of wound healing scenarios are expected. The procedure likely causes more than momentary pain, and there is the potential for infection of the burned area, especially because the environment on rookeries and haulouts is not aseptic.

Further, in order to facilitate branding a large number of pups, researchers gather them into large groups for processing. Moving pups into large groupings and leaving them this way can result in deaths by suffocation as smaller, younger or weaker animals may become buried under others. Some injuries to pups left in these centralized piles may occur when the adult females return to the rookery. Female Steller sea lions are very discriminating about suckling their pup, and only their pup. Females have been observed to grab and toss pups who have come too close and that are not theirs. If the pup lands too close to another lactating female that is not its mother, it may get tossed again. As noted above, very young pups are not well able to move away from hostile females because their motor skills are not sufficiently developed. Females have also been observed to fight over ownership of a pup following disturbance, by tugging it back and forth between them. Pups sustain injuries during these episodes. On a rookery, females choose and defend “territories” in which they give birth and nurse their young. Females with newborn and very young pups defend their pups, and their space, aggressively. When females with young pups leave on foraging trips the young pups do not usually move far from the spot where their mother left them. As a result, when adults are driven from the rookery and pups are placed in large groups in central locations for branding or other research activities, the potential for injury or abandonment of pups as females return ashore is greater than if they were left more widely spaced or near their original spots.

In 1993, 399 Steller sea lion pups were branded on Forrester Island in Southeast Alaska. Four to five days after branding six dead, branded pups were collected during pup counts. Necropsy revealed blunt trauma as the probable cause of death for two of the pups, and starvation was the likely cause of death for the other four. Although the pathologist stated that these deaths could not be linked to branding, it is not apparent how this possibility could be ruled out. In a subsequent report from the permit holder, it was stated that it was unclear whether branding operations contributed to abandonment of pups, and their subsequent starvation. An additional 36 dead pups were recovered on this rookery 4-5 days after branding. Five of these pups were from a growth study in which pups were marked to be recaptured regularly for weighing and other measurements: at least four of these pups appeared to have starved, possibly as the result of abandonment. Of the remaining 26 dead pups, one was stillborn, three were neonatal deaths of unknown cause, 15-16 were emaciated and probably starved to death, four died of trauma, one from pneumonia, and one drowned. The possibility that the deaths of the emaciated animals or those that died from trauma, pneumonia or drowning were related to the branding and research activities cannot be ruled out.

In 2001, during branding of Steller sea lion pups on rookeries in Oregon (under Permit No. 782-1532), approximately 1/3 of the pups present were captured and branded. Several days later 7 pup carcasses were observed on the rookery: 6 of the dead pups were branded. It is not known what percentage of these mortalities could be attributed to the research activities vs. natural causes. Necropsy indicated that one of the dead branded pups probably died as the result of trauma associated with a bite wound on the head.[9] An additional dead pup was recovered during the branding operations whose death was believed to be due to suffocation as a result of being trapped in a crevice beneath another pup: this is being counted against the total number of accidental mortalities allowed under their permit.

Seven pups died during branding operations in 2003. Six of the pups died while researchers were on the rookery. Researchers attributed the cause of death for five of the pups to asphyxiation and terminal aspiration. The sixth pup died of aspiration of milk and asphyxiation post anesthesia. The seventh pup died of fulminant pulmonary edema caused by asphyxiation of cesspool fluids. This seventh pup apparently died before people were even on the island, perhaps as a result of the disturbance caused by the approach of researchers to the rookery. Only one of the seven pups was actually handled prior to death. The other pups died as an indirect consequence of the presence and actions of researchers on the rookery.

In their report to the Permits Division, the researchers explain that the deaths of these pups “can be attributed to the most common problem faced on a rookery, the tendency for pups to pile up on

[9] Memo from D.P. DeMaster to Ann Terbush, dated July 25, 2001 regarding Steller sea lion pup mortality during and after handling activity at Rogue Reef, Oregon.

each other when frightened. When this happens around even small pools of water with zero visibility it is impossible to know if a pup is in the pool without draining it. When it occurs while pups are being herded, a pup can suffocate within seconds.[10] As a result of the deaths in 2003, the holders of the permit modified their protocols to minimize the potential for recurrence of these types of research-related mortalities. In 2004 a single pup was reported to have died from asphyxiation following anesthesia.

NMFS used an estimated risk of mortality for roundups for branding of 0.001 for the western endangered population of Steller sea lions, and an estimated risk of mortality of 0.007 for the eastern threatened population of Steller sea lions. The former estimate, according to the final PEIS, is based on 2 mortalities in branding 1,449 individuals as observed and reported by NMML for their activities between 2000 through 2005. The latter mortality rate of 0.007, however, is based on pooled data from all efforts in both the eastern and the western DPS (NMML and ADFG, unpublished data). According to our calculations, the risk of a mortality during a corralling event is as high as 0.02 (calculated independently for each event where mortalities occurred).

General Effects of Attaching Scientific Instruments

In addition to the effects of capture and restraint described above, the attachment of an instrument can have both short- and long-term adverse effects. Possible chronic, short-term effects can include a reduction in foraging activity or an increase in grooming at the expense of other behaviors (Kenward 1987). These types of effects are likely present after most tagging events and may be as much a delayed result of the capture and handling as of the tag's presence.

Reactions of pinnipeds fitted with "crittercams" ranged from apparent curiosity about the instrument, to attempts to dislodge it, and aggressive reactions (Marshall 1998). Short-term effects can lead to acute problems for animals of various species: the presence of a tag has exacerbated capture shock and led to death in hares; the disturbance of tagging has resulted in desertion by incubating birds; abandonment or rejection of young in birds and ungulates was seen following tagging; and tagging may be enough to stop a dispersing animal from securing a territory, or push an animal over the brink of starvation when food is short (Kenward 1987).

The hydrodynamic drag created by the instrument can exert an additional energetic demand on an animal which could, over time, result in reduced foraging success, increased metabolic load, and resultant stress to the animal.[11]

The attachment of instruments to the hair with epoxy should not cause any pain if done properly, but may result in discomfort if the placement of the instrument causes pulling of the hair or skin as the animal moves. In addition, if the ratio of resin and catalyst is not correctly measured, the resultant exothermic (heat-producing) reaction can burn the animal's skin. Both the resin and hardener (catalyst) can cause skin irritation (itching, rashes, hives) and prolonged or repeated skin contact may cause sensitivity (itching, swelling, rashes). The low vapor pressure of the resin by itself makes inhalation unlikely in normal use. There is the possibility that an

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[10] 2003 Annual Report for Permit No. 358-1564, submitted by ADFG and on-file with NMFS Permits, Conservation and Education Division, Silver Spring, MD.
[11] from batched BiOp for 545-1562, 753-1599, etc. re: crittercam tags

instrument could be knocked or torn off, pulling out the hair and/or some of the underlying skin, which would then be open to infection.

General Effects of Administering Drugs and Other Substances

As with the other activities, the potential adverse affects of administering drugs in general are related to the effects of capture and restraint, as described above. In addition, because the blubber in some areas is not well vascularized, inadvertent injection of drugs into the blubber frequently results in aseptic necrosis, sometime leading to large abscesses (Fowler 1986). As a result, subcutaneous administration of drugs is usually problematic in marine mammals. There is the possibility of accidentally injecting drugs subdurally (beneath the dura matter, a fibrous membrane covering the central nervous system) when attempting to inject into the extradural vein (Stoskopf 1990).

Effects of Deuterium Oxide Injection: Deuterium oxide administration with pre-and post-blood sampling is used to determine the energetic condition of the animal and is performed concurrent with bio-electrical impedance analysis. For this procedure, researchers would prepare a sea lion's skin with cleaning swabs of isopropyl alcohol or dilute povidone iodine:saline. As soon as possible after an initial blood sample (2 ml) has been taken, researchers inject a deuterium dose (0.07g x kg body mass + 10 percent) slowly deep into the muscle of the hip(s). The procedure is normally conducted after an animal has been sedated, but it can be performed with animals trained to experience it. A second blood sample is taken at 2 hours post injection. The proposed permit would allow the Sea Life Center to administer deuterium oxide or oxygen-18 once per month, up to twelve times per year.

Deuterium oxide is a stable, relatively non-toxic and naturally occurring isotopes. Up to 20-25 percent of body water can be replaced by deuterium oxide in mice before toxic effects are observed. The use of deuterium oxide increases the amount of time an individual animal must be handled due to the need for multiple blood samples prior to and after administration. Steller sea lions at the ASLC would undergo deuterium oxide procedures while under anesthesia, thus reducing stress from repeated blood sampling. Sea lions at the ASLC have previously been administered D_2O up to every four months while under anesthesia with no adverse reactions (ASLC Annual Reports 2002 - 2004).

Effects of Lidocaine: A surface anesthetic effect, e.g. loss of feeling or sensation, can be achieved by subcutaneous injection. Lidocaine hurts for several seconds to a minute following injection into the skin. Lidocaine can produce serious side-effects if injected intravascularly, and if accidentally swallowed, can cause convulsions.[12] The use of lidocaine with epinephrine is contraindicated as it may cause tachycardia (rapid heart rate). As a surface anesthetic, lidocaine is relatively safe, as evidenced by its available in a variety of over-the-counter topical preparations for relieving pain and itching in humans.

Effects of Valium: The effects are dose-related, and cumulative. It is metabolized by the liver and excreted by the kidneys. Possible side effects include bradycardia (slowed heart rate), respiratory depression, tremor, confusion, photo-phobia, blurred vision, nausea, vomiting, depressed gag reflex, lethargy, and ataxia (inability to coordinate muscle activity during

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[12] Lidocaine: adverse reactions. http://www.infomed.org/100drugs/lidotoc.html

voluntary movement). It should be used with caution in animals experiencing shock.[13] Injectable valium is irritating to the vein and tissue, and may cause pain during administration. It has a rapid onset when given intravenously.

Effects of Injecting Evans Blue Dye: Evans blue is a diazo dye used for determination of blood volume on the basis of dilution of a standard solution of the dye in plasma following intravenous injection. The dye binds to albumin in the blood stream and remains bound long enough to circulate and distribute in the entire plasma volume of the blood stream. Evans blue was carcinogenic in one study in rats when administered intraperitoneally, the only species and route tested. It produced sarcomas of the reticuloendothelial system in the liver.[14] This dye is considered a teratogen at high doses, which can cause abnormal prenatal development. However, although there are no references to the safety of this dye in Steller sea lions, this dye is currently used safely for numerous human medicine applications.

Effects of Betadine: Following contact with skin, a burning sensation and itching can occur. Severe complications are rare following application on intact skin.

Effects of Bioelectric Impedence Analyses

Bio-electrical impedance analysis (BIA) measures an animal's composition by measuring the conductivity across electrodes placed on the skin or inserted under the skin. The procedure involves inserting four needles (two behind the skull and two near the tail), attaching leads to a BIA unit, and measuring the rate of the current between them. The procedure can also be performed using dermal surface electrodes that are not intrusive; however, this method has not been validated, so both methods must be used (needles and surface electrodes).

If animals are anesthetized, there would be no pain associated with the insertion of the needles. The insertion of needles does pose a risk of infection: bacteria or other infectious agents that may be present on the animal's skin or hair can be introduced under the skin. When performed by a qualified, experienced person using commonly accepted standards of good practice, these risks are likely negligible. However, the 2000 annual report for Permit No. 881-1443 (ASLC) reported development of a subcutaneous abscess on a captive adult female Steller sea lion, apparently resulting from tissue necrosis induced by the focal electrical current at the site of a bioimpedence electrode implant. The abscess was opened for drainage and began to heal slowly over the next 5-6 months. However, a scab and area of granulation tissue then formed at the site and was treated with topical antibiotics for several months, resulting in a small area of scar tissue, which will likely remain hairless.

Effects of Stomach Intubation and Enemas

In addition to the effects of capture and restraint, as described above, there is the risk of introduction of liquid into the trachea, initiating aspiration pneumonia or death when performing stomach intubation. There is also a risk of cross-contamination if equipment is not properly disinfected between animals. When performed by a qualified, experienced person using commonly accepted standards of good practice, these risks are likely negligible.

[13] http://www.kcmetro.cc.mo.us/pennvalley/emt/diazep.htm
[14] Animal carcinogenicity data. http://193.51.164.11/htdocs/Monographs/Vol08/EvansBlue.html

Any time a foreign object is inserted into the rectum there is the possibility of perforation, which can lead to peritonitis that may result in death. When performed by a qualified, experienced person using commonly accepted standards of good practice, these risks are likely negligible. As animals must be restrained for this procedure, and are usually chemically restrained, the risks associated with capture and restraint are also associated with this procedure.

Effects of Surgical Implant of Instruments

In addition to the effects of capture and restraint, as described above, there is a risk of infection and mortality associated with making an incision into the peritoneum. The surgery itself will not result in pain as the animals will be anesthetized. However, a certain amount of post-operative pain and discomfort is likely due to trauma associated with incisions through the abdominal wall. Any pain or discomfort associated with the surgery or subsequent wound healing may adversely affect an animal's ability to forage or escape predation. However, for animals held in captivity during wound healing, both infections and post-operative pain can be treated with appropriate antibiotics and analgesics.

Effect of Removal and Temporary (90-day) Captivity of Juveniles

The "transient" juvenile program at the ASLC, which began with the capture of 2 animals in 2003, was the first of this type of program authorized by NMFS for threatened and endangered Steller sea lions. NMFS considered the possible effects of this activity before authorizing the program. In general, NMFS assumed that the animals removed from the wild and held in temporary, but prolonged captivity, would either suffer reduced fitness (either in the form of reduced body condition or behavioral deficiencies that would affect survival) or they would leave the ASLC in better body condition than their free-ranging cohorts because of access to more food during captivity.

The ASLC removed 12 juvenile sea lions from the wild into their facilities between August 2003 and December 2004 for the "transient juvenile" program. ASLC released and followed all of the animals via satellite tags for at least several weeks. While this demonstrates that ASLC can successfully capture, maintain, and sample sea lions for up to three months, it does not establish whether such activities have adverse or beneficial effects on the individual sea lions held captive. ASLC handled the sea lions and conducted various sampling protocols, including many of the procedures described previously, each with some risk of adverse effects.

Three stranded Steller sea lion pups retrieved from Año Nuevo Island, California, and housed in the Marine Mammal Center for about 10 months for later release in the wild appeared to make remarkable recovery and transition back into the wild (Lander and Gulland 2003). Although a small sample size from which to draw inferences, time-depth records were attached to the dorsal fur of the three pups enabling researchers to track their movements up to 3 months, post release. The largest of the three pups exhibited greater diving capabilities relative to the other two pups, which led researchers to speculate that the excess weight gain during captivity may have provided this individual with supplemental energy and a slight advantage over wild counterparts. Even so, the sample size is too small to draw inferences about the recovery and reintegration of animals released by ASLC following 3 months of holding. Presumably, a rehabilitation program would significantly limit handling time to avoid acclimation of animals to the artificial environment, whereas the ASLC is a laboratory program that allows and promotes significant testing and handling.

Under the thirteen permits that the Permits Division is proposing to authorize pursuant to the research PEIS, NMFS would permit the expansion of ASLC's transient juvenile program. This program and the proposed permit is focused exclusively on taking individuals from the western endangered population out of the wild, to hold them for a temporary albeit extended period (up to 3 months) at their facility in Seward, Alaska, where a number of experiments will be conducted. The proposed permit would authorize ASLC to take up to 30 juvenile Steller sea lions per year for temporary holding (up to 3 months). Since the permit does not allow ASLC to hold more than 6 animals at a time, then ASLC would need to conduct at least five separate capture events to retrieve a total of 30 animals from the wild per year. At the time of this assessment, the draft permit would authorize up to 90 individuals to be captured during the life of the permit, but discussions with the Animal Plant and Health Inspection Service and their concern over the suitability of the holding facilities for male Steller sea lions suggest that ASLC may need to focus their studies on female Steller sea lions. In this event, we suspect that the actual number of individuals authorized for capture may be increased so that ASLC can retain a sufficient number of females for their experiments.

We discussed the effects of capturing and restraining wild Steller sea lions previously. We expect that the stress associated with prolonged and repeated handling would be particularly great for the animals held in captivity, relative to wild animals that are left alone in their natural habitat after a few hours. Unfortunately, we do not have reliable information on the animals that were released after their temporary captivity under the previous permit to suggest whether the animals incorporated back into the population successfully, and will successfully reproduce. Short-term tracking suggest that several of the animals did survive for some time in the first year, post release. The program allows for repeated sampling over the course of the animal's captivity. We discussed many of the same sampling procedures authorized for these animals previously. Two additional procedures that were previously conducted at ASLC on captive animals are discussed below.

Adrenocorticotropic Hormone (ACTH) Challenge. ACTH administration is standard means of determining adrenal function in both humans and animals. Veterinarians and human physicians routinely use both stimulating protocols. These stimulations do not require hospitalization for humans or overnight holding in the case of veterinary patients. Blood sampling during these studies would be conducted while the animals are under gas anesthesia to the maximum extent possible and a catheter would be used to facilitate multiple blood samples. Generally, a veterinarian would closely monitor animals during anesthesia. Husbandry staff would closely monitor animals during dry holding time and would respond appropriately to any stress or discomfort the animals may have.

The ASLC has conducted the ACTH procedure previously on the three adult sea lions. According to the 2002 and 2003 Annual Reports from the ASLC, the animals had no negative reactions to the anesthesia-facilitated blood sampling, and animals ate and behaved normally while confined in a cage for fecal sampling.

Manipulate diet and induce fasting. The study procedure consists of feeding different suites of prey on a rotated basis. Between each trial, ASLC staff will measure the animal's condition (body measurements, deuterium oxide and BIA analysis, standard blood chemistry, and assessment of assimilation efficiency) to determine how the prey suite has affected them over the trial period. ASLC would conduct pulse feedings to determine how blood chemistry and fatty acid profiles in blubber change with changing diet. Diets may also be varied for these animals.

ASLC has conducted similar diet experiments and the sea lions appeared to have adapted to new diets and prey items without negative effect (ASLC Annual Reports 2000 – 2004).

Effects of the Action on Critical Habitat

Some of the proposed research activities will occur within designated critical habitat for Steller sea lions, but the research is not expected to adversely affect any of the physical, chemical, or biotic features that form and maintain critical habitat. The proposed research would not affect population ecology, or population dynamics of prey species, predators, or competitors of Steller sea lions. At best incremental and transient disturbances are anticipated from increased human presence. For the most part, we do not expect that changes in prey distribution would be measurable even for the short period of time researchers may be in designated critical habitat. As a result, the proposed permits are not likely to adversely affect critical habitat that has been designated for Steller sea lions and is not addressed further.

Cumulative Effects

Cumulative effects include the effects of future state, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultations pursuant to section 7 of the ESA. Past and present impacts of non-federal actions are part of the environmental baseline discussed previously. Some of the future state, local, and private actions discussed below were discussed previously as part of the environmental baseline because the effects of these actions have occurred in the past, and to the best of our knowledge will continue into the future. We do not restrict our environmental baseline analyses to impacts that occurred only in the past and present, particularly where certain activities and their impacts are expected to continue into the foreseeable future. Nevertheless, to offer greater clarity to the reader we reiterated the effects of these continuing actions below.

Subsistence Harvest. We considered subsistence harvest of Steller sea lions by Alaska natives previously under the *Factors Affecting the Species*, and we expect these activities to continue into the foreseeable future. ADFG documents subsistence harvest, in part through surveying Alaskan natives. Estimates by Wolfe and Mishler (1996) indicate a mean annual subsistence harvest of animals from the western population between 1992 and 1995 of 448 animals. Harvest has decreased since this period, although harvest during 2004 was the highest on record in the past ten years (Wolfe et al. 2005). In the past, the majority (99 percent) of the statewide subsistence take was from the western population. The overall future impact of the subsistence harvest on the western population will be determined by the number of animals taken, their sex and age class, and the location where they are taken.

State Commercial Fisheries. We considered the effect of State commercial fisheries on Steller sea lions from both the western and eastern DPS under the *Factors Affecting the Species* section of this Opinion. We expect these activities to continue into the foreseeable future. In comparison with federal authorized fisheries, the state fisheries are generally small, such that anticipated effects would generally be proportional to the harvest. However, we analyzed the effects of state and federally authorized commercial fisheries together as part of the our assessment. There is a reasonable expectation that the State of Alaska will expand their management of groundfish fisheries within state waters given their recent proposals that have been reviewed by NMFS (e.g., Aleutian Islands pollock and Pacific cod). It is unclear at this time how or whether these changes in the management of Alaska groundfish fisheries will affect Steller sea lion populations. At present, we know of no changes in other state fisheries that would alter the level of impact these fisheries are collectively having on Steller sea lions. Therefore, at a minimum, we expect that current impacts from commercial fisheries will continue into the foreseeable future, such that several fisheries, such as the pollock and cod fisheries, will compete with foraging Steller sea lions, and contribute to their nutritional stress. The fisheries may reduce the abundance of prey within marine foraging areas and would alter the distribution of groundfish in ways that would reduce the effectiveness of foraging sea lions.

Sport and Subsistence/Tribal Fisheries. Relative to commercial fisheries, we expect that sport and tribal/subsistence fisheries have an incremental effect on listed Steller sea lions. For perspective, Alaska's sport fishery harvests about 1 percent (4,000 mt) and subsistence fishery harvests 2 percent (8,000 mt) of the annual State of Alaska total fish harvests, while the commercial fisheries accounted for 97 percent (900,000 mt) of the annual harvest in 1998. The actual effect these fisheries have on Steller sea lions is likely incremental, particularly in comparison to commercial fisheries. Impacts are likely limited to minor removals of the potential foraging base, but in such small volumes that we expect only incremental adverse effects, if any. However, we expect any increases would continue in relatively low amounts in the future. The nature of these fisheries is slow removal rates and dispersed catch. Other effects from these activities may include general human disturbance as more fishers recreate in remote areas that are occupied by Steller sea lions. In general, sport and subsistence fisheries are expected to continue into the foreseeable future throughout the action area and may increase in the future as tourism and population increases.

Population Growth and Development. In general, we expect that the populations of coastal states within the action area would increase in the foreseeable future. We would expect that recreational activities, including sport fishing, will experience growth as well. In Alaska, subsistence harvest would likely increase in relation to population increases. To bolster population declines, like in the Aleutians, the state of Alaska has begun to develop local fisheries. For example, the state would like to see the development of a community in Adak, to help accomplish this the state has implemented a local Adak Pacific cod fishery where vessels fishing under the federal TAC would be excluded by size in order to allow the local small boat fleet to harvest the TAC in that area. This effectively takes management control away from the federal government, concentrates catch inside of state waters (out to 3 miles), and focuses the dependence of specific coastal communities on a resource which may not be available in the future. This system may put severe pressure on fishery managers in the future to enact regulations that provide for near-shore fisheries. At present, however, there are a significant number of hurdles to such modifications, such that we have not considered the impact of these modified fisheries because we do not believe they are "reasonably certain to occur" for purposes of this assessment.

In general, however, as the size of human communities increase, there is an accompanying increase in habitat alterations for housing, roads, commercial facilities, and other infrastructure. The impact of these activities on pristine landscapes and the biota they support increases as the size of the human population expands. As terrestrial plant communities and coastal areas are destroyed, modified, or fragmented for the construction of human communities, native plants and animals are displaced, and can become locally extinct.

As the human population expands (as is expected in particular around major cities), the risk of interactions between people and listed species increases. For instance, Steller sea lions typically haul out on offshore rocks and islands; however, in some areas they have adopted man made structures (e.g., jetties) as haulout habitat. The south jetty at the mouth of the Columbia River is such a location and is routinely used by several hundred Steller sea lions in addition to similar numbers of California sea lions.

Steller sea lions also occasionally forage in estuaries and the mouths of rivers along the west coast. Many of these estuary areas are also developed as marine terminals for shipping and boat moorage. The lower river reaches and estuaries are kept in navigable condition by maintenance dredging. Noise from dredge operations may cause temporary behavioral avoidance by Steller sea lions in the vicinity of the activity.

INTEGRATION AND SYNTHESIS OF EFFECTS

Steller sea lions are protected pursuant to the ESA, as two distinct population segments. While their use of some areas may overlap, they are distinguished by whether they occur west or east of 144° W longitude. Animals east of 144° W are part of the eastern DPS, which is listed as threatened, and animals west of 144° W are part of the western DPS, which is listed as endangered. Fisheries, subsistence harvest, climate change, increased predation by killer whales and sharks, historic legal and now illegal shooting, and altered prey base (e.g., reduced biomass, changes in availability and nutritional value) are a few of the factors that may have led to current low levels of Steller sea lions from both populations, and some of the factors that continue to impact current populations. Much speculation has surrounded the animal and the causes of its precipitous decline in the 1970s and the reasons for their continued decline in the 1980s. When in 2000 NOAA Fisheries issued a finding that the commercial fisheries posed a threat to the recovery of Steller sea lions, the controversy seemed to reach a pinnacle. Congress responded with a sizeable increase in funding for Steller sea lion research activities so that NOAA and others could "produce the science and data to keep the fisheries open while protecting the sea lion population." With this increase in funding, NMFS received about a four-fold increase in requests for research permits for studies on Steller sea lions from both the western endangered DPS and the eastern threatened DPS. The first of these "new" research permits were issued in 2002. Litigation over the program's implementation ensued in 2005, and this represents the first time the agency has taken on a more holistic review of the Steller sea lion research program, combining its review with that of the Northern fur seal research program.

Of the two Steller sea lion populations, the eastern population is slowly increasing. Trends in the endangered western population of Steller sea lions continue to decline, although in two of the three most recent surveys some modest increases were evident. Presently, both populations may now face threats that are different from the ones that caused their initial decline. From the 1950s through the 1980s, animals in both populations were killed intentionally and unintentionally by fishers, in commercial harvests, and in subsistence harvests, which may have begun to destabilize the population. These harvests, however, appear to have disproportionately affected the western population. The harvest of over 45,000 pups from 1963 to 1972 probably changed the number of animals that recruited into the adult, breeding population in that region and contributed to local population trends in the 1960s through the early 1980s in the Gulf of Alaska and the eastern Aleutian Islands. Similarly, subsistence harvests prior to the 1990s were not measured but may have contributed to population decline in localized areas where such harvests were concentrated. The measurement of subsistence harvest began in 1992, and showed that natives were harvesting a modest number of animals from the western population. Current estimates indicate about 200 animals are harvested from the western population each year.

Predation may have shifted over the years, although this too is subject to considerable debate among scientists. One hypothesis, presented by Springer et al. (2003) is that killer whale predation of Steller sea lions increased in response to depleted whale populations post World War II, and this drove current pinniped declines. Others dispute this assertion. While their role in the initial decline is in dispute, the role of killer whales as a predator of at least some Steller sea lions is not. Roughly 20 percent of sea lion mortality is attributed to killer whales and other top predators like sharks (Loughlin and York 2002). Commercial harvest of Steller sea lions is no longer permitted by law, but large harvests were likely a contributing factor in the decline of the population to its current levels. Today, no mortalities are attributed to commercial harvest. Some level of mortality occurs due to direct, illegal activities like shooting, but no population wide estimates are available.

Estimates suggest incidental mortality attributed to known stressors like fisheries has declined significantly in recent years. The total estimated incidental catch of Steller sea lions during 1966 to 1988 in foreign and joint-venture trawl fisheries operating off of Alaska was over 20,000 animals (Perez and Loughlin 1991). As fisheries have declined, the estimated level of incidental mortalities has also continued to decline. Additionally information from satellite tagged animals suggests that Steller sea lions rarely go beyond the U.S. EEZ into international waters (Angliss and Outlaw 2007). As a result the current estimate of incidental mortality of Steller sea lions in the western population attributed to commercial fisheries is 25 animals per year and insignificant numbers taken in commercial fisheries in international waters (Angliss and Outlaw 2007). The estimated mean annual mortality from stranding from entanglement in fishing gear is less than one animal each year (NMFS 2005). The current estimate of incidental mortality of Steller sea lions in the eastern population attributed to commercial and tribal fisheries is 3 animals per year (includes estimates of mortality from entanglement from fishing gear; Angliss and Outlaw 2007). We expect that this represents a minimum estimate of mortality that would continue into the future. These estimates do not factor in the indirect impacts that fishing has on Steller sea lion populations, not the least of which is the altered distribution of forage species.

Individual Steller sea lions exhibit a range of responses from human disturbance, from simple behavioral responses and low level transient displays of agitation to more extreme responses like the evacuation of suitable habitat. When the latter occurs, individuals, particularly pups may be injured or killed. The extent to which these types of incidences influence mortality rates in a population or breeding aggregation is not clear. In the face of this uncertainty, we cannot assume that mortality from these events or events like random shootings of sea lions is inconsequential. Evidence suggests it has occurred in the past, and will continue into the future.

The status of the Steller sea lion populations remains well below historic levels. Recent small increases in the numbers of animals in the western population but must be watched with cautious optimism given that the species is long-lived, and the long-term average trend between 1991 and 2004 is a 3.1 percent decline per year. On the other hand, increases in the number of animals in the eastern population have been apparent for some time. It is too soon to tell if the decline is leveling off for the western population. Our review of the status of the species and the factors affecting the species indicates that a number of threats continue to adversely affect Steller sea lions, such that the small upswings in the western population numbers are not significant enough to indicate the species future is anything other than uncertain. Certainly, the longer time series does not support the conclusion that this population is on an upward trend. In fact, a great deal of uncertainty surrounds the future prospects of this population, and some of the breeding aggregations. There remains so much we don't know. For instance, mortality from known sources accounts for only about 1/5 of the losses witnessed between 1985 and 1989 (NRC 2003), such that a significant amount of past mortality remains unaccounted for.

As such, more research is necessary to describe linkages between changes in the environment and to better describe the dynamics of Steller sea lion populations. Distinguishing between anthropogenic and environmentally-driven stressors that influence the population's past is necessary in order to understand and predict the future of the populations, and to predict the effect of management strategies. Even so, the research activities themselves may lead to sometimes severe consequences for an individual, the breeding aggregation, and even the populations they compromise.

Studies of natural populations generally have unpredictable effects on the populations that are being studied. Research itself can pose a risk of killing or seriously injuring wild animals while they are captured and restrained. The aerial surveys could effectively disturb every animal in both the eastern and western populations of Steller sea lions several times throughout the year, although best available information suggestions that generally only a small fraction of an aggregation responds to these stressors through flight. Of greater concern are the activities that cause entire aggregations to startle, flee, and even stampede. Unfortunately, research activities conducted on Steller sea lions for more than two decades have not collected or reported detailed information on the responses of the sea lions to the various procedures that would make it possible to assess the individual and collective effects of these research activities on the population ecology of Steller sea lions.

Animals may be injured and die as a result of disturbances, and the risk of death and injury likely increases depending upon the state of the animal, the nature of the capture event, and the number of procedures conducted. More intrusive procedures can cause wounds and infection. Animals may experience varying degrees of pain in response to specific kinds of stimuli including trauma, heat, and corrosive chemicals. Because there is survival value in appearing not to experience pain, be damaged, or incapacitated in any way, it is not appropriate to assume a procedure is not painful to the animal simply because it does not appear to react. In addition, marine mammals may not exhibit symptoms of disease until very late in the disease process, possibly because to appear weak or sick would make them more susceptible to predation. Instead, a disease process is usually fairly advanced before overt symptoms are evident. This means that not only might researchers be unlikely to observe injuries or infections resulting from research that may affect an animal's survival if they do not conduct adequate post-activity monitoring, they may not be able to tell from a cursory exam that an animal selected for handling is already ill in a way that would predispose them to adverse reactions to research activities.

The total number of accidental mortalities per year that would be authorized under all permits is not likely, in the absence of other sources of mortality, to contribute significantly to the decline or failure to recover of threatened or endangered Steller sea lions, assuming they would be distributed among both sexes, and all age classes. However, the potential for indirect mortality and chronic sub-lethal affects associated with disturbance are of concern. These sub-lethal effects include research activities that: (1) disrupt one or more behavioral patterns that are essential to an individual animal's life history or to the animal's contribution to a population, or both; and (2) have the potential for injuries that may manifest themselves as an animal that fails to feed successfully, breed successfully (which can result from feeding failure), or complete its life history because of changes in its behavioral patterns. Injury to an individual animal could be injurious to a population because the individual's breeding success will have been reduced.

The most commonly observed response of pinnipeds to disturbance is avoidance, where the animals move away from the source of the disturbance. It has commonly been assumed that animals are not affected, or only minimally affected, if they do not move away when human activities are occurring in close proximity. However, a recent study suggests that an animal's behavioral response to disturbance is also a function of a variety of factors including the quality of the site currently occupied, the distance to and quality of other suitable sites, the relative risk of predation or density of competitors in different sites, and the investment that an individual has made in a site (e.g., in establishing territory or gaining dominance status). As a result, animals with no suitable habitat nearby may be forced to remain despite disturbance, and regardless of the consequences for their survival or reproductive success. Disturbance can result in stress that leads to a variety of neurochemical and hormonal changes with physiological consequences including suppression of the immune system and increased susceptibility to viral and bacterial diseases (Fair and Becker 2000). Disturbance can also result in increased agonistic behaviors that can result in injuries or death, and can lead to stress, which has been shown to decrease reproductive success or survival in a variety of mammals and invertebrates (Neuman 1999). It is not certain whether even short periods of physical exertion, as when disturbance results in increased vigilance, avoidance/escape, or agonistic behaviors, may have significant impacts on an individual's energy budget.

The research that has been conducted thus far has been assumed to have negligible short- and long-term effects on Steller sea lions populations, but that assumption has not been the subject of its own study. The best available information suggests that there is the potential for adverse physical and behavioral effects on individual Steller sea lions from the research activities that will result from the proposed permits. Under the PEIS the program is proposing to authorize up to 15 percent of PBR for each stock in research-related mortalities. According to NMFS estimates of predicted mortality resulting from activities authorized under the thirteen permits, only 33 animals in the threatened Steller sea lion population and 35 Steller sea lions from the endangered Steller sea lion population would die each year from research related activities. Our best estimate of likely mortalities suggest that the Permits Division may be underestimating the number of animals that may die from some capture methods such as darting with Telazol (based on data from NMML's work between 1990 and 1996, more than 50 animals could be struck and lost during projectile injections) and overestimating the number of animals that die from aerial surveys.

In addition to the overall number of mortalities the PEIS suggests NMFS may authorize, the program would authorize a number of untold disturbance events at uncertain locations within each DPS, which do not readily lend themselves to a quantitative prediction as presented in the mortality tables. Discussions with the Permits Division and the PEIS indicate that the mortality estimates intend to capture some of these effects. However, it is unclear to us how they derived such estimates, and the information upon which they would have been based. This, in of itself would be informative to our analysis, and should be explored in depth in the upcoming program review. If there is more than one plausible expert opinion, then we believe NMFS should have done more to elicit, weigh, and calibrate their predictions (see Burgman 2005 for a discussion on *experts, stakeholders and elicitation*). We expect that the program review NMFS is planning to undertake would explore the utility of the mortality predictions used in the PEIS.

Nevertheless, assuming 100 Steller sea lions die each year in the western population and up to 300 each in the eastern population (as proposed in the PEIS), its not clear that this loss would appreciably reduce the species' likelihood of surviving and recovering in the wild. We are concerned, however, that persistent and chronic low level disturbance from research could have localized effects, disproportionately affecting certain rookeries more than others. We expect that research activities in some areas could alter the distribution of the species due to chronic persistent impacts on land sites. Although the mortalities associated with the permits and research activities would reduce the numbers, and may even reduce the reproduction of endangered Steller sea lions and also threatened Steller sea lions, the "jeopardy" standard requires us to consider those effects on the species' survival and recovery in the wild. Specifically, we must determine whether the reductions in a species' reproduction, numbers or distribution would be expected to appreciably reduce a species likelihood of surviving and recovering in the wild. Because natural or other stochastic or environmental factors would cause variations in the numbers of juvenile Steller sea lions reaching maturity each year, the small loss in juvenile animals associated with the proposed research would likely be masked by natural or other sources of mortality, and probably by itself would not significantly reduce its likelihood of survival and recovery. Our earlier discussion under *Serious Injury and Mortality* suggests that the loss is not appreciable (our best estimate is that the loss could delay recovery by year).

Even so, when compared against the backdrop of a only a moderate likelihood of persistence for the next 100 years, and the long-term decline of the endangered species, we are concerned that the loss of some 35 to 100 animals, and some untold number lost to indirect causes would contribute to the overall decline of the species. Notwithstanding the degree of uncertainty in NMFS' mortality estimates, arguably the small number predicted to die relative to the size of a population that numbers tens of thousands, does not warrant a finding that the Steller sea lion and Northern fur seal research program is likely to jeopardize the continued existence of the endangered population. Nevertheless, given that the purpose of the research program is to contribute to the species' conservation and recovery it should be clearly evident that the species chances for survival with an adequate potential for recovery are greater if the research were conducted. To this end, we are please that NMFS is committed to undertaking a more holistic review of its program over the next few years and look forward to the outcome of that review. In the interim, we have included a few conservation recommendations to further minimize the impacts of the activities being proposed.

Conclusion

After reviewing the current status of the endangered western population of Steller sea lions, the threatened eastern population of Steller sea lions, the environmental baseline for the action area, the effects of the proposed research program, and the cumulative effects, it is NMFS' biological opinion that the research program, as proposed, is not likely to jeopardize the continued existence of the endangered western of Steller sea lion DPS or the threatened Steller sea lion DPS. Critical habitat for this species has been designated for listed Steller sea lions, however, the proposed action is not expected to affect that area and no destruction or adverse modification of that critical habitat is anticipated.

Incidental Take Statement

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibits the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by NMFS to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

Amount or Extent of Take

The proposed action requests directed take of threatened and endangered Steller sea lions in waters off Alaska, Washington, and Oregon. NMFS does not expect any other listed species to be taken incidentally to this research.

Conservation Recommendations

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

The following conservation recommendations would provide information that would improve the level of protections afforded in future consultations involving proposals to issue permits for research on the endangered and threatened Steller sea lions and would minimize the effects of the proposed activities.

1. No permits should authorize the taking of adult female Steller sea lions until further investigations can be performed on surrogates or females from the threatened DPS to ensure that this critical life stage is not disproportionately affected by the proposed research activities.
2. Before authorizing any additional permits for activities similar to those contained in the proposed permits, the Permits Division should review the annual reports and final reports submitted by all researchers that have conducted pinniped research under permits received from this office as well as any data and results that can be obtained from the permit holders. This should be used to estimate the amount of harassment and other adverse effects that occur given the level of research effort, and how the harassment affects the life history of individual animals. The results of the study should be provided to the Endangered Species Division for use in the consultations of future research activities and presented as part of the proposed program review.

3. No permits should authorize the use of darted injectable sedatives for capture purposes until more comprehensive investigations can be made on the probable fate of non-captured and lost animals. Other, lower risk, methods of capture should be substituted.
4. NMFS should require more detail in annual and final reports to ensure that permit holders are identifying variables meaningful to evaluating research related risks. Reports should request:
   a. For "number of animals taken" specify the number of individual animals present (e.g., during surveys or incidental disturbance) or captured within a permit year. If animals were recaptured, they should only be accounted for once in this column. Recaptures would be accounted for separately.
   b. For "Dates of Activity" specify the date on which the activity occurred.
   c. For "Locations of Activity" specify where the activity occurred with as much detail as possible. For example, give name of island on which animals were captured or harassed, or coordinates for surveys.
   d. For "procedures" specify each procedure (e.g., method of capture, method of restraint, marks, types of instruments attached, types of tissue samples collected) performed on an individual animal during the capture or recapture event.

In order for NMFS Endangered Species Division to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the Permits, Conservation and Education Division of the Office of Protected Resources should notify the Endangered Species Division of any conservation recommendations they implement in their final action.

REINITIATION NOTICE

This concludes formal consultation on NMFS' Steller sea lion and Northern fur seal research program. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this Opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this Opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of authorized take is exceeded, NMFS Permits, Conservation and Education Division must immediately request reinitiation of section 7 consultation.

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Appendix A, Table 1. MMPA Permit Issuance Criteria

Relevant Section of the Statute	Requisite Provisions/Criteria for Issuance	Definition or Other Clarifications
	Any permit issued under this section shall specify:	
	A. The number and kind of animals which authorized for taking or importation	
	B. The location and manner (which must be humane) in which animals are taken or imported	Humane - Least possible degree of pain and suffering practicable
	C. The period during which the permit is valid	
Any Permit (Sect.104 (b))	D. Any other Terms or Conditions deemed appropriate	
Importation for Display or Research (sec. 104(c))	Any permit issued which authorizes the taking or importation for scientific research, or enhancing the survival or recovery of a species shall specify: the methods of capture, supervision, care, and transportation.	
Section 104(c)(3)(A)	The Secretary may issue a permit for scientific research purposes to an applicant who submits with his permit application information indicating that the taking is required to further a bona fide scientific purpose	*Bona fide* - The results of which (a) likely would be accepted for publication in a refereed scientific journal, (b) are likely to contribute to the basic knowledge of marine mammal biology or ecology; or (c) are likely to evaluate or resolve conservation problems
Section 104(c)(3)(B)	No permit issued shall authorize the lethal taking unless the applicant demonstrates that a non-lethal method of conducting the research is not feasible	
	The Secretary shall not issue a permit for research that involves the lethal taking from a depleted stock/species unless the research directly benefits the species, or fulfills a critically important research need	
Section 104(c)(4)(A)	A permit may be issued for enhancing the survival or recovery only after determining: (i) taking is likely to contribute significantly to maintaining or increasing distribution or numbers necessary to ensure the survival or recovery of the species or stock, (ii) Taking is consistent with conservation or recovery plan, or must enhance the survival or recovery of the species in light of factors that would be in such a plan	

Appendix A, Table 2. MMPA (Implementing Regulations) Permit Issuance Criteria

Relevant Section	Criteria for Issuance	Definition or Other Clarifications
50 CFR 216.34(a)	The activity is humane and does not present unnecessary risks to health and welfare	
	For T/E marine mammals, the activity must be consistent with the purposes and policies of the section 2 of the ESA	
	The activity by itself, or in combination with other activities, will not likely have significant adverse impacts on the species	
	Applicant's expertise, facilities, and resources must be adequate to accomplish successfully the objectives and activities stated in the application	
	For animals held in captivity held and transported, the applicant's qualifications, facilities, and resources must be adequate for proper care and maintenance of the marine mammal	
	Requested import or export will not likely result in the taking of parts beyond those authorized in the permit	
	Opinions or views of scientists or other persons or organizations knowledgeable of the marine mammals that are the subject of the application or of other matters germane to the application will be considered	
50 CFR 216.41(b)	Must further a bona fide scientific or enhancement purpose	
	If lethal taking is proposed: non-lethal methods are not feasible, the results will directly benefit the T/E species	
	Any permanent removal of a marine mammal from the wild is consistent with quota set by the Office Director	
	Will not likely have significant adverse effects on any other component of the marine ecosystem	
	Listed & Proposed species - research cannot be accomplished using a species or stock that is not designated or proposed	
	Will not likely have a long-term direct or indirect adverse impact on the species	
	Will contribute to fulfilling a research need or objective identified in a conservation or recovery plan	
	Will contribute significantly to understanding the basic biology or ecology of the species or stock, or resolve conservation problems	
	Will contribute significantly to fulfilling a critically important research need	
	Only living marine mammals and parts necessary for enhancement of the survival, recovery or propagation of the affected species may be taken	
	The activity will likely contribute significantly to maintaining or increasing distribution or abundance enhancing the health or welfare of the species	
	The activity is consistent with an approved conservation plan developed under section 115(b) of the MMPA or recovery plan developed under section 4(f) of the ESA for the species or stock; or actions that would be addressed in such a plan	
	Captive Maintenance: will likely contribute directly to the survival or recovery by maintaining a viable gene pool, increasing productivity, providing necessary biological information, or establishing animal reserves	
	Captive Maintenance: Expected benefit to the species outweighs the expected benefits of alternatives	

Appendix A, Table 3. ESA Permit Issuance Criteria under section 10

Relevant Section	Criteria for Issuance	Definition or Other Clarifications
10(a)(1)(A)	Any act prohibited by §9 for scientific purposes or to enhance the propagation or survival of the affected species	
10(d)	Exceptions must be applied for in good faith	
	The action must not operate to the disadvantage of the endangered species	
	The action must be consistent with the purposes and policy of the ESA	

Appendix A, Table 4. ESA Permit Issuance Criteria under section 10 (Implementing Regulations)

Relevant Section	Criteria for Issuance	Definition or Other Clarifications
50 CFR 222.308(c)	In determining whether to issue a permit for scientific purposes or to enhance the propagation or survival of the affected endangered species, the Assistant Administrator shall specifically consider the following:	
	Whether the permit was applied for in good faith	
	Whether the permit, if granted and exercised, will not operate to the disadvantage of the endangered species	
	Whether the permit would be consistent with the purposes and policy of the ESA	
	Whether the permit would further a bona fide and necessary or desirable scientific purpose or enhance the propagation or survival of the endangered species, taking into account the benefits anticipated to be derived on behalf of the endangered species	
	The status of the population of the requested species and the effect of the action on the population, both direct and indirect	
	If a live animal is to be taken, transported, or held in captivity, the applicants qualifications of the proper care and maintenance of the species and the adequacy of the applicants facilities	
	Whether alternative non-endangered species or population stocks can and should be used	
	Whether the animal was born in captivity or was (or will be) taken from the wild	
	Provision for disposition of the species if and when the applicant’s project or program terminates	
	How the applicant's needs, program, and facilities compare and related to proposed and ongoing projects and programs	
	Whether the expertise, facilities, or other resources available to the applicant appear adequate to successfully accomplish the study objectives	
	Opinions or views of scientists or other persons or organizations knowledgeable about the species or other matters germane to the application	
	Terms and Conditions. Permits applied for shall contain terms and conditions deemed appropriate, including:	
	the number and kind of species covered	
	the location and manner of taking	
	port of entry or export;	
	the methods of transportation, care and maintenance to be used with live species	
	Any requirements for reports or rights of inspections with respect to any activities carried out pursuant to the permit;	
	The transferability or assignment of the permit;	
	The sale or other disposition of the species, its progeny, or the species product;	
	A reasonable fee covering the cost of issuance, including reasonable inspections and an appropriate apportionment of overhead and administrative expenses.	