National Marine Fisheries Service
Endangered Species Act Section 7
Biological Opinion

Title: Biological Opinion on the Issuance of Permit No. 13430 for Research on Pacific Harbor Seals, California Sea Lions and Northern Elephant Seals in Coastal Waters, Rookeries and Haulouts of Washington and Oregon

Action Agency: Permits, Conservation and Education Division, Office of Protected Resources, National Marine Fisheries Service

Consultation Conducted By: Endangered Species Division, Office of Protected Resources, National Marine Fisheries Services

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NOAA's National Marine Fisheries Service
Endangered Species Act Section 7 Consultation

Biological Opinion

Agency:	Permits, Conservation and Education Division of the Office of Protected Resources, NOAA's National Marine Fisheries Service
Activity Considered:	Biological Opinion on the Proposal to Issue Permit (No. 13430) for Research on Pacific Harbor Seals, California Sea Lions and Northern Elephant Seals in Coastal Waters, Rookeries and Haulouts of Washington and Oregon.
Consultation Conducted by:	Endangered Species Division of the Office of Protected Resources, NOAA's National Marine Fisheries Service
Approved by:	[signature] for J. H. Leahy
Date:	FEB 16 2010

Section 7(a)(2) of the Endangered Species Act (ESA) (16 U.S.C. 1531 *et seq.*) requires that each federal agency shall ensure that any action authorized, funded, or carried out by such agency 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" listed species or critical habitat that has been designated for them, that agency is required to consult formally with either NOAA's National Marine Fisheries Service (NMFS) or the U.S. Fish and Wildlife Service, depending upon the listed resources that may be affected. Federal agencies are exempt from this requirement if they have concluded that an action "may affect", but is "unlikely to adversely affect" listed species or designated critical habitat, and NMFS or USFWS conclude with that conclusion (50 CFR 402.14[b]).

For the actions described in this document, the action agency is NMFS' Office of Protected Resources – Permits, Conservation and Education Division. The consulting agency is NMFS' Office of Protected Resources – Endangered Species Division. NMFS' Office of Protected Resources – Permits, Conservation and Education Division proposes to issue a permit for direct takes of Pacific harbor seals (*Phoca vitulina*), California sea lions (*Zalophus californianus*) and Northern Elephant Seals (*Mirounga angustirostris*) within coastal waters, rookeries and haulouts of Washington and Oregon, pursuant to the Marine Mammal Protection Act (MMPA). This permit would also authorize "takes" of non-target endangered Southern Resident killer whales (SRKWs) (*Orcinus orca*) and threatened Eastern Distinct Population Segment (DPS) Steller sea lions (*Eumetopias jubatus*) pursuant to the MMPA and the Endangered Species Act (ESA). This ESA Section 7 consultation (Opinion) considers the effects of the proposed studies on endangered and threatened species and designated critical habitat.

Consultation History

On April, 14 2009, NMFS Permits, Conservation and Education Division requested consultation with NMFS Office of Protected Resources – Endangered Species Division on the proposal to issue Permit No. 13430 for research on Pacific harbor seals (*Phoca vitulina*), California Sea Lions (*Zalophus californianus*) and Northern Elephant Seals (*Mirounga angustirostris*) within coastal waters, rookeries and haulouts of Washington and Oregon states. A completed Environmental Assessment was submitted with this request.

On July 20, 2009, NMFS Office of Protected Resources – Endangered Species Division initiated formal consultation on this proposed action.

On September 21, 2009, the proposed permit was revised to allow "takes" of non-target endangered Southern Resident killer whales (SRKWs) (*Orcinus orca*) and threatened Eastern Distinct Population Segment (DPS) Steller sea lions (*Eumetopias jubatus*) and public comments were solicited.

On November 5, 2009, NMFS Office of Protected Resources – Permits, Conservation and Education Division submitted a revised proposal to issue Permit No. 13430 to NMFS' Office of Protected Resources – Endangered Species Division.

BIOLOGICAL OPINION

Description of the Proposed Action

NMFS proposes to issue a permit for research on marine mammals, pursuant to the MMPA, as amended (MMPA, 16 U.S.C. 1361). The permit would exempt the applicant from the MMPA's and ESA's prohibition against activities that may result in directed "takes" of Pacific harbor seals (*Phoca vitulina*), California sea lions (*Zalophus californianus*), and Northern elephant seals (*Mirounga angustirostris*). It would also allow for "takes" of the Eastern DPS of threatened Steller sea lions (*Eumetopias jubatus*) and members of the endangered Southern Resident DPS of killer whales (*Orcinus orca*) within coastal waters, rookeries and pinniped haulouts of Washington and Oregon states. "Take" is defined by the ESA 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. The proposed permit would last for five years.

The proposed permit would authorize aerial, boat and ground surveys, capture, collection of tissue samples as well as the attachment of scientific instruments and identifying marks and tags to Pacific harbor seals, California sea lions and Northern elephant seals. Up to thirty of these survey, capture, sampling and collection events are proposed to occur annually. Any combination of the proposed actions can comprise the thirty annual permitted events.

In addition to the aforementioned activities, the proposed action also includes audio playback experiments designed to replicate the sounds of predatory killer whales in order to document responses of California sea lions. These playback studies would occur concurrently with the proposed survey, capture, sampling and collection activities. This combination of activities is proposed to occur year-round in all nearshore coastal waters of Oregon and Washington, based on the presence of target species. Actions are proposed to take place weekly in the summer months and biweekly throughout the rest of the year. These proposed activities are described below.

Aerial, Boat and Ground Surveys

Harbor Seals, Sea Lions and Northern Elephant Seals

Proposed aerial surveys would be flown at a minimum of 500 ft at speeds of 80 to 100 knots in a fixed-wing, single engine aircraft. Boat surveys would be conducted from small (15-26 ft) power boats. These surveys would occur close enough to shore so that marks and tags of target species may be observed, photographed and recorded. Sites would be approached from a distance of 30-50 m. Proposed ground surveys would be conducted by investigators hiding behind blinds, docks or natural cover. Investigators would approach these sites by vehicle or on foot. These proposed activities are to occur in areas where SRKWs and Steller sea lions may be present.

Capture, Restraint, Morphometrics, Tagging, Scat Collection and Dead Pup Surveys

Proposed capture, restraint, morphometrics, tagging, scat collections and dead pup surveys of target species may occur throughout the year. Animals would be captured, and scats would be collected by researchers on foot while target animals are restrained. The proposed activities are to occur at rookeries and haulouts of the target species throughout the entire coastlines of Oregon and Washington. These activities are proposed to occur at all times of year. Steller sea lions may be present in the areas where these actions are proposed to occur.

Harbor Seals

Capture would be conducted by deploying 120 to 170 m long by 8 m deep beach seine nets from boats. The capture nets are made from 20-30 cm stretch mesh. Seals are entangled as the net is brought to shore. Once captured, seals are to be placed in individual hoop nets. Animals are then to be branded with hot irons, dyed, shaved or applied with neoprene patches to aid in future identification. Captured harbor seals may also be fitted with a combination of VHF radio tags, satellite tags, time-depth recorders or acoustic tags attached to the pelage with epoxy adhesives. Temperature transmitters are also proposed to be placed in the stomachs of some captured seals. Blood and other tissue samples are to be collected from captured animals before release.

California Sea Lions

California sea lions are proposed to be captured in traps consisting of a floating platform surrounded by steel mesh or chain-link fencing. Animals enter the cage and are trapped when an investigator closes a trap door. The animals are then transferred from the trap onto a floating barge. Sea lions are to be weighed and restrained, then measured, branded and marked. Animals may also be fitted with a combination of satellite tags, time depth recorders, VHF radio tags, or acoustic tags. These instruments would be applied to the sea lions in the same manner as described for harbor seals. Blood and other tissue samples may also be taken from captured animals.

Northern Elephant Seals

Under the proposed permit, up to 50 northern elephant seals may be captured, marked and tagged in Washington and Oregon each year. Capture and tagging activities are expected to occur primarily at Cape Arago, the Columbia River, Destruction Island, Protection Island, and Dungeness Spit, but Northern Elephant seals in other areas may also be captured. Individuals would be physically restrained by use of a hoop net or head bag, sexed, measured, marked with dye and tagged via ear tags similar to methods described for harbor seals and California sea lion.

Testing Killer Whale Vocalization Playbacks

California Sea Lions

The behavioral responses of California sea lions to underwater playbacks of killer whales would be tested at various locations in the Pacific Northwest including, but not limited to, Shilshole Bay, Everett, Ballard Locks, Neah Bay and East Bodelteh Island in Washington, and at Bonneville Dam, Astoria, Rogue River, and the lower Columbia River near Astoria in Oregon. Three types of killer whale vocalizations would be tested including local mammal eating calls from transient whales, local fish eating calls from resident whales and presumably unfamiliar calls recorded from Alaskan killer whales.

Each playback test would be filmed with video cameras to record visual responses. These playback experiments would broadcast recorded killer whale vocalizations from an underwater speaker deployed at a depth of approximately 5 m from a small boat anchored 100 m from California sea lion haulout sites. The frequency range of the signal would be 10–22 kHz, centered at 22 kHz, with a maximum source level at 148 dB. Sea Lions in the water would be filmed and counted. Distances of target species to the sound sources would be determined by using laser rangefinders during experiments and for at least two minutes prior, and at least two minutes after the playbacks conclude. The total number of proposed one minute playbacks per day will not exceed 10 per location and up to 2 locations are proposed to be tested per day. The investigators expect the project to be completed in 10-12 days.

Mitigation Measures

The permit application supplied by the NMFS Permits, Conservation and Education Division lists several mitigation techniques that the applicants propose to reduce adverse effects to target and non-target species. These include:

1. Not targeting or intentionally approaching any listed species from boat or on land during any of the proposed activities.

2. Employing slow speeds (80 to 100 kn) and high altitude flights (minimum 500 ft) during proposed aerial surveys to reduce noise and subsequent disturbance to protected species.

3. For surface surveys, boats would reduce engine noise or turn engines off during approaches from 100-150 m. After the target species become acclimated to the boats, closer approaches are to be made to within 30-50 m to read tags or brands and to take photographs. This is intended to minimize disturbance and the applicant notes that these methods typically do not result in any behavioral response from seals or sea lions.

4. Ground surveys will be conducted downwind, behind natural or man-made cover as researchers maintain a low profile and observe quietly.

5. The total number of proposed one minute killer whale vocalization playbacks per day would not exceed 10 per location at 2 locations per day.

In addition to these measures, the following are some of the conditions of the proposed permit that also apply:

1. Researchers must suspend all permitted activities in the event serious injury or mortality of protected species reaches that specified in the permit. The Permit Holder must contact the Chief, NMFS Permits, Conservation and Education Division (hereinafter "Permits Division") by phone (301-713-2289) within two business days.

2. If authorized take is exceeded, investigators 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.

3. Researchers must comply with the following conditions related to the manner of taking:

    a. Except where disturbance during pupping season is expressly authorized, Researchers must not conduct any rookery activities

b. When working on rookeries, Researchers must, 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.

c. Researchers must take appropriate actions (e.g., disinfection procedures) for minimizing the introduction of new disease agents, vectors capable of efficiently transmitting indigenous dormant diseases or those not currently being effectively transmitted, and species that can serve as amplification hosts for transmitting indigenous diseases to other species.

d. 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. Any observed abandonment of a dependent marine mammal pup is to be reported to the NMFS Regional Stranding Network Coordinator.

Approach to the Assessment

NMFS approaches its section 7 analyses of agency actions through a series of steps. The first step identifies those aspects of proposed actions that are likely to have direct and indirect physical, chemical, and biotic effects on listed species or 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 that spatial extent over time. The result of this step includes defining 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 which listed resources are likely to be exposed to an action's effects and the nature of that exposure, we examine the scientific and commercial data available to determine 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 continued existence of threatened or endangered species as those "species" have been listed, which can include true biological species, subspecies, or Distinct Population Segments (DPSs) of species. The continued existence of these "species" depends on the fate of the populations that comprise them. 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).

Our risk analyses reflect these relationships between listed species, the populations that comprise that species, and the individuals that comprise those populations. Our risk analyses begin by identifying the probable risks actions pose to listed individuals that are likely to be exposed to an action's effects. Our analyses then integrate those individual risks to identify consequences to the populations those individuals represent. Our analyses conclude by determining the consequences of those population-level risks to the species those populations comprise.

We measure risks to listed individuals using the individuals' "fitness," or the individual's growth, survival, annual reproductive success, and lifetime reproductive success. In particular, we examine the scientific and commercial data available to determine if an individual's probable lethal, sub-lethal, or behavioral responses to an action's effect on the environment (which we identify during our response analyses) are likely to have consequences for the individual's fitness.

When individual, listed plants or animals are expected to experience reductions in fitness in response to an action, those fitness reductions are likely to reduce the abundance, reproduction, or growth rates (or increase the variance in these measures) of the populations those individuals represent (see Stearns, 1992). Reductions in at least one 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. As a result, 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 (e.g., Brandon, 1978; Mills and Beatty, 1979; Stearns, 1992; Anderson, 2000). As a result, if we conclude that listed plants or animals are *not* likely to experience reductions in their fitness, we would conclude our assessment.

Although reductions in fitness of individuals is a *necessary* condition for reductions in a population's viability, reducing the fitness of individuals in a population is not always *sufficient* to reduce the viability of the population(s) those individuals represent. Therefore, if we conclude that listed plants or animals are likely to experience reductions in their fitness, we determine whether those fitness reductions are likely to reduce the viability of the populations the individuals represent (measured using changes in the populations' abundance, reproduction, spatial structure and connectivity, growth rates, variance in these measures, or measures of extinction risk). In this step of our analyses, we use the population's base condition (established in the *Environmental Baseline* and *Status of listed Resources* sections of this Opinion) as our point of reference. If we conclude that reductions in individual fitness are not likely to reduce the viability of the populations those individuals represent, we would conclude our assessment.

Reducing the viability of a population is not always *sufficient* to reduce the viability of the species those populations comprise. Therefore, in the final step of our analyses, we determine if reductions in a population's viability are likely to reduce the viability of the species those populations comprise using changes in a species' reproduction, numbers, distribution, estimates of extinction risk, or probability of being conserved. In this step of our analyses, we use the species' status (established in the *Status of the Species* section of this Opinion) as our point of reference. Our final determinations are based on whether threatened or endangered species are likely to experience reductions in their viability and whether such reductions are likely to be appreciable.

To conduct these analyses, we rely on all of the evidence available to us. This evidence might consist of monitoring reports submitted by past and present permit holders, reports from NMFS Science Centers, reports prepared by State or Tribal natural resource agencies, reports from non-governmental organizations involved in marine conservation issues, the information provided by the Permits, Conservation and Education Division when it initiates formal consultation and the general scientific literature. We supplement this evidence with reports and other documents – environmental assessments, environmental impact statements, and monitoring reports – prepared by other federal and state agencies such as the Minerals Management Service, U.S. Coast Guard and U.S. Navy whose operations extend into the marine environment.

During the consultation, we conducted searches of peer reviewed scientific literature, master's theses, doctoral dissertations, government reports and commercial studies. These searches included the use of literature search engines such as *Science Direct, Ingenta Connect, JSTOR,* and *Google Scholar* as well as the use of NOAA and university libraries. These searches focused on identifying recent information on the biology, ecology, distribution, status, and trends of the threatened and endangered species considered in this opinion. We considered the results of these searches based on the quality of their study design, sample sizes and study results.

Action Area

The action area encompasses the beaches, nearshore coastal waters and pinniped rookeries and haulouts along the entire coasts of Washington and Oregon at all times of year for five years.

Exposure Analysis

Exposure analyses identify the co-occurrence of ESA-listed species within the action's effects in space and time, and identify the nature of that co-occurrence. They identify as possible, the number, age or life stage, and gender of the individuals likely to be exposed to the action's effects and the population(s) or subpopulation(s) those individuals represent.

The proposed permit would authorize activities in all nearshore coastal waters of Washington and Oregon as well as all rookeries and haulouts in these states. Because of the widespread nature and timing of the aerial and boat surveys, along with the proposed land based activities, it is expected listed SRKWs and Eastern DPS Steller sea lions may be affected. Because these species are highly mobile, and because the proposed activities are to take place at multiple locations at multiple times of year, individual listed species may suffer repeated exposures.
Table 1 identifies the number of disturbance events to which listed species are proposed to be exposed annually as authorized by the proposed permit. Individuals exposed may be of either sex.

Table 1. Proposed takes[1] to listed species from the proposed activities.

Species	Total Individuals Permitted to be Disturbed	
	Per Year	Total
SRKW	100	500
Eastern DPS Steller Sea Lion	250	1250

[1] Takes (as defined in the *Description of the Proposed Action* section above) may occur from any combination of the proposed activities

<u>Species Likely to be Adversely Affected</u>

NMFS has determined that the actions considered in this Opinion may affect the following listed resources provided protection under the endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq*.; ESA):

Killer whale, Southern Resident DPS	*Orcinus orca*	endangered
Steller sea lion, Eastern DPS	*Eumetopias jubatus*	threatened

The biology and ecology of these species are described in the *Species Descriptions* Section below, and will contribute to the effects analysis for this Opinion.

<u>Species Not Affected or Not Likely to be Adversely Affected</u>

Sei and Northern Right Whales

Sei and Northern right whales occur in the range of the action area. However, only five sei whale sightings were made off California, Oregon and Washington during ship and aerial surveys from 1991-2005 (Hill and Barlow, 1992; Carretta and Forney, 1993; Mangels and Gerrodette, 1994, Forney, 2007). Similarly, right whale sightings are very rare in the eastern north Pacific despite extensive survey efforts (see NMFS, 2006c; Wade et al., 2006). Because of the scarcity of these species in the proposed action area and the highly targeted nature of the proposed research activities, these species are very unlikely to be exposed to the proposed activities and therefore no effects to them are expected.

Humpback, Fin, Blue and Sperm Whales

Proposed boat surveys are to be localized to the immediate coast near the rookeries and haulouts of the target species where humpback, fin, blue and sperm whales are not likely to be present (see Carretta et al., 2007). Similarly, proposed killer whale vocalization playback experiments are to take place near shore and are thus also unlikely to affect these species. The responses of cetaceans to aircraft disturbances are variable. However, there is no indication that occasional aircraft noise causes long term displacement of whales (Richardson et al., 1995). Because of these factors, humpback, fin, blue and sperm whales are not expected to be affected from the proposed actions.

Leatherback Sea Turtles

Leatherback sea turtles (*Dermochelys coriacea*) occur in the action area and are known to forage in coastal waters. They could therefore potentially be exposed to the proposed survey and capture activities. However, because these activities are targeted specifically to pinnipeds and because of the mostly pelagic nature of leatherback sea turtles in the action area and their resulting rarity in the coastal areas where these activities are proposed to take place, effects are extremely unlikely and therefore discountable. Leatherback sea turtles do not nest in the Pacific Northwest and therefore will not be affected by land based activities. There are no hearing data available for leatherback sea turtles. However, other sea turtles do not respond to sounds in the frequency range of the proposed activities (Ridgway et al., 1969). It is therefore unlikely that the proposed playback actions will affect leatherback sea turtles.

Marine and Anadromous Fish

Listed Evolutionarily Significant Units (ESUs) of Pacific salmon may occur in the action area, including ESUs of Chinook salmon (*Oncorhynchus tshawytscha*), chum salmon (*O. keta*), coho salmon (*O. kisutch*), sockeye salmon (*O. nerka*), and steelhead (*O. mykiss*). The listed Southern DPS of the green sturgeon (*Acipenser medirostris*) also occurs within the proposed action area. Because of the high altitude nature (minimum 500 feet) and low speeds (80 to 100 kn) of the proposed aerial surveys, in addition to boat noise reduction techniques such as slow approaches, reducing engine noise and turning engines off when not needed, survey activities should not negatively impact any listed fish species. Similarly, capture activities are also unlikely to affect these species because the large net mesh size (20 cm -30 cm) in the seines proposed to be used should allow for their easy escape. Proposed audio playback activities are unlikely to affect listed fish species because the frequency of the proposed playback (22 kHz) is over an order of magnitude higher than the optimal hearing range for salmonids of approximately 150 Hz (Hawkins & Johnstone, 1978). The proposed activities are therefore not likely to adversely affect listed fish species.

<u>Critical habitat</u>

The proposed activities may occur within the critical habitat of the southern DPS of the green sturgeon which includes coastal U.S. marine waters within 60 fathoms (fm) depth from Monterey Bay, California, north to Cape Flattery, Washington, including the Strait of Juan de Fuca, Washington, to its United States boundary; the Sacramento-San Joaquin Delta and Suisun, San Pablo, and San Francisco bays in California; the lower Columbia River estuary; and certain coastal bays and estuaries in California, Oregon, and Washington (74 FR 52300).

The proposed activities also occur within critical habitats for the listed Chinook salmon (*Oncorhynchus tshawytscha*), chum salmon (*O. keta*), coho salmon (*O. kisutch*), sockeye salmon (*O. nerka*) and steelhead trout (*O. mykiss*). The areas designated for these species include multiple riverine and nearshore marine areas along the U.S. west coast[1].

Critical habitat for the SRKW also lies within the action area of the proposed activities. This critical habitat was designated on November 29, 2006 (71 FR 69054). Three specific areas were designated; (1) the Summer Core Area in Haro Strait and waters around the San Juan Islands; (2) Puget Sound; and (3) the Strait of Juan de Fuca.

The proposed activities will also occur within the critical habitat of the Eastern DPS of Steller sea lions. Critical habitat was designated on August 27, 1993, for both the eastern and western DPS Steller sea lions in California, Oregon, and Alaska (58 FR 45269). Steller sea lion critical habitat includes all major rookeries in California, Oregon, and Alaska and major haulouts in Alaska.

The Primary Constituent Elements (PCEs) for Pacific salmon species include adequate spawning sites, food resources, water quality and quantity and riparian vegetation. The PCEs for both the estuarine and marine portions of the southern DPS green sturgeon include prey availability, preservation of migratory routes and good water and sediment quality. The PCEs for the Southern Resident DPS of killer whales includes good water quality, sufficient prey and conditions that allow for migration, resting and foraging. The essential features for the Eastern DPS of Steller sea lions include rookeries and haulouts where breading, pupping, refuge and resting occurs.

The proposed activities involve the playbacks of killer whale vocalizations, aerial, boat and ground surveys for pinnipeds and their dead pups, sampling of these species and the collection of their scats. No effects are expected to water quality, riparian vegetation, sediment, or prey abundance. In addition, no significant effects to any rookeries or haulouts are expected to occur. These actions should therefore have no appreciable effect on any listed species' PCEs. The proposed activities are not likely to destroy or adversely modify the critical habitat of any listed species.

[1] See for details: http://www.nmfs.noaa.gov/pr/species/criticalhabitat.htm

Species Descriptions

Killer Whale, Southern Resident DPS (SRKW)

Species Description, Distribution, and Population Structure

The Southern Resident killer whale (*Orcinus orca*) is a toothed whale and is the largest member of the dolphin family. Based on genetic research, it is believed that multiple subspecies of killer whales exist worldwide (Krahn et al., 2004; Reeves et al., 2004; Waples and Clapham, 2004; Jefferson et al., 2008). Resident killer whales in the Northeast Pacific are distributed from Alaska to California, with four distinct communities recognized: southern, northern, southern Alaska, and western Alaska (Krahn et al., 2002; Krahn et al., 2004). The SRKW occurs in the northeastern Pacific Ocean along the west coasts of the United States and Canada. Resident whales exhibit advanced vocal communication and live in highly stable social matriarchal groupings called pods. They frequent a variety of marine habitats and their range does not appear to be limited constrained by depth, temperature or salinity (Baird, 2000).

The SRKW DPS consists of three pods, designated J, K, and L, that reside for part of the year in the inland waterways of Washington State and British Columbia (Strait of Georgia, Strait of Juan de Fuca, and Puget Sound), principally during the late spring, summer, and fall (Bigg, 1982; Ford et al., 2000; Krahn et al., 2002). Pods have visited coastal sites off Washington and Vancouver Island (Ford et al., 2000), and are known to travel as far south as central California and as far north as the Queen Charlotte Islands off British Columbia. The locations of SRKWs in the late fall, winter, and early spring are less well known.

Parsons (2009) noted that members of different pods interact, but members generally remain within their matrilinear group. Interaction between pods has increased over the past two decades, and may be the result of a common response among pods to the stress of a declining population (Parsons et al., 2009). The rate of intrapod interaction was lowest within L pod, which is the largest of the SRKW pods (Parsons et al., 2009).

Life History Information

Male SRKWs become sexually mature at a mean age of approximately 15 years and are thought to remain sexually active throughout their adult lives (Christensen et al., 1984; Perrin and Reilly, 1984; Duffield and Miller, 1988; Olesiuk et al., 1990). Females first give birth at a mean age of approximately 14.9 years and produce an average of approximately 5.4 surviving calves over a reproductive life span of about 25 years (Olesiuk et al., 1990; Matkin et al., 2003). Gestation periods, as observed in captive killer whales, average around 17 months (Asper et al., 1988; Walker et al., 1988; Duffield et al., 1995). The mean interval between viable calve births is four years (Bain, 1990). Older mothers tend to have greater calving success and they appear to be assisted in calf rearing by grandmothers (Ward et al., 2009b). Some females may reach 90 years of age (Olesiuk et al., 1990). Mothers and offspring maintain highly-stable, lifelong social bonds and this relationship appears to be the basis for their matrilinear social structure (Bigg et al., 1990; Baird, 2000; Ford et al., 2000).

Although mating can occur year-round, most killer whale reproduction in the North Pacific has been observed to occur primarily from April to October (Olesiuk et al., 1990; Matkin et al., 1997), with a peak in calving occurring between September and March (Olesiuk et al., 2005; Jefferson et al., 2008). Killer whales are polygamous (Dahlheim and Heyning, 1999), and genetic data indicate that resident males mate with females outside of their own pods almost exclusively. This reduces the chances of inbreeding (Barrett-Lennard, 2000; Barrett-Lennard and Ellis, 2001).

Killer whales are apex predators and consume a varied diet but fish are their preferred prey (Scheffer and Slipp, 1948; Ford et al., 1998; Ford et al., 2000; Saulitis et al., 2000). Although the record is incomplete, data suggest that SRKWs have a strong preference for Chinook salmon during late spring to fall (Hanson et al., 2005; Ford and Ellis, 2006). Their winter and early spring diet is largely unknown. SRKWs spend about half of their time hunting prey. Approximately 95% of their time spent underwater is at depths of less than 30 m (Baird, 2000; Baird et al., 2003; Baird et al., 2005). They detect prey via echolocation and passive listening, and likely hunt through a combination of vision and echolocation (Barrett-Lennard et al., 1996; Baird, 2000). Maximum observed dive depths average 141 m (Baird et al., 2003). Baird *et al.* (2005) reported that although the deepest recorded dive for a SRKW is 264 m, they are probably capable of diving to at least 330 m. No significant differences in the diving behavior of the three Southern Resident pods has been observed (Baird et al., 2005).

Killer Whale Hearing and Acoustics

Killer whales produce numerous types of vocalizations for navigation, communication, and hunting (Ford, 1989; Barrett-Lennard et al., 1996; Ford et al., 2000; Miller, 2002). These vocalizations consist of different types of calls distinctive to each pod. These distinct vocalizations are known as a dialects (Ford, 1991). Within pods, matrilines have distinctive call patterns (Miller and Bain, 2000), and it is likely that individual whales learn their unique dialect through contact with their mother and other pod members (Ford, 1989, 1991; Miller and Bain, 2000; Yurk et al., 2002).

Most killer whale calls consist of both low-frequency components with tones between 250-1,500 Hz with harmonics to about 10 kHz, and high-frequency components with tones between 5-12 kHz and harmonics ranging to over 100 kHz (Bain and Dahlheim, 1994). Au et al. (2004) reported source levels of killer whale echolocation signals between 94 and 224 dB re 1 μPa. Hearing by odontocetes such as killer whales involves the lower jaw and head which transmit sound to the middle and inner ear (Mohl et al., 1999; Au, 2002). Killer Whale hearing is the most sensitive of any toothed whale tested, with a range of one to at least 120 kHz. Hearing sensitivity declines below 4 Hz and above 60 kHz is most sensitive in the range of 18-42 kHz (Szymanski et al., 1999) with the most sensitive frequency at 20 kHz.

Listing Status

The SRKW has been listed as endangered under the ESA since November 18, 2005 (70 FR 69903); critical habitat for this species was designated on November 29, 2006 (71 FR 69054). In April 2004, the Washington Department of Fish and Wildlife (WDFW) designated killer whales in Washington State as a "state endangered species" (WAC 232-12-297). SRKWs are also protected by the MMPA and Canada's Species at Risk Act (SARA).

Status and Trends of SRKWs

The only pre-1974 account of Southern Resident abundance is from Sheffer and Slipp (1948) and merely notes that the species was "frequently seen" during the 1940s in the Strait of Juan de Fuca, northern Puget Sound, and off the coast of the Olympic Peninsula, with smaller numbers along Washington's outer coast. Little information exists on the historic abundance of SRKWs. Until the mid- to late-1800s, the SRKW community may have numbered more that 200 animals (Krahn et al., 2002). Using the estimated abundance of SRKWs in 1971 of 67 whales, and factoring in various sources of mortality, NMFS estimated a minimum historical abundance of about 140 SRKWs (Olesiuk et al., 1990). The SRKW population had grown to 90 whales by September 2006, but declined in 2007 with the loss of five individuals and the gain of two new calves leaving the total number at 87, with 25 whales in J pod, 19 whales in K pod, and 43 whales in L pod (Center for Whale Research, unpublished data cited in NMFS, 2008b). At present, the Southern Resident population has declined to essentially the same size that was estimated during the early 1960s, when it was considered to be depleted (Olesiuk et al., 1990).

Photo-identification catalogs for SRKWs provide information on recent abundance and trends of these pods (see Dahlheim, 1997; Dahlheim et al., 1997; Ford and Ellis, 1999; Matkin et al., 1999). From 1974–2007, the SRKWs as a whole have gone through several periods of growth and decline. For example, the DPS appeared to experience a period of recovery by increasing to 99 whales in 1995, but then declined by 20 percent to 79 whales in 2001 before another slight increase to 83 whales in 2003 (Ford et al., 2000; Carretta et al., 2005). This abrupt decline and unstable population status continue to be cause for concern, particularly given the small size of the DPS which makes it potentially vulnerable to Allee effects (e.g., inbreeding depression) that could cause further population decline or preclude a substantial increase in abundance (see NMFS, 2008b). The intensity of factors affecting the species is increased by stochastic events such as the small number of reproductive age males and high mortality rates for this group and is a major reason that the SRKW was listed as endangered rather than threatened (NMFS, 2008b).

Using data from 1974–2003, Krahn et al. (2002; 2004) further analyzed the population dynamics of the DPS to identify demographic factors contributing to the latest decline in abundance. Changes in survival were not related to stochastic variation caused by the SRKW community's small size, such as random patterns in births or deaths or to annual fluctuations in survival. Rather, the survival patterns were more likely influenced by external causes, such as changes in prey availability etc.

Eastern DPS Steller Sea Lions

Species Description, Distribution, and Population Structure

Steller sea lions (*Eumetopias jubatus*) are distributed around the North Pacific rim from northern Japan, through the Aleutian Islands, along the southern coast of Alaska, and south to California (Kenyon and Rice, 1961; Loughlin, 1997). The western DPS of Steller sea lions includes animals located west of Cape Suckling, Alaska (144°W) (62 FR 24345) while the Eastern DPS of Steller sea lions includes animals east of Cape Suckling, Alaska (144°W) south to California waters (55 FR 49204).

Steller sea lions require both terrestrial and aquatic resources for survival. Terrestrial sites called rookeries are used for pupping, nursing, and mating during the reproductive season. Haulouts are terrestrial areas used by all size and sex classes but are generally not sites of reproductive activity. The continued use of particular sites may be due to site fidelity, with animals often returning to the site of their birth (Calkins and Pitcher, 1982; Ban, 2005). Within the action area, major Steller sea lion rookeries and haulouts occur in Oregon and California (Angliss and Outlaw, 2008). Although pups were observed at one haulout site in 1997 and 1998, Washington is the only western U.S. coastal state that does not presently contain a Steller sea lion rookery (Angliss and Outlaw, 2008).

Steller sea lions are not known to make regular migrations but do move considerable distances. Adult males may travel hundreds of kilometers after the breeding season (Calkins and Pitcher, 1982; Calkins, 1986; Loughlin, 1997) and adult females may travel out to waters of depths greater than 1000 m (Merrick and Loughlin, 1997). Immature Steller sea lions generally remain within 300 miles of rookeries their first year of life and travel further away in subsequent years (Raum-Suryan et al., 2004).

Life History Information

Female Steller sea lions reach sexual maturity between three and eight years of age and remain reproductively active for approximately 10 years (Pitcher and Calkins, 1981; Calkins and Pitcher, 1982; York, 1994). They give birth to a single pup in late spring through early summer (Pitcher and Calkins, 1981) with a gestation period of about 50 to 51 weeks (Pitcher and Calkins, 1981). The Steller sea lions birth rate is estimated to be 55% to 70% or greater (Pike and Maxwell, 1958; Gentry, 1970; Pitcher and Calkins, 1981). Twinning has also been observed (Maniscalco and Parker., 2009).

Newborn pups are entirely dependent upon their mother for milk during their first three months of life and continue to be highly dependent upon them through their first winter (Porter, 1997; Trites et al., 2006). Mothers make their first foraging trip at about one week after giving birth (Merrick and Loughlin, 1997; Milette, 1999; Pitcher et al., 2001; Milette and Trites, 2003; Maniscalco et al., 2006) and may nurse their offspring for up to two years (Gentry, 1970; Sandegren, 1970; Pitcher and Calkins, 1981; Calkins and Pitcher, 1982; Trites et al., 2006). Females attending pups tend to stay within 20 nm of the rookery (Calkins, 1996; Merrick and Loughlin, 1997).

Males reach sexual maturity at about the same time as females (Loughlin et al., 1987), but are not large enough to effectively compete for mates until about eight to ten years of age (Pitcher and Calkins, 1981). The sex ratio of pups at birth is assumed to be about 1:1 but becomes biased towards females as they become juveniles (Pike and Maxwell, 1958; Calkins and Pitcher, 1982; Trites and Larkin, 1992; York, 1994).

Eastern DPS Steller sea lions are known to eat a wide variety of fish and invertebrates and occasionally birds and other marine mammals (Jones, 1981; Pitcher and Fay, 1982; Calkins and Goodwin, 1988; Olesiuk et al., 1990; Daniel and Schneeweis, 1992; Sinclair and Zeppelin, 2002; McKenzie and Wynne, 2008). Haulout selection appears to be driven at least in part by the availability of prey (Winter et al., 2009). Most adult Steller sea lions occupy rookeries during the pupping and breeding season, which extends from late May to early July (Pitcher and Calkins, 1981). Adult females generally return to the rookeries of their birth to pup and breed (Kenyon and Rice, 1961; Pitcher and Calkins, 1981).

While adult males rarely enter the water during the breeding season (Loughlin, 2002), females tend to hunt for one to two days and return to nurse pups (NRC, 2003a),. As pups mature and are weaned, they develop greater diving abilities up to roughly 10 years of age (Pitcher et al., 2005). Juveniles usually make shallow dives of around 50 feet, but much deeper dives in excess of 1,000 feet are known (Loughlin et al., 2003). Younger animals tend to stay in waters under 100 m in depth and stay within 20km from shore (Fadely et al., 2005). Nearly 90% of Steller sea lion sightings off Oregon and Washington have occurred within 21 km of shore and none have been made further than 40 km or in waters greater than 200 m deep (Bonnell et al., 1992). Bonnell (1992) estimated the fall mean density in this area to be approximately 0.011 animals/km^2 (Bonnell et al., 1992).

Steller Sea Lion Hearing and Acoustics

A recent audiogram study involving one male and one female Steller sea lion showed the maximum hearing sensitivity at 1-25 kHz (Kastelein et al., 2005). Although these results only represent the responses of two captive individuals, other eared seals exhibit similar responses and display maximum sensitivities of between 2-28 kHz (Schusterman et al., 1972; Moore and Schusterman, 1987; Babushina et al., 1991; Kastak and Schusterman, 1995). The high frequency cutoff for these species was observed to be around 40 kHz (Schusterman, 1981).

Listing Status

Steller sea lions were originally listed as threatened under the ESA on November 26, 1990 (55 FR 49204), following a decline in the U.S. of about 64% over previous three decades. In 1997 the Steller sea lion population was split into separate western and eastern stocks based on observed demographic and genetic dissimilarities (Bickham et al., 1996; Loughlin, 1997). These stocks are now listed under the ESA as the Eastern DPS and Western DPS. Only the Eastern DPS is expected to be affected by the proposed activities. Critical habitat has been designated for Steller sea lions on the major foraging sites, haulouts, and rookeries throughout their range (58 FR 45269). The critical habitat within the action area for this Opinion is located in Oregon.

Status and Trends of Steller Sea Lions, Eastern DPS

The decline of Steller sea lions was first witnessed in the eastern Aleutian Islands in the mid-1970s and then spread westward to the central Aleutian Islands and eastward to the western Gulf of Alaska in the late 1970s and early 1980s. Similarly, counts are frequently presented for the area from Kenai to Kiska Island, which is considered to encompass the center of abundance for the species. Population surveys suggest that the Eastern DPS is stable or increasing in the northern part of its range while the Western DPS is declining.

Loughlin et al. (1984) estimated the worldwide population of Steller sea lions was between 245,000 and 290,000 animals in the late 1970s and that 90% of the worldwide population of Steller sea lions was in the western DPS in the early 1980s (75% in the U.S. and 15% in Russia) and 10% in the Eastern DPS. Steller sea lions collected in the Gulf of Alaska during the early 1980s showed evidence of nutritional limitation (Calkins and Goodwin, 1988; Calkins et al., 1998; Pitcher et al., 1998).

After conducting a range-wide survey in 1989, Loughlin et al. (1992) noted that the worldwide Steller sea lion population had declined by over 50% in the 1980s, to approximately 116,000 animals, with the entire decline occurring in the range of the Western DPS. Between late 1970s and the mid-1990s, counts of the western population of sea lions fell 80% from 109,880 animals to 22,167 (Hauser et al., 2007). Fritz and Stinchcomb (2005) estimate that from 1991 to 2000, the number of animals in the western population declined by approximately 38%. Surveys by Fritz and Stinchcomb (2005) indicate that the current number of non-pups in the western population is 29,037.

The current minimum population estimate of the western stock of Steller sea lions in the western U.S. is 38,988 (Angliss and Outlaw, 2008). When combined with data on Steller sea lions in Russia the minimum estimate for the Western population is 44,780 (Angliss and Outlaw, 2007). According to several population models the western DPS has significant chance of going extinct within the next 100 years (York et al., 1996; Goodman, 2006; Winship and Trites, 2006). Individual rookeries such as those in the western Aleutian islands and the Gulf of Alaska have a much higher risk of failure (Winship and Trites, 2006).

The eastern stock appears to be more stable. Pup count data from 2002 through 2005 from across the range of the eastern population, multiplied by a factor of 4.5 (after Calkins and Pitcher, 1982) or 5.1 (after Trites and Larkin, 1996) results in a population estimate of 48,519 or 54,989 animals (Angliss and Outlaw, 2008). The current minimum population estimate is 44,404 animals (Angliss and Outlaw, 2008). NMFS calculates this estimate by adding non-pup counts taken in 2002 in Southeast Alaska, to counts of animals in Washington in 2002 as well as counts of pups and non-pups in Canada in 1998, Oregon in 2002, California in 2004, and southeastern Alaska in 2005 (Angliss and Outlaw, 2008).

Environmental Baseline

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 that are contemporaneous with the consultation in process (50 CFR §402.02).

The *Environmental Baseline* for this Opinion includes the effects of many activities on the survival and recovery of ESA listed species in the action area; it focuses primarily on past and present impacts to these species. A number of human activities have contributed to the current status of listed marine species in the action area. Some of those activities, (e.g. commercial whaling and intentional shooting) no longer regularly occur. However, the effects from these activities may still persist. Other human activities are ongoing and appear to be directly or indirectly affecting these species. Additionally, unrelated factors may be acting together to affect listed species. For example, vessel effects combined with the stresses of reduced prey availability or increased contaminant loads may reduce foraging success and lead to chronic energy imbalances and poorer reproductive success; or all three factors may work to lower an animal's ability to suppress disease (Williams et al., 2002b; NMFS, 2008a).

Taken together, the components of the environmental baseline for the action area include sources of natural mortality as well as influences from natural oceanographic and climatic features in the action area. Circulation and productivity patterns influence prey distribution and habitat quality for listed species. The effects of climatic variability on these species in the action area and the availability of prey remain largely undetermined; however, it is likely that any changes in weather and oceanographic conditions resulting in effects on prey populations would have consequences for marine mammals.

The baseline also includes human activities resulting in disturbance, injury or mortality of individuals. Historically, commercial harvest of Steller sea lions and the live capture of killer whales significantly affected these species. Although these activities are not conducted now as in the past, effects from these activities still persist today. Current anthropogenic activities and effects on individuals in the action area are thought to include habitat degradation (e.g., due to contaminants, risk of oil spills, underwater sound sources, changes in prey availability), interactions with fishing gear and with vessels and scientific research. Conservation and management efforts are ongoing and have a positive effect on the status of listed marine mammals within the action area.

The following discussion summarizes the natural and human phenomena in the action area that may affect the likelihood that these species will survive and recover in the wild. These include natural mortality; oceanographic and climate conditions; commercial harvest and live capture; habitat degradation; environmental contaminants and the risk of oil spills; noise; changes in prey availability; interactions with fishing gear and vessels and scientific research and conservation efforts.

Natural and Anthropogenic Stressors

Natural Mortality

SRKWs

The causes of natural mortality in SRKWs are largely unknown. Individual and mass live-strandings and entrapments of killer whales are considered rare (Dahlheim and Heyning, 1999). However, disease has been observed to drive animals ashore (Walsh et al., 2001). Perrin et al (2002) reported lethal stranding events involving SRKWs occurring in 1995 and 1996 off Northern Vancouver Island and the Queen Charlotte Islands. A similar event occurred in 2002 off Long Beach in Washington state (as reported in NMFS, 2008b). SRKWs have no natural predators and little is known about disease in this species (Gaydos et al., 2004), although some mortality from disease has been observed. Disease epidemics have never been reported in killer whales in the northeastern Pacific (Gaydos et al., 2004).

Eastern DPS Steller Sea Lions

Killer whale predation may significantly reduce Steller sea lion populations (Frid et al., 2009). Sleeper sharks are also significant predators of Steller sea lions and, when combined with killer whale attacks, may restrict their foraging ability (Frid et al., 2009). The reduction in Steller sea lions at multiple rookeries and haulouts indicates that predation by killer whales and other sources of natural mortality may contribute to the decline in local areas (Barrett-Lennard et al., 1995). Evidence indicates that these animals are also exposed to diseases and carry parasites (see Dailey and Hill, 1970; Fay and Furman., 1982; Gerber et al., 1993). However, it is unclear whether these factors are impeding recovery.

Commercial Harvest, Live Captures and Intentional Shooting

Except for a limited amount of harvesting of Steller sea lions by native people of Alaska, commercial harvesting, live captures and intentional shooting are no longer permitted on any listed species in the proposed action area. However, prior exploitation may have altered the population structure and social cohesion of the species such that effects on abundance and recruitment continue for years after harvesting ceases.

SRKWs

In contrast with large whale species, killer whales were not heavily targeted in the 19th and early 20th centuries because of their limited amounts of oil and their difficulty to capture (Scheffer and Slipp, 1948). However, harvest statistics show that killer whales were killed on an average of about 43-56 individuals annually from the 1940s to 1981 (Ohsumi, 1975; Øien, 1988; Hoyt, 1990) before ceasing in the early 1990s. These harvests probably had little impact on populations in the northeastern Pacific (Baird, 2001; Reeves et al., 2003).

From 1962-1977, 275-307 killer whales were captured in Washington and British Columbia waters. Of these, 55 were transferred to aquaria, 12 or 13 died during capture operations, and 208-240 were released or escaped back into the wild (Bigg, 1975; Asper and Cornell., 1977; Olesiuk et al., 1990). The practice of live-captures declined significantly after 1971, with only eight whales removed (Bigg, 1975; Asper and Cornell., 1977; Olesiuk et al., 1990). The live-capture of killer whales in the northeastern Pacific stopped altogether after 1977. Forty seven of the whales retained or killed during live-capture activities were SRKWs (Olesiuk et al., 1990). By 1971, these captures contributed to the reduction of the population to approximately 67 individuals (Olesiuk et al., 1990).

Killer whales have historically been killed by humans because they were perceived to interfere with fishing activities (Klinowska, 1991; Matkin et al., 1997). Shootings of SRKWs were probably once relatively common in the proposed action area (Scheffer and Slipp, 1948; Olesiuk et al., 1990; Baird, 2001). These shootings still occasionally occur (Klinowska, 1991; Matkin and Saulitis, 1997; Reeves et al., 2003) but are not considered to significantly affect the fitness of SRKWs (Carretta et al., 2001).

Eastern DPS Steller Sea Lions

Steller sea lions were commercially harvested prior to 1973. However, commercial harvest was probably not a major factor in the Steller sea lion decline (Shima et al., 2000). However, Eastern DPS Steller sea lions have been subject to commercial exploitation and killing as a means of predator control which has reduced their abundance (Bonnot, 1928; Rowley, 1929; Scheffer, 1945; Bonnot and Ripley, 1948; Scheffer, 1950; Pearson and Verts, 1970; Bigg, 1988; Atkinson et al., 2008). Prior to 1972, over 45,000 Steller sea lions were intentionally killed in Alaska during state-sanctioned commercial harvest and predator control programs (Merrick et al., 1987). These killings may have depressed recruitment in the short term and may explain declines in Steller sea lions at some sites in the eastern Aleutian Islands and Gulf of Alaska. However, they do not appear to explain overall declines experienced in all regions (Loughlin and York., 2000). With the enactment of the MMPA in 1972, such activities were made illegal except for subsistence hunting. Both the ESA and the MMPA contain provisions that allow Alaska Natives to harvest Steller sea lions. Today, anecdotal reports of shootings continue (Loughlin and York., 2000).

Disturbance

Disturbance in Terrestrial Areas

Disturbance in Steller sea lion haulouts and rookeries can potentially cause disruption of reproduction, stampeding or increased exposure to predation. In order to decrease the likelihood of such disturbances, "no transit zones" were established under the ESA in 1990 for vessels within three nautical miles of rookeries. In 2002, NMFS implemented the North Pacific Fishery Management Council's recommendation to require a Vessel Monitoring System on federally licensed groundfish vessels involved in pollock, cod and Atka mackerel fisheries. The system tracks fishing vessels, providing real-time information on vessel location and violation of no-transit and no-trawl areas.

Noise

In addition to natural sources of noise, noise generated by human activity occurs and includes sound generated by commercial and recreational vessels, aircraft, commercial sonar, military activities, seismic exploration, in-water construction activities, and acoustic harassment devices (AHDs). These activities all occur within the action area to varying degrees throughout the year.

Marine mammals generate and rely on sound to navigate, hunt and communicate with other individuals. As a result, anthropogenic noise can interfere with these important activities. The effects of sound on marine mammals can range from behavioral effects to physical damage (Richardson et al., 1995), although noise levels at which sound may adversely affect these animals are not well understood.

Commercial shipping traffic is a major source of low frequency anthropogenic noise in the action area (Richardson et al., 1995). Although large vessels emit predominantly low frequency sound, studies report broadband noise from large cargo ships that includes significant levels above 2 kHz, which may interfere with important biological functions of cetaceans (Holt, 2008). Commercial sonar systems are used on recreational and commercial vessels and may effect with marine mammals (NRC, 2003b). Although, little information is available on potential effects of multiple commercial sonars to marine mammals, the distribution of these sounds would be small because of their short durations and the fact that the high frequencies of the signals attenuate quickly in seawater (Richardson et al., 1995).

On May 5, 2003, the U.S. Navy guided missile destroyer U.S.S. Shoup passed through the Strait of Juan de Fuca and Haro Strait operating its mid-frequency sonar during a training exercise. SRKWs were present at the time and exhibited unusual behaviors (Commander U.S. Pacific Fleet, 2003). NMFS concluded that the SRKWs were exposed to levels likely to cause behavioral disturbance, but not temporary or permanent hearing loss (see NMFS, 2005, 2006).

Seismic surveys using towed airguns also occur within the action area and are the primary exploration technique for oil and gas deposits and for fault structure and other geological features. Airguns generate intense low-frequency sound pressure waves capable of penetrating the seafloor and are fired repetitively at intervals of 10-20 seconds for extended periods (NRC, 2003b). Most of the energy from the guns is directed vertically downward, but significant sound emission also extends horizontally. Peak sound pressure levels from airguns usually reach 235-240 dB at dominant frequencies of 5-300 Hz (NRC, 2003b). Most of the sound energy is at frequencies below 500 Hz. In the United States, all seismic projects for oil and gas exploration and most research activities involving the use of airguns with the potential to take marine mammals are covered by incidental harassment authorizations under the MMPA.

Acoustic harassment devices are another source of underwater noise that may occur in the action area and may be disruptive to listed marine species. AHDs used at salmon aquaculture farms emit signals intended to displace nuisance harbor seals and sea lions (Petras, 2003). These signals can also cause responses in cetaceans (Olesiuk et al., 2002). Morton and Symonds (2002) describe one AHD model that broadcast a 10 kHz signal at 194 dB re 1 μPa at 1 m and was potentially detectable above ambient levels in open water for up to 50 km.

Pollution

Pesticides and Contaminants

Exposure to pollution and contaminants has the potential to cause adverse health effects in marine species. In the eastern North Pacific, marine ecosystems receive pollutants from a variety of local, regional, and international sources and their levels and sources are therefore difficult to identify and monitor (Grant and Ross, 2002). Marine pollutants come from multiple municipal, industrial and household sources as well as from atmospheric transport (Iwata, 1993; Grant and Ross, 2002; Garrett, 2004; Hartwell, 2004).

The accumulation of persistent pollutants through trophic transfer may cause mortality and sub-lethal effects in long-lived higher trophic level animals (Waring et al., 2004), including immune system abnormalities, endocrine disruption and reproductive effects (Krahn et al., 2007). Recent efforts have led to improvements in regional water quality and monitored pesticide levels have declined, although the more persistent chemicals are still detected and are expected to endure for years (Mearns, 2001; Grant and Ross, 2002).

Organochlorines, such as polychlorinated biphenyls (PCB), dioxins, furans and dichlorodiphenyltrichloroethane (DDT) are found in the action area (Ross et al., 2000; CBD, 2001; Krahn et al., 2002; Cullon et al., 2009; Krahn et al., 2009). These compounds are persistent in the environment and have the potential to bioaccumulate in fatty tissues (Haraguchi et al., 2009; Krahn et al., 2009). Southern Resident killer whales may accumulate these toxins in their tissues, which has the potential to cause physical and physiological problems (Krahn et al., 2009). Levels are much higher in field-sampled individuals than those found in a captive killer whales (Bennett et al., 2009).

PCBs and DDT, have been observed in Steller sea lions in greater concentrations than any other pinniped during the 1980s, although these levels appear to be declining (Barron et al., 2003; Hoshino et al., 2006). The levels of these compounds have been found to have twice the burden in individuals from Russia than from western Alaska (Myers et al., 2008). In addition, heavy metals have also been identified in Steller sea lion tissues, but are in concentrations lower than other pinnipeds (Noda et al., 1995; Kim et al., 1996; Castellini, 1999; Beckmen et al., 2002). Contaminant burdens are transferred to the fetus *in utero* as well as through lactation (Lee et al., 1996; Myers et al., 2008) meaning that new generations start with a higher level of contaminants than their parents.

Hydrocarbons

Exposure to hydrocarbons released into the environment via oil spills and other discharges pose risks to marine species. Marine mammals are generally able to metabolize and excrete limited amounts of hydrocarbons, but exposure to large amounts of hydrocarbons and chronic exposure over time pose greater risks (Grant and Ross, 2002). Acute exposure of marine mammals to petroleum products causes changes in behavior and may directly injure animals (Geraci, 1990). Cetaceans have a thickened epidermis that greatly reduces the likelihood of petroleum toxicity from skin contact with oiled waters (Geraci, 1990). However, they may inhale these compounds at the water's surface and ingest them while feeding (Matkin and Saulitis, 1997).

Hydrocarbons have the potential to negatively affect Steller sea lions. Potential effects include pelage fouling, inhalation of contaminant vapor and ingestion of oil or oil-contaminated prey. Hydrocarbons also have the potential to impact prey populations, and therefore may affect listed species indirectly by reducing food availability. Roughly 30 individuals died as a result of the Exxon *Valdez* oil spill and contained particularly high levels of polycyclic aromatic hydrocarbons contaminants (Calkins et al., 1994; Loughlin et al., 1996). Subsequently, premature birth rates increased and pup survival decreased after this event (Calkins et al., 1994; Loughlin et al., 1996).

Marine Debris

Types of marine debris include plastics, glass, metal, polystyrene foam, rubber, and derelict fishing gear from human marine activities or transported into the marine environment from land. The sources of this debris include littering, dumping and industrial loss and discharge from land. Marine debris can damage important marine habitat, such as rookeries and haulout sites by making them inhospitable to the species that rely on them. Marine animals can also become entangled in marine debris, or ingest it, which may lead to injury or death.

While SRKW entanglements with marine debris are rare (Carretta and Chivers, 2004; Angliss and Outlaw, 2005), Steller sea lions become entangled in a variety of debris including many types of fishing gear, loops of line, and packing bands (Loughlin and Nelson, 1986) which may cause mortality.

A study conducted in the Aleutian Islands during June-July 1985 to investigate the rate of entanglement found that a approximately 0.07% of observed sea lions were entangled in marine debris (Loughlin and Nelson, 1986). A follow-up study noted no entangled pups and only one entangled juvenile out of a total of 3,847 sea lions examined (Loughlin and Nelson, 1986). However, these studies cannot fully evaluate the frequency of entanglement because most entangled animals die at sea and are never observed.

Prey Availability

SRKWs

Reductions in prey may require marine mammals to spend more time and energy foraging, which in turn could have negative effects on reproductive rates and mortality. Human activities have had impacts on the abundance of many prey species in the northeastern Pacific during the past 150 years (Slaney et al., 1996; Gregory and Bisson, 1997; Press, 2003; Schoonmaker et al., 2003). Salmon, a major prey item for both SRKWs and Steller sea lions, have declined due to degradation of aquatic ecosystems resulting from human activities (Slaney et al., 1996; Gregory and Bisson, 1997; Press, 2003; Schoonmaker et al., 2003). A 50% reduction in killer whale calving has been correlated with years of low Chinook salmon abundance (Ward et al., 2009a). In addition, competition with non-native species all have the potential to affect populations of prey (Wonham and Carlton, 2005).

It is difficult to assess whether SRKWs have adequate prey resources to support their survival and recovery because there is insufficient information on the food habits and seasonal ranges of killer whales. In addition, uncertainties about the historic and current abundance levels of many localized populations of prey and the cyclic nature of large-scale changes in ocean conditions further complicate the issue (see NMFS, 2008b). However, despite these limitations, some general trends are apparent, including the significant reduction in natural breeding populations of most salmonid species along much of the west coast of North America during the past 150 years, especially from Washington to California. This phenomenon may have reduced the region's ability to support historical numbers of Southern Residents (Krahn et al., 2002).

Eastern DPS Steller Sea Lions

Steller sea lions may compete with Commercial fisheries and for prey. Significant evidence supports the idea that the western DPS is declining as a result of observed reductions in growth, birth, and survival rates because of changes in diet, presumably from this competition (Calkins and Goodwin, 1988; Calkins et al., 1998; Pitcher et al., 1998; Trites and Donnelly, 2003; Atkinson et al., 2008). As a result, limitations on fishing grounds, duration of fishing season, and monitoring programs have been established to prevent Steller sea lion nutritional deficiencies as a result of inadequate prey availability. However, in contrast with the Western DPS of Steller sea lion, no evidence suggests that Steller sea lions in the Eastern DPS were nutritionally limited during the 1970s and 1980s (see NMFS, 2008c).

Interactions with Fishing Activities

Drowning from accidental entanglements in fishing equipment is a minor source of mortality for killer whales (Carretta and Chivers, 2004; Angliss and Outlaw, 2005). In Washington, Sheffer and Slipp (1948) documented several deaths of animals caught in gillnets between 1929 and 1943. However, killer whales are usually able to avoid nets by swimming around or underneath them (Jacobsen, 1986; Matkin, 1994).

Steller sea lions may become entangled and drown in commercial fishing gear (Atkinson et al., 2008). Steller sea lions have been incidentally caught in a variety of commercial fishing gear including gillnets (Wynne, 1990), trawls (Loughlin and DeLong, 1983), and longlines (Angliss and Outlaw, 2005). Steller sea lions may also ingest baited hooks set by commercial or recreational trollers (Angliss and Outlaw, 2005). The minimum estimate of lethal takes from fishing between 1996 and 2000 averaged 29.5 animals a year (Angliss and Outlaw, 2005) and was 3.6 in 2005 for the Eastern DPSs (Angliss and Outlaw, 2005). It is estimated that 0.26% of Steller sea lions have marine debris around their necks or are hooked by fishing gear (0.07%) (FOC, 2008; Raum-Suryan et al., 2009).

Ship Strikes and Other Vessel Interactions

Ship strikes of killer whales are considered rare, but do occur and can result in serious injury and mortality (Ford et al., 2000; Baird, 2001; Carretta et al., 2005). Prior to 1950, Scheffer and Slipp (1948) noted several collisions between killer whales and boats, but gave no information on effects to the whales from these encounters. One such mortality was reported between the 1960s and 1990s (Baird, 2002). In 2006 a killer whale was killed after being struck by a tug boat (Gaydos et al., 2007). Also that year, the death of a stranded individual was attributed to blunt trauma likely from a vessel strike (Gaydos et al., 2007). Five additional accidents between vessels and killer whales have been documented in the region since the 1990s (Baird, 2001) but no mortality was reported from these events. In coastal waters, there are no known incidents of collisions with vessels.

In addition to physical injury or mortality, several studies indicate vessels may contribute to short-term behavioral changes in resident killer whales (Kruse, 1991; Kriete, 2002; Williams et al., 2002a; Bain et al., 2006b). Commercial whale-watching has increased in recent years (Osborne et al., 1999; Erbe, 2002; MMMP, 2002; Koski, 2004; Koski, 2006, 2007). Although regulated, there are concerns over behavioral changes these activities may cause (Kruse, 1991; Kriete, 2002; Williams et al., 2002a; Foote et al., 2004; Bain et al., 2006a; Bain et al., 2006b; Wiley et al., 2008; Noren et al., 2009).

Although more research is needed, there is concern these short-term behavioral responses could lead to biologically significant consequences, particularly given the substantial proportion of time SRKWs spend in proximity to vessels (Bain et al., 2006a; Noren, 2006). Potential impacts on SRKWs resulting from the physical presence of vessels or increased underwater sound levels from these vessels may include effects on foraging efficiency, communication, energy expenditure, as well as effects from chronic stress responses such as reduced immune function (Gordon and Moscrop, 1996; Holt, 2008).

Vessel traffic also disturbs hauled-out Steller sea lions to varying degrees. Reactions of Steller sea lions to occasional disturbance range from no reaction to the complete and immediate departure from the haulout area (Calkins and Pitcher, 1982). As with other marine mammals, the consequence of this type of disturbance on the overall population of Steller sea lions is difficult to measure.

Scientific Research

SRKWs

SRKWs have been the subject of scientific research activities in the action area as authorized by NMFS permits. Most of the scientific research is in the inland waters of Washington State. Approved permits include a variety of activities including close approaches for vessel and aerial surveys, photo-identification, behavioral observation, video and acoustic recording, biopsy, breath sampling, and suction cup tagging (see NMFS, 2006). No mortalities or serious injuries are authorized for SRKWs under any permits. A complete list of all active research permits for the SRKW is located in Appendix A.

Repeated disturbance of individuals is probable under these permits. It is difficult to assess the effects of such disturbance on the species. However, NMFS has taken steps to limit repeated harassment through conditions included in the permits requiring coordination among permit holders and limiting the repeated harassment of individuals under each permit.

Eastern DPS Steller Sea Lions

Intentional lethal sampling of eastern Steller sea lions was a primary means of collecting samples for scientific research before the MMPA was implemented. These activities were discontinued once the species was listed as threatened under the ESA. Activities authorized under the MMPA and ESA are highly regulated and closely monitored and may include the incidental taking or harassment in the course of research, including counting, capturing, and handling animals. These activities may result in inadvertent or indirect eastern Steller sea lion mortality. The NMFS Permit office reviews permit applications, which are also reviewed by the Marine Mammal Commission and made available for public review through notice in the Federal Register. Investigators are required to submit annual plans and reports of research activities and real-time reports of research-related mortality. A complete list of all active research permits for the SRKW is located in Appendix B.

Oceanographic Features and Climatic Variability

Climatic variability and change may be affecting listed species through change in habitat and prey availability. However, these effects are not well understood. Possible effects of climatic variability for marine species include the alteration of community composition and structure, changes to migration patterns or community structure, changes to species abundance, increased susceptibility to disease and contaminants, alterations to prey composition and altered timing of breeding (MacLeod et al., 2005; Robinson et al., 2005; Kintisch, 2006; Learmonth et al., 2006; McMahon and Hays, 2006). Naturally occurring climatic patterns, such as the Pacific Decadal Oscillation and the El Niño and La Niña events, are identified as major causes of changing marine productivity worldwide and may also therefore influence listed species' prey abundance (Mantua et al., 1997; Francis et al., 1998; Beamish et al., 1999; Hare et al., 1999; Benson and Trites, 2002). Gaps in information and the complexity of climatic interactions complicate the ability to predict the effects of climate change and variability may have to these species (Kintisch, 2006; Simmonds and Isaac, 2007).

Conservation and Management Efforts

Several conservation and management efforts have a positive effect on listed marine mammals in the action area. Recovery plans under the ESA help guide the protection and conservation of listed species and final plans are in place for SRKWs and Steller sea lions. NMFS implements conservation and management activities for these species through its Regional Offices and Fishery Science Centers in cooperation with states, conservation groups, the public, and other federal agencies.

For the SRKW, increased law enforcement in coordination with Washington State has been enacted to prohibit the approach of killer whales within less than 100 yards. Recovery of killer whales has also been incorporated into several related conservation plans including Pacific salmon recovery programs and the Puget Sound Partnership Action Agenda. Increased monitoring, education and outreach programs have also been enacted.

The revision and implementation of the Steller sea lion recovery plan was finalized in 2008. In addition, several monitoring and research programs are currently in place to help understand threats and trends of the Eastern DPS of Steller sea lions. Agreements between NMFS and the Aleut Communities of St. George and St. Paul islands have been enacted to help conserve and manage subsistence marine species with special focus on Steller sea lions. A cooperate agreement has also been enacted between NMFS and the Alaska Sea Otter and Steller Sea Lion Commission for education and outreach concerning the Eastern DPS of Steller sea lions.

Effects of the Proposed Action

Pursuant to Section 7(a)(2) of the ESA, federal agencies are directed to ensure that their activities are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat. Direct adverse effects of the permitted activities on listed species that are within the action area would include disruption of feeding, breeding, resting and other behaviors. Some displacement may result from these activities. The duration of the behavioral disruptions and displacements are expected to vary by species and type of disturbance.

In this section, we describe the potential physical, chemical, or biotic stressors associated with the proposed action, the probability of individuals of listed species being exposed to these stressors based on the best scientific and commercial evidence available, and the probable responses of those individuals (given probable exposures) based on the available evidence. As described in the *Approach to the Assessment* section, for any responses that would be expected to reduce an individual's fitness (i.e., growth, survival, annual reproductive success, and lifetime reproductive success), the assessment would consider the risk posed to the viability of the population(s) those individuals comprise and to the listed species those populations represent. The purpose of this assessment is to determine if it is reasonable to expect the proposed studies to have effects on listed species that could appreciably reduce their likelihood of surviving and recovering in the wild.

For this consultation, we are particularly concerned about behavioral disruptions that may result in animals that fail to feed or breed successfully or fail to complete their life history because these responses are likely to have population-level consequences. The proposed permit would authorize non-lethal "takes" by harassment of listed species during activities. The ESA does not define harassment nor has NMFS defined the term pursuant to the ESA through regulation. However, the MMPA of 1972, as amended, defines harassment as any act of pursuit, torment, or annoyance which has the potential to injure a marine mammal or marine mammal population in the wild or has the potential to disturb a marine mammal or marine mammal population in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering [16 U.S.C. 1362(18)(A)]. The latter portion of this definition (that is, "...causing disruption of behavioral patterns including...migration, breathing, nursing, breeding, feeding, or sheltering") is almost identical to the U.S. Fish and Wildlife Service's regulatory definition of "harass"[2] pursuant to the ESA. For this Opinion, we define harassment similarly as an intentional or unintentional human act or omission that creates the probability of injury to an individual animal by disrupting one or more behavioral patterns that are essential to the animal's life history or its contribution to the population the animal represents.

Potential Stressors

The assessment for this consultation identified several possible stressors associated with the activities to be authorized under proposed permit: (1) noise and visual disturbance generated by research boats, aircraft and human presence while engaged in surveys, captures, sampling and collection activities, (2) potential boat strikes resulting from these activities, (3) effects from recorded playback activities and (4) oil or fuel leakage from vessels. The following section describes these stressors in greater detail, describes the probability of interactions then describes the probable responses of listed species based on the evidence available.

The proposed permit does not distinguish how many of each type of disturbance the total number of "takes" comprises. Rather, any single type of "take" or combination thereof can contribute to the total number allowed under the proposed permit. Because of this, we assess the risks of each respective proposed activity as if that activity alone comprises all of the proposed takes per species. Up to 30 boat and land based survey, capture, sampling and collection activities are proposed to occur each year for five years. Although the investigators expect to complete playback experiments in 10-12 days, the amount of playbacks is not expressly specified. Because 10 playbacks are to be permitted per location at two locations per day, there is a possibility of 20 playback events affecting hundreds of kilometers of ocean area per day for five years[3].

Up to 250 members of the Eastern DPS of Steller sea lions are proposed to be "taken" per year for five years with 1,250 total "takes" over five years. One hundred SRKWs are proposed to be taken per year with a total of 500 individuals "taken" total over the five year period. While "takes" resulting from boat, aerial and ground based survey, capture, sampling and collection activities can easily be observed and recorded, it is not clear how the investigators could observe "takes' occurring from playback experiments that can occur kilometers away. Therefore our assessment will assume that each playback experiment will result in "takes" of listed species, regardless of observation.

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2 An intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering (50 CFR 17.3)

3 See the *Playbacks of Killer Whale Vocalizations* section on pg. 31 for details on how the distance to which playback noise could reach was estimated.

Response Analyses

As discussed in the *Approach to the Assessment* section of this Opinion, response analyses determine how listed resources are likely to respond after being exposed to an action's effects on the environment or directly on listed animals themselves. For the purposes of consultation, our assessments try to detect potential lethal, sub-lethal, physiological or behavioral responses that might reduce the fitness of individuals. The proposed activities have the potential to produce disturbances that may affect listed marine mammals.

The responses by animals to human disturbance are similar to their responses to potential predators (Harrington and Veitch, 1992; Lima, 1998; Gill and Sutherland, 2001; Frid and Dill, 2002; Frid, 2003; Beale and Monaghan, 2004; Romero, 2004). These responses include interruptions of essential behavior and physiological processes such as feeding, mating, nursing, resting, digestion etc. This can result in stress, injury and increased susceptibility to disease and predation (Frid and Dill, 2002; Romero, 2004; Walker et al., 2006).

Risks to listed individuals are measured in terms of changes to an individual's "fitness." Fitness is defined as the individual's growth, survival, annual reproductive success and lifetime reproductive success. 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 (Brandon, 1978; Mills and Beatty, 1979; Stearns, 1992; Anderson, 2000). As a result, if the assessment indicates that listed plants or animals are not likely to experience reductions in their fitness, we conclude our assessment. If possible reductions in individuals' fitness are likely to occur, the assessment considers the risk posed to populations to which those individuals belong, and then to the species those populations represent.

The proposed actions may expose listed species to disturbance from boat, air and ground based survey, capture, sampling and collection activities. In addition, there is the potential for boat strikes to occur. Playback experiments of recorded killer whale vocalizations also have the potential to disturb SRKWs and members of the Eastern DPS of Steller sea lions. These activities have the potential to harass, wound, injure, or kill listed individuals. In addition, these animals may undergo changes in behavior in response to disturbances from the proposed activities.

<u>Noise and Visual Disturbance from Boat, Aerial and Land Based Activities</u>

SRKW

Although some capture techniques are proposed to employ the use of boats, these activities will be limited to the immediate shoreline and therefore any effects to SRKWs from these activities are extremely unlikely. However, proposed surveys from boats and aircraft may cause disturbances to SRKWs. Cetaceans exhibit a variety of responses to boat survey activities including short-term changes in swimming and feeding behavior, as well as diving in and staying submerged for longer periods of time (Watkins et al., 1981; Malme et al., 1984; Richardson et al., 1985; Baker and Herman, 1987; Brown et al., 1991; Clapham and Mattila, 1993; Jahoda et al., 1997; Patenaude et al., 2002; Best et al., 2005). These responses create additional energy expenditures that result in the animal incurring an energy debt that must be compensated for by increased foraging. This can further interrupt normal behavior. Individually and collectively, these disturbances can adversely affect already imperiled individuals and populations.

To limit adverse responses by both target and non-target species, the proposed boat survey activities are to employ noise reduction techniques, such as maintaining slow speeds, idling and turning engines off when not needed. When operating at slow speeds or in idle, these boats usually do not appear to disrupt SRKW behavior (Krahn et al., 2004).

When exposed to aircraft noise, toothed whales such as SRKWs appear to respond to a lesser degree than do other marine mammals, with some showing no response, even from surveys from altitudes as low as 300 ft (Richardson et al., 1995). The proposed aerial surveys are to be conducted altitudes greater than 500 ft. Overall, there is no indication that occasional aircraft noise causes long term displacement of whales (Richardson et al., 1995). In addition, no mortality or physical injury is expected from these activities. Land based activities will not affect SRKWs. Therefore, it is extremely unlikely that the proposed boat and land based survey, capture, sampling and collection activities would reduce the fitness of any individual SRKW.

Eastern DPS Steller Sea Lions

Eastern DPS Steller sea lions are highly mobile and utilize a variety of areas as haulouts (Calkins, 1979). They occur in the action area and thus may be exposed to noise and visual disturbance from aerial, boat and ground activities. Pinnipeds such as Steller sea lions react to such disturbances by entering the water as an escape response (Richardson et al., 1995). This not only increases the animals' energy expenditure and interrupts normal behavioral and physiological processes, but can also result in trampling, pup abandonment (Johnson, 1977) and may make them more susceptible to predation. These severity of these reactions is variable and can range from complete evacuation of the haulout area to no reaction at all (Calkins and Pitcher, 1982). These responses are similar regardless of whether the disturbance is from human presence or from the presence of boats and aircraft and their corresponding engine noise (Richardson et al., 1995).

The reactions of pinnipeds to disturbance from aerial surveys appear to be strongest from aircraft that fly at low altitudes (< 200 ft) (Richardson et al., 1995). The proposed surveys are to be conducted at relatively high altitudes (>500 ft) and at slow speeds (<100 kn) in order to reduce disturbance to target pinniped and non-target species. Similarly, slow approaches during boat based surveys of rookeries are to occur from a distance of 100-150 m in order to reduce disturbance to both target and non target pinnipeds. After the target animals become acclimated to the boats, closer approaches are to be made to within 30-50 m in order to read tags or brands and to take photographs. It is presumed that Steller sea lions in the area, if present, would become similarly acclimated. In addition, as mentioned, no listed species is to be approached directly. These combined measures should therefore reduce disturbance to Steller sea lions and any adverse responses that do occur should be negligible. No reduction in fitness to any individual Steller sea lion is expected from these activities.

The proposed capture, restraint, morphometrics, tagging, scat collection and land based surveys are to employ measures to reduce disturbance to target and non-target pinnipeds. Observers are to maintain a low profile and observe quietly from downwind and from behind cover when possible. These measures are intended to reduce stress and adverse responses of target pinnipeds and should reduce such responses from Steller sea lions. Because of these measures, and the fact that the activities are directed at target species and no listed species would be approached, disturbances to Steller sea lions would be unlikely. In the event of a disturbance, no mortality or physical harm is expected. Consequently, any risks to Steller sea lions from these activities would be negligible. No reduction in fitness to any individual is expected.

<u>Boat Strikes</u>

There is a potential for boat strikes to listed species resulting from these survey activities. However, because of the small size (15-26 ft) and maneuverability of the vessels, boat strikes are extremely unlikely. As a result, any risk of boat strikes to any listed animal is therefore discountable.

<u>Playbacks of Killer Whale Vocalizations</u>

The behavioral responses of California sea lions to underwater playbacks of killer whales would be tested at various locations throughout the action area. These activities have the potential to adversely affect listed species. In order to calculate the linear distance to which playback noise could reach, we employed the following formula for the attenuation of energy through media[4]:

$$A_{(z)} = A_0 e^{-\alpha z}$$

Where:

- $\mathbf{A_0}$ is the initial sound level (148 dB)
- **e** is the base of the natural logarithm
- z is distance from sound origin
- α is the extinction coefficient of noise in seawater
- $\mathbf{A_{(z)}}$ is the sound level at distance z

The extinction coefficient of 10 kHz sound in 10º seawater (typical temperature for OR, WA waters[5]) is 0.92 dB/km (Schulkin and Marsh, 1962). The extinction coefficient for the 10 kHz frequency was chosen because it is at the low end of the proposed frequency

4 Adapted from a modification of the Beer–Lambert Law for the extinction of energy relative to the properties of the material through which it moves.
5 See http://www.nodc.noaa.gov/dsdt/cwtg/npac.html for information on ocean water temperatures.

spectrum and as such would travel the farthest, thus yielding the largest and most conservative estimate for the distance affected. This resulted in a calculated planar distance of approximately 12.0 km from the noise source to be attenuated to < 0.01 dB. This estimate is supported by Miller (2000), who found that the estimated maximum detectable range of killer whale vocalizations at all frequencies ranged from 4.5 to 26.2 km, which is similar to our estimate.

With a radius of 12.0 km, the expected total planar area that would be exposed to these sounds would be 452 km^2. However, because the noise source is located at the coastline, the extent of this noise into the ocean would only be one half of this area, or roughly 226 km^2. This is a conservative estimate because these noises would cease to be salient at distances where they fall below the variable ambient noise levels, and therefore would likely not be detectable at the farthest extent of this area.

Although it is expected that the project can be completed in 10-12 days, the amount of playbacks is not specified. Because 10 playbacks are to be permitted per location at two locations per day, there is a possibility of 20 playback events affecting hundreds of kilometers of ocean area per day for five years. Listed species in the action area are therefore likely to be affected by these playback activities.

SRKW

Studies on the effects of playback experiments on toothed whales are scarce (Deeke, 2006). While it is reasonable to assume that SRKWs could respond to these playbacks, these sounds are recorded vocalizations of the same species and are at frequencies and at levels commonly used and encountered by SRKWs (Diercks et al., 1971). Therefore, no injury, mortality or significant deleterious behavioral response is expected to occur. The proposed activities should therefore not result in the reduction of fitness to any individual SRKW.

Eastern DPS Steller Sea Lions

Data are lacking on the effects of playbacks of marine mammal vocalizations on Steller sea lions (Deeke, 2006). However, there are numerous studies on the responses of other pinnipeds to such noises. These responses include diving to avoid detection and are stronger when pinnipeds are exposed to playback calls from transient mammal-eating killer whales (Deeke et al., 2002; Deeke, 2006). This occurs presumably because the sounds are unfamiliar, or are perceived as more of a threat than those of fish-eating resident killer whales (Deeke et al., 2002).

Although the proposed experiments would be targeted specifically to California sea lions, Steller sea lions occur in the action area and could be exposed. While responses to playback experiments would incur a physiological cost by disrupting normal behavior and result in additional energy expenditure, they are expected to be temporary and, because they are at frequencies and levels commonly encountered naturally, would not be expected to directly cause any physical injury or mortality. The proposed playback experiments are therefore not expected to reduce the fitness of any individual Steller sea lion.

Hydrocarbons

The proposed surveys have to potential to introduce hydrocarbons into the environment through fuel and oil spills and leaks. However, because of the small size the boats and aircraft, any hydrocarbon discharges should be easily identified and contained. The only significant risk of the introduction of hydrocarbons into the environment would be from a catastrophic failure resulting in the sinking of a vessel or the downing of an aircraft. However, even in the unlikely event that this were to occur, the small size of the vessels and aircraft and their resulting small fuel tanks and oil reservoirs would result in a negligible amount of hydrocarbon release. No effects are expected from hydrocarbon release from any of these proposed survey activities to any listed animal.

Cumulative Effects

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this Opinion. Future Federal actions, including research authorized under ESA Section 10(a)1(A), that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. After reviewing available information, NMFS is not aware of effects from any additional future non-federal activities in the action area that would not require federal authorization or funding and are reasonably certain to occur during the foreseeable future.

NMFS expects the natural phenomena in the action area (e.g., oceanographic features, storms, and natural mortality) will continue to influence listed whales as described in the *Environmental Baseline*. We also expect current anthropogenic effects will also continue, including the introduction of sound sources into marine mammal habitat, changes in prey availability, vessel traffic and scientific research. Potential future effects from climate change on marine mammals in the action area are not definitively known. However, climatic variability has the potential to affect these species in the future, including indirectly by affecting prey availability.

As the size of human communities increase, there is an accompanying increase in habitat alterations resulting from an increase in housing, roads, commercial facilities and other infrastructure. This results in increased discharge of sediments and pollution into the marine environment. These activities are expected to continue to degrade the habitat of marine mammals as well as that of the prey on which they depend.

Integration and Synthesis of Effects

The following text integrates and synthesizes the *Status of the Species*, the *Environmental Baseline* and the *Effects of the Action* sections of this Opinion. This information, in addition to the known cumulative effects, is used to assess the risk the proposed activities pose SRKWs and members of the Eastern DPS of Steller sea lions.

As explained in the *Approach to the Assessment* section, risks to listed individuals are measured using changes to an individual's "fitness." 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 (e.g., Brandon, 1978; Mills and Beatty, 1979; Stearns, 1992; Anderson, 2000).

When individual, listed plants or animals are expected to experience reductions in fitness in response to an action, those fitness reductions can reduce the abundance, reproduction, or growth rates of the populations that those individuals represent (see Stearns, 1992). If we determine that reductions in individual plants' or animals' fitness reduce a population's viability, we consider all available information to determine whether these reductions are likely to reduce the viability of any species as a whole.

The proposed issuance of scientific research Permit No. 13430 would authorize "takes" of endangered SRKWs and threatened Eastern DPS Steller sea lions. One hundred SRKWs are proposed to be taken per year with a total of 500 individuals "taken" over the five year period. Up to 250 members of the Eastern DPS of Steller sea lions are proposed to be "taken" per year for five years with 1,250 total "takes" over five years. It is not clear how the investigators could observe "takes' occurring from playback experiments that can occur several kilometers away. Therefore our assessment assumes that each playback experiment will result in "takes" of listed species, regardless of their observation.

<u>Current and Historic Stressors</u>

The current and historic stressors to these species are detailed in the *Environmental Baseline* section of this Opinion. These stressors include natural mortality, depletion of populations due to historic killing, depletion of prey, pollution, noise, fishing interactions, ship strikes, vessel interactions and scientific research. Of these factors, prey availability, especially that of Pacific salmonid species, has greatly contributed to the decline of SRKWs. For Eastern DPS Steller sea lions, a major factor responsible for decline was historic intentional shooting and harvesting.

Human activities have reduced the abundance of prey species in the northeastern Pacific over the last 150 years (Slaney et al., 1996; Gregory and Bisson, 1997; Press, 2003; Schoonmaker et al., 2003). Salmon, a major prey item for both SRKWs and Steller sea lions, have declined due to human caused degradation of aquatic ecosystems (Slaney et al., 1996; Gregory and Bisson, 1997; Press, 2003; Schoonmaker et al., 2003). In fact, a 50% reduction in killer whale calving has been correlated with years of low Chinook salmon abundance (Ward et al., 2009a). The significant reduction in populations of most salmonid species along much of the west coast of North may have reduced the region's ability to support historical numbers of SRKWs (Krahn et al., 2002).

From 1912 through 1968, thousands of Steller sea lions in British Columbia were killed as a result of government control programs (Bigg, 1985). The population had been reduced by an estimated 70% and one rookery had been eliminated by the time the species was given protection in Canada in 1970 (Olesiuk, 2001; Olesiuk, 2008). Although the Eastern DPS population has stabilized and may be increasing (Angliss and Outlaw, 2008), threats from interactions with commercial fishing gear (Atkinson et al., 2008) and marine debris (Raum-Suryan et al., 2009) continue to pose threats to their recovery.

Possible Stressors from the Proposed Activities

The assessment for this consultation identified several possible stressors associated with the activities to be authorized under proposed permit: (1) noise and visual disturbance generated by research boats, aircraft and human presence while engaged in surveys, captures, sampling and collection activities, (2) potential boat strikes resulting from these activities, (3) effects from recorded playback activities and (4) oil or fuel leakage from vessels. For this consultation, we are particularly concerned about behavioral disruptions that may result in animals that fail to feed or breed successfully or fail to complete their life history because these responses are likely to have population-level consequences for SRKWs or members of the Eastern DPS Steller Sea Lions.

Expected Responses to Stressors from the Proposed Activities

As explained in the *Response Analyses* section of this Opinion, noise and visual disturbances that would result from proposed aerial, boat and land based activities are expected to be brief and not to have any long-term consequences to individual SRKWs or Eastern DPS Steller sea lions or the populations or species that they comprise. Similarly, because of their small size (15-26 ft) and maneuverability, boat strikes are extremely unlikely and therefore discountable. Any behavioral responses to listed species resulting from playback experiments are also expected to be minor and temporary and therefore also discountable. No significant release of hydrocarbons is expected and therefore should have no effect on any individual listed animal or its habitat.

Conclusion

After reviewing the current status of species; the environmental baseline for the action area; the anticipated effects of the proposed activities; and the cumulative effects, it is the NMFS' Opinion that the activities authorized by the proposed issuance of scientific research permit No. 13430, as proposed, are not likely to jeopardize the continued existence of the Eastern DPS of threatened Steller sea lions (*Eumetopias jubatus*) and members of the endangered Southern Resident DPS of killer whales (*Orcinus orca*) under NMFS' authority. Critical habitat that occurs within the action area is not expected to be affected by the proposed activities.

Incidental Take Statement

Section 9 of the ESA and federal regulation pursuant to section 4(d) of the ESA prohibit 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 the 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 Sections 7(b)(4) and 7(o)(2), taking that is incidental 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. However, as discussed in the accompanying Opinion, only the species permitted in the proposed research activities will be significantly harassed as part of the intended purpose of the proposed action. Therefore, the NMFS does not expect the proposed action will incidentally take threatened or endangered species.

Conservation Recommendations

Section 7(a) (1) of the ESA directs federal agencies to use their authorities to further the purposes of the ESA 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.

We recommend the following conservation recommendations, which would provide information for future consultations involving the issuance of marine mammal permits that may affect endangered whales as well as reduce harassment related to authorized activities:

1. *Cumulative Impact Analysis*. The Permits Division should work with the Marine Mammal Commission, International Whaling Commission, and the marine mammal research community to identify a research program with sufficient scope and depth to determine cumulative impacts of existing levels of research on whales. This includes the cumulative sub-lethal and behavioral impacts of research permits on listed species.

2. *Estimation of Actual Levels of "Take."* For future permits authorizing activities similar to those contained in the proposed permit, the Permits Division should continue to review all annual and final reports submitted by investigators that have conducted such research 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 that occurs 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 on future research activities.

3. *Assessment of Permit Conditions*. The Permits Division should periodically assess the effectiveness of its permit conditions, including those for notification and coordination of research.

4. *Data Sharing*. For any permit holders planning to be in the same geographic area during the same year, the Permits Division should encourage investigators to coordinate their efforts by sharing research vessels and the data they collect as a way of reducing duplication of effort and the level of harassment threatened and endangered species experience as a result of field investigations.

In order for NMFS' endangered Species Division to be kept informed of actions minimizing or avoiding adverse effects on, or benefiting, listed species or their habitats, the Permits Division should notify the endangered Species Division of any conservation recommendations they implement in their final action.

Reinitiation Notice

This concludes formal consultation on the proposal to issue scientific research permit No. 13430. 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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