NOAA's National Marine Fisheries Service

Endangered Species Act Section 7 Consultation

Biological Opinion

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

Proposed Action: Issuance of Permit No. 17344 for research on Southern Resident killer whales, pursuant to Section 10(a)(1)(A) of the Endangered Species Act of 1973

Prepared by: Endangered Species Act Interagency Cooperation Division
Office of Protected Resources, National Marine Fisheries Service

Approved by: Donna S. Wieting
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Date: JUL 08 2014

Section 7(a)(2) of the Endangered Species Act (ESA; 16 U.S.C. 1531 et seq.) requires each federal agency to ensure that any action authorized, funded or carried out by such an 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 an action of a federal agency "may affect" endangered or threatened species or critical habitat, that agency is required to consult with the National Marine Fisheries Service (NMFS) or U.S. Fish and Wildlife Service, depending on the species that may be affected. This Biological Opinion (Opinion) is the result of an intra-agency consultation between the Permits and Conservation Division and the ESA Interagency Cooperation Division in the NMFS Office of Protected Resources. This Opinion describes whether Permits and Conservation Division's issuance of a scientific research Permit No. 17344 (Principal Investigator: Samuel Wasser, Ph.D.) would likely jeopardize the existence of the endangered Southern Resident killer whales.

This Opinion has been prepared in accordance with section 7 of the ESA and regulations promulgated to implement that section of the ESA. It is based on information provided in the research permit application, the Permits and Conservation Division's draft categorical exclusion memo, the draft permit, the most current marine mammal stock assessment reports, published and unpublished scientific information on the biology and ecology of endangered Southern Resident killer whales, and other sources of information.

A complete administrative record for this consultation is on file at the NMFS Office of Protected Resources.

Figures

Tables

Abbreviations and Acronyms

the Applicant	Samuel Wasser, Ph.D, University of Washington, Department of Biology
DDT	dichlorodiphenyltrichloroethane
DOT	Department of Transportation
DPS	distinct population segment
ESA	Endangered Species Act
ESU	evolutionarily significant unit
FERC	Federal Energy Regulatory Commission
ft	feet
HCB	hexachlorobenzene
HCH	hexachlorocyclohexanes
kHz	kilohertz
km	kilometer
m	meter
mi	mile
MMPA	Marine Mammal Protection Act
NMFS	National Marine Fisheries Service
NMFS HQ	National Marine Fisheries Service Headquarters Office in Silver Spring, Maryland
NMML	National Marine Mammal Laboratory
NOAA	National Oceanic and Atmospheric Administration
NR	Northern Resident
Opinion	this biological opinion
PBDE	polybrominated diphenyl ethers
PCB	polychlorinated biphenyls
the Permits Division	Permits and Conservation Division of the Office of Protected Resources, National Marine Fisheries Service
POP	persistent organic pollutant
SAR	stock assessment report
SARA	Species at Risk Act
SR	Southern Resident
U.S.	United States
yds	yards

1 Consultation History

On January 23, 2014, the Permits and Conservation Division (Permits Division) requested a consultation under the ESA in a memorandum on its proposal to issue a scientific research Permit No. 17344. The applicant would be conducting research on endangered Southern Resident (SR) killer whales (*Orcinus orca*) distinct population segment (DPS) in waters of the state of Washington, including the Salish Sea, and offshore waters.

Consultation was initiated on January 30, 2014, after additional information was provided by the Permits Division.

2 Description of the Proposed Action

The Permits Division proposes to issue a scientific research permit pursuant to section 10(a)(1)(A) of the ESA and the Marine Mammal Protection Act of 1972, as amended (MMPA; 16 U.S.C. 1361 et seq.).

The proposed action is to issue scientific research Permit No. 17344 to Samuel Wasser, PhD., of the University of Washington, Department of Biology. Upon issuance the permit would authorize close vessel approaches for photo-identification and collection of fecal samples from endangered SR killer whales and non-listed transient killer whales. This research would be a continuation of research conducted under Permit No. 10045, currently held by Dr. Wasser. The purpose of this study is to use noninvasive physiological measures to study the SR killer whale population by collecting and analyzing fecal samples. Killer whale fecal samples are collected from a boat using highly trained scat detection dogs to locate fresh killer whale scat floating on the water's surface. Samples are analyzed for glucocorticoid, thyroid, aldosterone, progesterone, and testosterone hormone metabolites. These hormone levels in the fecal samples will be compared to partition the relative impacts of threats to the SR killer whale population: reduced prey availability, exposure to environmental contaminants, and disturbance from increased boat traffic.

The proposed permit would authorize the "take" of listed species during research activities. Take is defined under the ESA as an activity that would harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect a listed species, or to attempt to engage in any such conduct (Table 1).

Table 1. The proposed number of killer whales authorized to be non-lethally taken in the inland waters of Washington State annually during vessel surveys conducted under Permit No. 17344.

Listing Unit/Stock	Authorized Take (n)	Takes per animal per year	Procedures	Details
Southern Resident killer whale (NMFS Endangered)	100	6	Photo-id; Sample, fecal	Not to exceed population size (currently 80)†
Transient killer whale*	15	2	Photo-id; Sample, fecal	

*Transient killer whales are not listed under the ESA.
†Estimate as of April 2014 (Center for Whale Research).

No lethal takes of listed species would be authorized. The endangered whale species that would be taken is the SR killer whale DPS; the Permits Division would also authorize takes of the non-listed Eastern North Pacific Transient Stock of killer whales. As this DPS is not listed under the ESA, it will not be considered further in this Opinion. The proposed permit would be valid for five years. Activities would be authorized to occur year-round each year the permit is valid, but sampling would be concentrated from May through October.

2.1 Close approach by vessels, photo-id and fecal sample collection

The proposed permit would authorize close vessel approaches to whales for photo-identification and collection of fecal samples. Each individual in the DPS would be allowed to be approached with the exception of calves less than six months old and females accompanying such calves.

The authorization would include a yearly limit of six takes per individual. The best available information indicates there are currently 80 SR killer whales as of December 2013 (Center for Whale Research[1]); as a result, the permit would authorize up to 480 takes of SR killer whales during the first year of the permit due to close vessel approaches. Calves would not be closely approached until older than six months of age. In subsequent years, the total authorized takes of SR killer whales would depend on the size of the DPS. The amount of actual take would fluctuate according to the growth or decline of the SR killer whale population, but takes per year would not exceed 100 individuals. Accordingly, the maximum authorized takes in each of the subsequent years would be 600 (100 takes per year, with six takes per individual).

For the proposed permit, a close vessel approach is defined as a continuous sequence of vessel maneuvers directed toward a whale (or whales) which involves one or more instances of coming

[1] http://www.whaleresearch.com/#!orcas/cto2; Accessed April 22, 2014

closer than 100 yds (91 m). This approach can include drifting or parking in a whale’s path. Close vessel approaches would be conducted in open-hulled 18- to 20-ft (5.5 to 6.1-m) boats equipped with 90-225 horsepower four-stroke engines, which provide the vessel with the necessary maneuverability with minimal exhaust fumes. When whales are located, all individuals in the targeted group would be closely approached slowly and from oblique angles. Calves less than six months old or females accompanying such calves would not be approached. To minimize disruption to the animals, whales would be photographed for identification at the greatest distance possible. In the event a parallel approach is required to obtain a photograph, the vessel would parallel the animal for five to ten minutes (about two surfacing sequences) until the identification of the whale is confirmed.

After sighting, the research vessel would follow downwind of a whale at a minimum distance of at least 200 yds to look for fecal samples. The vessel would travel at slow speeds to match that of the targeted individual. Fecal sample collection would be facilitated by using a highly trained scat-sniffing dog, positioned on the bow of the vessel. The wind blows the scent from the fecal sample in a scent cone, and the researchers can estimate where the sample is in the water based on the direction the whales are swimming relative to the wind direction and approach the expected scent cone perpendicular to the wind. The dog’s change in behavior from passive to highly animated alerts the handler that the boat has entered the scent cone. Changes in the dog’s position on the boat and body posture inform the handler to direct the driver to make small corrections as they proceed toward the sample. If the scent strength starts to diminish or is lost, the dog stands back and looks back in the direction of the scent, directing the boat to turn around. The dog is rewarded with a game of tug-of-war as soon as the sample is collected.

The scat detection dog would help locate fecal samples and thus minimize time following SR killer whales. At no point would the dog enter the water. These dogs are trained to not vocalize when working; therefore, vocalizations from the dog are not expected. In the unlikely event the dog barks, the research vessel would move away from the whales.

The duration of each close approach would vary, depending on when a fecal sample is observed; however, close approach duration would not exceed 20 minutes. A close vessel approach toward an individual would stop either as soon as a sample is obtained, or after 20 minutes regardless of whether a sample is obtained. If an individual abruptly changes swimming direction toward the boat (e.g., while foraging), the motor would be placed in neutral or turned off to minimize the chance of collisions or injury. On rare occasions if whales socialize around the boat during sample collection, the vessel would remain stationary and no longer pursue an animal once a sample is detected. If chronic avoidance or extreme behavioral reactions (e.g., repetitive tail slaps, breaches) occur, the close approach effort to collect a sample from that individual would cease.

Once a fecal sample is sighted, it is scooped up using a 1-liter wide-mouthed polypropylene beaker attached to a telescoping pole. All samples are centrifuged and decanted immediately upon collection. The sample pellet is stored on dry ice to minimize any potential post-excretion metabolism by fecal bacteria. At the end of each day, all samples are placed in a -20°C freezer.

A portion of each fecal sample is separated into a labeled 5-ml polypropylene tube for DNA-based sex determination and individual identification of each sample. DNA analyses on the fecal samples would be conducted at the Northwest Fisheries Science Center in Seattle, WA. All samples will be analyzed for glucocorticoid, thyroid, aldosterone, progesterone and testosterone hormone metabolites. Toxicants in these samples would also be analyzed, such as polychlorinated biphenyls (PCBs) and polybrominated diphenyl ethers (PBDEs) at the same lab.

2.2 Research Practices and Permit Conditions

Researchers are expected to apply the following practices, which are considered “good practice,” and commonly taken by qualified, experienced personnel to minimize the potential risks associated with the proposed activities. To minimize disturbance and ensure adequate opportunities for photo-identification and fecal sampling, permit holders shall approach animal(s) gradually, from behind or alongside, rather than head-on. Researchers must approach at slow speeds, avoid making sudden changes in speed or pitch, and avoid using reverse gear. The amount of time spent in close proximity to an animal(s) shall be limited to the minimum necessary to meet research objectives. Whenever possible, four-stroke engines shall be used, because they are quieter than two-stroke engines. Researchers must leave the vicinity of an animal(s) if the animal(s) show a response to the presence of the research vessel. Approaches to individual animals are limited to three per day and efforts to approach an individual must be discontinued if the animal displays avoidance behaviors, such as a change in direction of travel or departures from normal breathing and/or dive patterns. Only personnel with extensive experience operating vessels near animals may be involved in the vessel approaches.

The proposed Permit No. 17344 lists conditions which would be followed as part of the authorized activities. Developed by the Permits Division, these conditions are intended to minimize the potential adverse effects of the research activities on targeted whales, and include the following:

- Researchers working under this permit may collect visual images (e.g., photographs, video) in addition to the photo-identification or behavioral photo-documentation authorized in Appendix 1 as needed to document the permitted activities, provided the collection of such images does not result in takes.

- The Permit Holder may use visual images and audio recordings collected under this permit, including those authorized in Table 1, in printed materials (including commercial or scientific publications) and presentations provided the images and recordings are accompanied by a statement indicating that the activity was conducted pursuant to a NMFS

Permit. This statement must accompany the images and recordings in all subsequent uses or sales.

- The Chief, Permits Division may grant written approval for photography, filming, or audio recording activities not essential to achieving the objectives of the permitted activities, including allowing persons not essential to the research (e.g., a documentary film crew) to be present, provided:

  - The Permit Holder submits a request to the Permits Division specifying the location and nature of the activity, approximate dates, and number and roles of individuals for which permission is sought.

  - Non-essential photography, filming, or recording activities will not influence the conduct of permitted activities or result in takes of protected species.

  - Persons authorized to accompany the Researchers for the purpose of such non-essential activities will not be allowed to participate in the permitted activities.

  - The Permit Holder and Researchers do not require compensation from the individuals in return for allowing them to accompany Researchers.

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

  - <u>Counting and Reporting Takes</u>

    - Any "approach"[2] of a cetacean constitutes a take and must be counted and reported regardless of whether an animal reacts.

    - During an approach, Researchers may attempt all procedures in a take table row once.

    - No individual animal may be taken more than 3 times in one day.

  - <u>General</u>

    - To minimize disturbance of the subject animals the Permit Holder must exercise caution when approaching animals and must retreat from animals if behaviors indicate the approach may be interfering with reproduction, feeding, or other vital functions.

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[2] An "approach" is defined as a continuous sequence of maneuvers involving a vessel, including drifting, directed toward a cetacean or group of cetaceans closer than 100 yards for baleen and sperm whales and 50 yards for all other cetaceans.

- Where females with calves are authorized to be taken, Researchers:

    - Must immediately terminate efforts if there is any evidence that the activity may be interfering with pair-bonding or other vital functions;

    - Must not position the research vessel between the mother and calf;

    - Must approach mothers and calves gradually to minimize or avoid any startle response; and

    - Must not approach any mother or calf while the calf is actively nursing.

- <u>For research in the inland waters of Washington State :</u>

    Vessels engaged in research activities must fly a clearly visible triangular pennant at all times. The pennant must be yellow with minimum dimensions of 18"H x 26"L and with the permit number displayed in 6" high black numerals.

Other relevant permit conditions include:

- ensuring qualified individuals are authorized to conduct research activities;
- limiting the number of researchers present to essential personnel;
- requiring individuals to be properly licensed as necessary;
- prohibiting commercial activities to take place during research activities;
- requiring that new personnel must be reviewed by the Permits Division prior to being added to the permit;
- requiring that a copy of the permit must be retained on the boat during research for reference;
- providing requirements and instructions for submitting annual, final and incident reports;
- instructions for notifying NMFS Regional Office of the research activities;
- instructions to coordinate research activities with other researchers in the area;
- notification that activities conducted under the permit may be reviewed and observed by NMFS; and
- notification that the permit can be modified, suspended or revoked upon at the discretion of the Director, NMFS Office of Protected Resources.

3 Approach to the Assessment

NMFS approaches its section 7 analyses of research permits 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 results of this step define the action area for 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 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 populations of vertebrate species. Because the continued existence of species depends on the fate of the populations that comprise them, 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 population 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 of these measures) of the populations those individuals represent (Stearns 1992). Reductions in at least one of these variables (or one of the variables we derive from them) 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 (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 are 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' 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 the Species* 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 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 natural resource agencies in states and other countries; reports from domestic and foreign non-governmental organizations involved in marine conservation issues, the information provided by the Permits Division when it initiates formal consultation, and the general scientific literature.

During each consultation, we conduct electronic searches of the general scientific literature using search engines like Google Scholar, ScienceDirect, BioOne, Conference Papers Index, JSTOR, and Aquatic Sciences and Fisheries Abstracts. We supplement these searches with electronic searches of doctoral and master's theses. These searches specifically try to identify data or other information that supports a particular conclusion (for example, a study that suggests whales will exhibit a particular response to approach) as well as data that does not support our conclusion. When data are equivocal, or in the face of substantial uncertainty, our decisions are designed to avoid the risks of incorrectly concluding that an action would not have an adverse effect on listed species when, in fact, such adverse effects are likely.

We rank the results of these searches based on the quality of their study design, sample sizes, level of scrutiny prior to and during publication, and study results. Carefully designed field experiments (for example, experiments that control potentially confounding variables) are rated higher than field experiments that are not designed to control those variables. Carefully designed field experiments are generally ranked higher than computer simulations. Studies that produce large sample sizes with small variances are generally ranked higher than studies with small sample sizes or large variances.

4 Action Area

The action area is defined in 50 CFR 402.2 as "all areas to be affected directly or indirectly by the Federal Action and not merely the immediate area involved in the action." The action area under these proposed activities would be as follows. The proposed action area includes inland waters of Washington State. Activities would take place in the Salish Sea, within the area from the eastern inlet of the Strait of Juan de Fuca, Puget Sound to the south, the US boundary to the north, and the mainland to the east (Figure 1). As is demonstrated by activities conducted under Permit No. 10045, research would likely be concentrated in the vicinity of the San Juan Islands (Figure 2)

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Figure 1 Map of the proposed Action Area

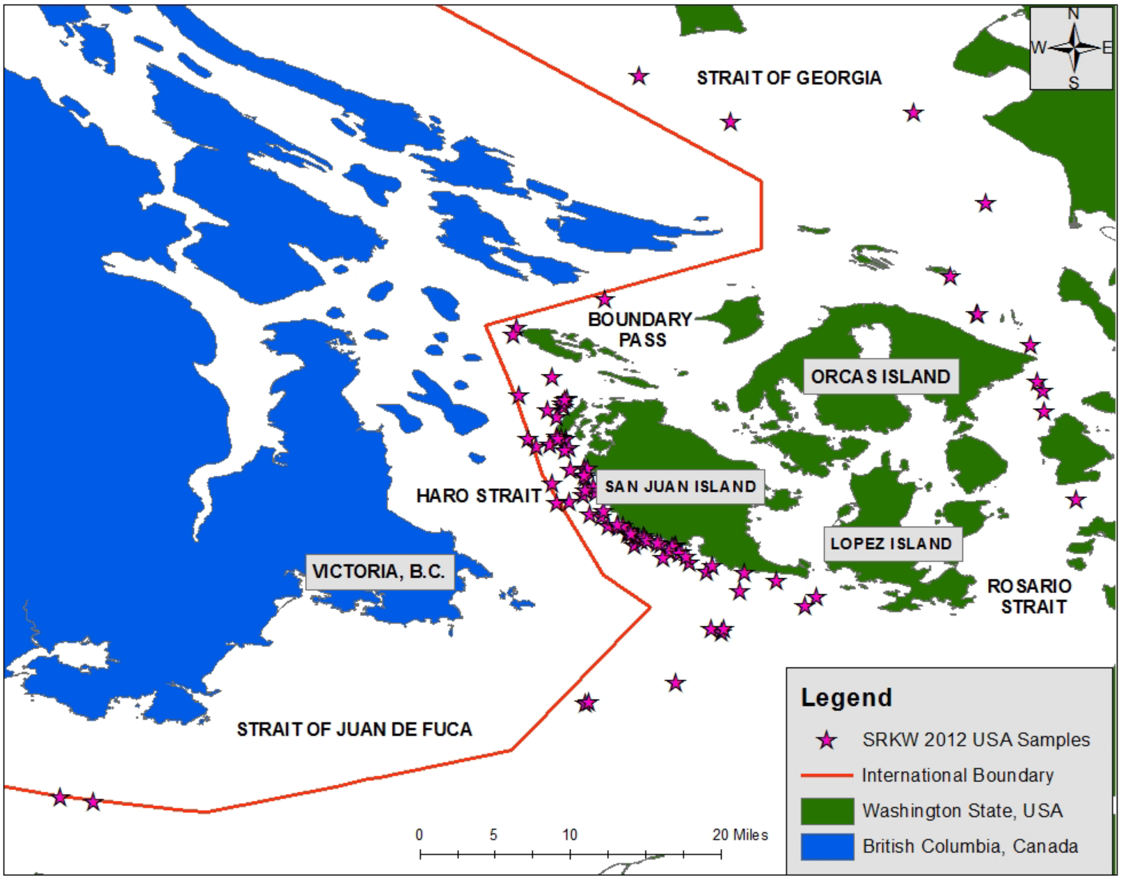

Figure 2 Locations of samples collected in U.S. waters in 2012 under Permit No. 10045. Obtained from the Applicant's 2012 annual report.

5 Status of Listed Resources

NMFS has determined that the actions considered in this Opinion may affect the following listed resources provided protection under the ESA of 1973, as amended (16 U.S.C. 1531 et seq.), and are described in the table below.

Table 2 Listed Resources within the Action Area

Species	ESA Status	Critical Habitat	Recovery Plan
Marine Mammals – Cetaceans			
Southern resident killer whale *(Orcinus orca)*	E - 70 FR 69903	71 FR 69054	73 FR 4176
Blue Whale (*Balaenoptera musculus*)	E - 35 FR 18319	-- --	07/1998
Fin Whale (*Balaenoptera physalus*)	E - 35 FR 18319	-- --	71 FR 38385
Humpback Whale (*Megaptera novaeangliae*)	E - 35 FR 18319	-- --	55 FR 29646
North Pacific Right Whale (*Eubalaena japonica*)	E - 73 FR 12024	73 FR 19000	-- --
Sei Whale (*Balaenoptera borealis*)	E - 35 FR 18319	-- --	-- --

Species	ESA Status	Critical Habitat	Recovery Plan
Sperm Whale (*Physeter macrocephalus*)	E - 35 FR 18619	-- --	75 FR 81584
Sea Turtles			
Green Turtle (*Chelonia mydas*)	E - 43 FR 32800	63 FR 46693	63 FR 28359
Loggerhead Turtle (*Caretta caretta*)	E - 76 FR 58868	-- --	63 FR 28359
Leatherback Turtle (*Dermochelys coriacea*)	E - 61 FR 17	77 FR 4170	63 FR 28359
Fish			
Georgia Basin Bocaccio *(Sebastes paucispinus*)	E - 75 FR 22276	78 FR 47635*	-- --
Georgia Basin Canary rockfish (*Sebastes pinniger*)	T - 75 FR 22276	78 FR 47635*	-- --
Georgia Basin Yelloweye rockfish *(Sebastes ruberrimus*)	T - 75 FR 22276	78 FR 47635*	-- --
Green sturgeon (*Acipenser medirostris*)	T - 75 FR 22276	74 FR 52300	-- --
Pacific Eulachon/smelt (*Thaleichthys pacificus*)	T - 75 FR 13012	76 FR 65324	-- --
Chinook Salmon (*Oncorhynchus tshawytscha)* Evolutionarily Significant Units (ESU)			
Puget Sound ESU	T - 70 FR 37160	70 FR 52630	72 FR 2493
Chum Salmon (*Oncorhynchus keta*) ESUs			
Hood Canal Summer Run ESU	T - 70 FR 37160	70 FR 52630	72 FR 29121
Steelhead Trout (*Oncorhynchus mykiss*) Distinct Population Segments (DPS)			
Puget Sound DPS	T - 72 FR 26722	-- --	-- --

*Proposed Rule

5.1 Species and designated critical habitat not considered further in this Opinion

To refine the scope of this Opinion, NMFS used two criteria (risk factors) to determine whether any endangered or threatened species or critical habitat are not likely to be adversely affected by vessel traffic or human disturbance associated with the proposed actions. The first criterion was *exposure*: if we conclude that particular endangered or threatened species or designated critical habitat are not likely to be exposed to vessel traffic or human disturbance , we must also conclude that those listed species or designated critical habitat are not likely to be adversely affected by the proposed action. The second criterion is *susceptibility upon exposure*: species or critical habitat may be exposed to vessel traffic or human disturbance, but may not be unaffected by those activities—either because of the circumstances associated with the exposure or the intensity of the exposure—are also not likely to be adversely affected by the vessel traffic or human disturbance. This section summarizes the results of our evaluations.

5.1.1 Cetaceans

Species

Humpback whale, North Pacific right whale, sperm whale, fin whale, blue whale, and sei whale may occur in the action area, but are not expected to be affected by the proposed activities.

If protected whales are observed in the action area, they would be avoided and the research vessel would operate at a reduced speed, following the Northwest regional marine mammal viewing guidelines.[3] Because of the protective measures in the permit, the effects of non-target

[3] See http://www.nmfs.noaa.gov/pr/pdfs/education/viewing_northwest.pdf

listed whales being exposed to the research activities would not reach the scale where take occurs. Therefore, the effects of the proposed action would be insignificant, and are not likely to adversely affect any non-target listed whales. These whale species are not likely to be adversely affected by the proposed action and will not be discussed further in this Opinion.

Critical Habitat
Critical habitat has been designated for the SR killer whale in Haro Strait, U.S. waters around the San Juan Islands, the Strait of Juan de Fuca, and throughout Puget Sound (71 FR 69054). The critical habitat designation encompasses approximately 2,560 mi^2 (6,495 km^2) of killer whale habitat (Figure 3). The physical, chemical, and biotic features that form killer whale critical habitat include water quality to support growth and development; prey species of sufficient quantity, quality, and availability to support individual growth, reproduction and development, as well as overall population growth; and passage conditions to allow for migration, resting, and foraging.

The critical habitat designation for SR killer whales includes three specific areas occupied by the whales in marine waters in Washington that contain these physical, chemical and biotic features – (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. Critical habitat includes all waters within these areas except those shallower than a contiguous line delimited by 20 ft (6.1 m) depth relative to extreme high water, as well as certain military sites and about 15 mi^2 (39 km^2) of waters in several small or shallow inlets, harbors, coves, and bays.

The proposed permit would authorize activities in critical habitat areas of the SR killer whale DPS, but the research is not expected to adversely affect any of the physical, chemical, or biotic features that form the critical habitat. The proposed activities would not adversely affect the population ecology or population dynamics of SR killer whale prey species and, therefore, are not expected to affect prey quality, quantity, or availability. Any effects on water quality or passage conditions are expected to be insignificant. As a result, the proposed activities are not likely to adversely affect the conservation value of the designated critical habitat for SR killer whale, or result in its destruction or adverse modification. Southern Resident killer whale critical habitat is not addressed further in this Opinion.

5.1.2 Sea Turtles

Species
Green sea turtle, North Pacific DPS loggerhead sea turtle, and leatherback sea turtle may occur in the action area, but are not expected to be exposed to the proposed activities. Because the research is focused on SR killer whales and would be conducted in ways that should only affect the targeted species, the effects of exposure to listed sea turtles should not reach the scale where take occurs. Therefore, the effects of the proposed action would be insignificant, and are not likely to adversely affect listed sea turtles. Sea turtles will not be discussed further in this Opinion.

Critical Habitat
Critical habitat for leatherback sea turtles on the Pacific coast was designated in 2012 (77 FR 4170). It includes approximately 16,910 mi^2 (43,798 km^2) stretching along the California coast from Point Arena to Point Arguello east of the 3,000 meter depth contour; and 25,004 mi^2

($64,760 km^2$) from Cape Flattery, Washington to Cape Blanco, Oregon east of the 2,000 meter depth contour (Figure 3). The proposed research would take place in the Salish Sea, which includes the Strait of Juan de Fuca and Puget Sound, but would not occur in leatherback sea turtle designated critical habitat. As such, the proposed action is expected to have no effect on designated critical habitat for leatherback sea turtle and will not be discussed further in this Opinion.

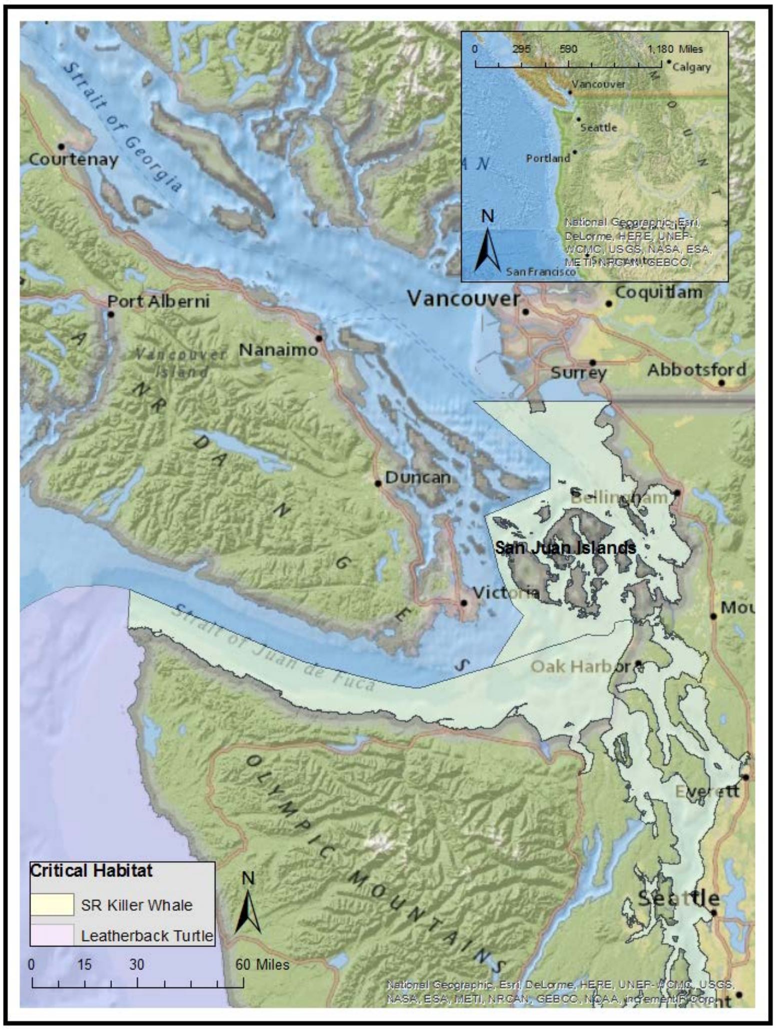

Figure 3 Map of designated critical habitat for SR killer whale and leatherback sea turtle in the action area

5.1.3 Fishes

Species

The Puget Sound/Georgia Basin DPSs for bocaccio, yelloweye rockfish, and canary rockfish, Southern DPS Pacific eulachon, Puget Sound Chinook salmon, Puget Sound steelhead, and Hood Canal summer-run chum salmon may occur in the action area, but are not expected to be exposed to the proposed activities. Because the research is focused on SR killer whales and would be conducted in ways that should only affect the targeted species, the effects of exposure to listed fishes should not reach the scale where take occurs. Therefore, the effects of the proposed action would be insignificant, and are not likely to adversely affect listed fishes. None of the threatened or endangered fish species listed above will be discussed further in this Opinion.

Currently, green sturgeon (*Acipenser medirostris*) range from California to British Columbia; however, the listed Southern DPS consists of coastal and Central Valley populations south of the Eel River, with the only known spawning population in the Sacramento River, California. Southern DPS green sturgeon are not expected to be within the action area; they are not likely to be adversely affected by the proposed action and are not considered further in this Opinion. Although the species is not expected to be present in the action area, critical habitat for the Southern DPS green sturgeon has been designated in the area; see discussion below.

Critical Habitat

Critical habitat designated for the Puget Sound Chinook and Hood Canal summer-run chum ESUs occurs within the action area in nearshore marine areas contiguous with the shoreline from the line of extreme high water out to a depth of 30 m (98 ft) relative to mean lower low water (70 FR 52630) (Figure 4). The Rule identifies several primary constituent elements (PCEs), including: freshwater spawning and rearing sites that are unobstructed with appropriate water quality conditions and natural cover, and freshwater migration corridors, unobstructed estuarine and nearshore marine areas with natural cover, and offshore marine areas with water quality and forage (70 FR 52630). Critical habitat for Puget Sound DPS Steelhead was proposed in 2013 (78 FR 2725); the research would not take place within the proposed critical habitat. The proposed research would not alter any physical habitat, impair water quality, or in any other way adversely affect designated critical habitat for Puget Sound Chinook salmon and Hood Canal summer-run chum salmon.

Critical habitat for Southern DPS green sturgeon was designated in 2009 (74 FR 52300), and includes the waters of Puget Sound in Washington, within the action area of the proposed research (Figure 4). Features identified as PCEs include food resources, substrate type and size, water flow, water quality, migratory corridor, water depth, and sediment quality. The proposed activity involves boating, fecal collection and photo-id of SR killer whales, which would not alter any of the PCEs. The proposed action would not destroy or adversely modify designated critical habitat for green sturgeon, and is not considered further in this Opinion.

Critical habitat for the Puget Sound/Georgia Basin DPS for bocaccio, canary rockfish, yelloweye rockfish was proposed in 2013 (78 FR 47635), and it overlaps with the proposed research area (Figure 4). The specific areas proposed for designation for canary rockfish and bocaccio include approximately 1,184.75 mi^2 (3,068.5 km^2) of marine habitat in Puget Sound, Washington. The specific areas proposed for designation for yelloweye rockfish include approximately 574.75 mi^2 (1,488.6 km^2) of marine habitat in Puget Sound, Washington. Features essential for adult canary rockfish and boccacio and adult and juvenile yelloweye rockfish (>30 m deep) include sufficient prey resources, water quality, and rocks or highly rugose habitat. For juvenile canary rockfish and boccacio features essential for their conservation include sufficient prey resources and water quality. The proposed research activities involves boating, fecal collection and photographing SR killer whales, and would not alter or impair benthic habitat, water quality, or prey resources of the proposed critical habitat for the Puget Sound/Georgia Basin DPS rockfishes. Thus, the proposed action would not result in the destruction or adverse modification of proposed critical habitat for the Puget Sound/Georgia Basin DPS for bocaccio, canary rockfish, or yelloweye rockfish, and is not considered further in this Opinion.

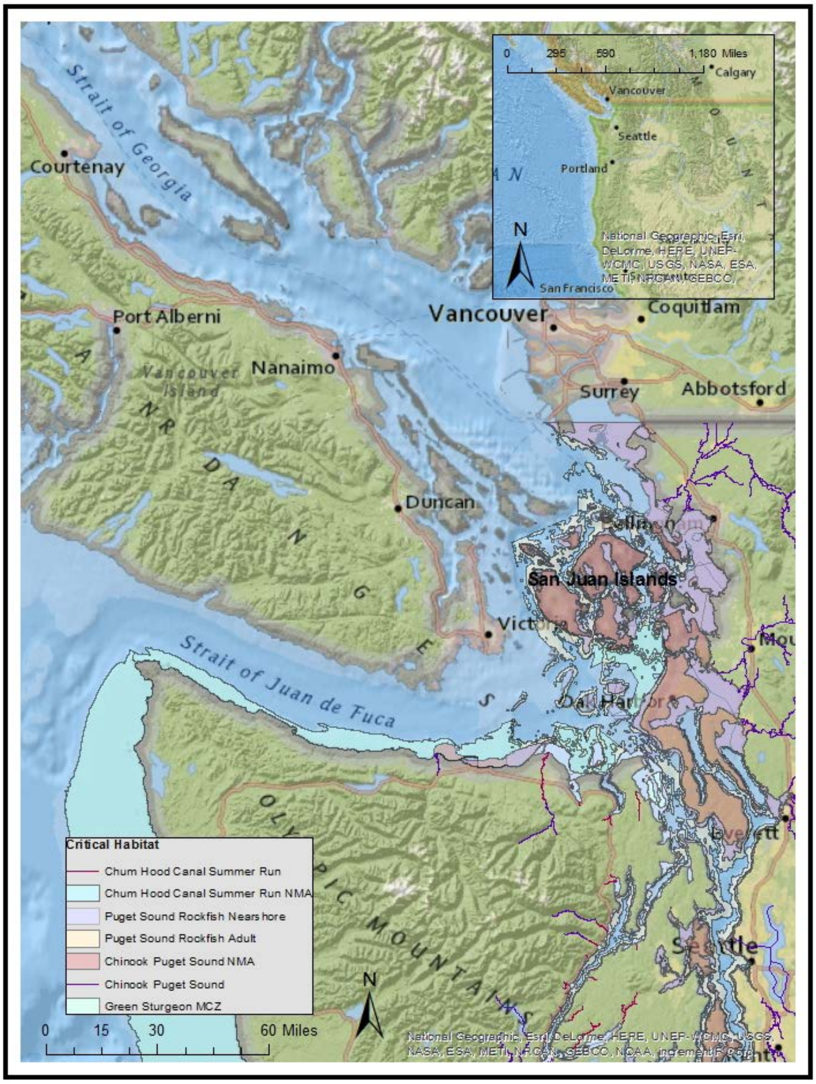

Figure 4 Map of designated critical habitat of listed fishes in the action area

5.2 Species Likely to be Adversely Affected by the Action

The proposed action is a research study targeting SR killer whales. The species narratives that follow focus on attributes of life history and distribution that influence the manner and likelihood that this species may be exposed to the proposed action, as well as the potential response and risk when exposure occurs. Consequently, the species' narrative is a summary of a larger body of information on localized movements, population structure, feeding, diving, and social behaviors.

A summary of the status and trends of SR killer whales is presented to provide a foundation for the analysis of the species as a whole. We also provide this brief summary of the species' status and trends as a point of reference for the jeopardy determination, made later in this Opinion. That is, we rely on a species' status and trend to determine whether an action's direct or indirect effects are likely to increase the species' probability of becoming extinct.

5.2.1 Southern Resident killer whale

Species description and distribution

Killer whales (or orcas) are distributed worldwide, but populations are isolated by region and ecotype (i.e., different morphology, ecology, and behavior). SR killer whales occur in the inland waterways of Puget Sound, Strait of Juan de Fuca, and Southern Georgia Strait during the spring, summer and fall. During the winter, they move to coastal waters primarily off Oregon, Washington, California, and British Columbia. The DPS was listed as endangered under the ESA on November 18, 2005 (70 FR 69903). We used information available in the final rule, the Recovery Plan (NMFS 2008), the 2011 Status Review (NMFS 2011b) and the 2012 Stock Assessment Report (NMFS 2012) to summarize the status of this species, as follows.

Life history

Southern Resident killer whales are geographically, matrilineally, and behaviorally distinct from other killer whale populations (70 FR 69903). The DPS includes three large, stable pods (J, K, and L), which occasionally interact (Parsons et al. 2009). Most mating occurs outside natal pods, during temporary associations of pods, or as a result of the temporary dispersal of males (Pilot et al. 2010). Males become sexually mature at 10 – 17 years of age. Females reach maturity at 12 – 16 years of age and produce an average of 5.4 surviving calves during a reproductive life span of approximately 25 years. Mothers and offspring maintain highly stable, life-long social bonds, and this natal relationship is the basis for a matrilineal social structure. They prey upon salmonids, especially Chinook salmon (Hanson et al. 2010).

Population dynamics

The most recent abundance estimate for the Southern Resident DPS is 80 whales in 2014 (Center for Whale Research). This represents a decline from just a few years ago, when in 2012, there were 85 whales. Population abundance has fluctuated over time with a maximum of approximately 100 whales in 1995 (NMFS 2012), with an increase of 35% between 1974 and 1993, from 76 to 93 individuals (Figure 5). As compared to stable or growing populations, the DPS reflects a smaller percentage of juveniles and lower fecundity (NMFS 2011a) and has demonstrated weak growth in recent decades.

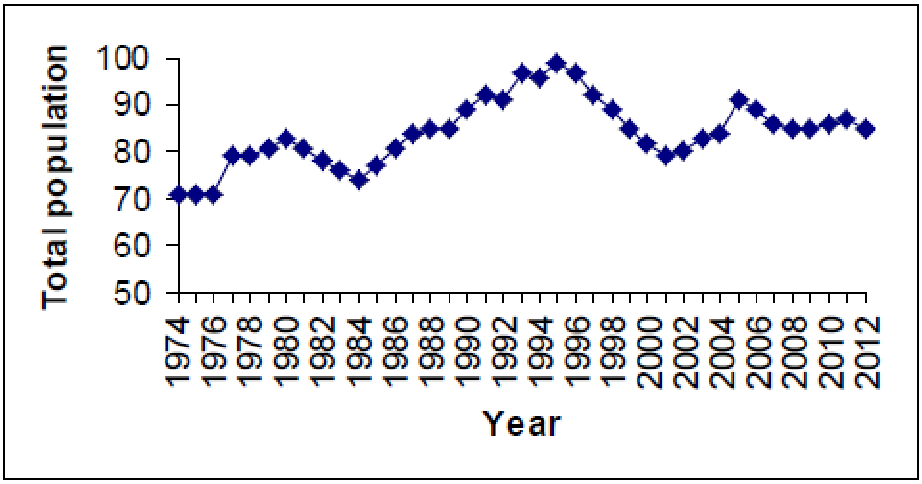

Figure 5 Population of SR killer whales, 1974-2012, from NMFS draft SAR, 2013.

Status

The Southern Resident killer whale DPS was listed as endangered in 2005 in response to the population decline from 1996 – 2001, small population size, and reproductive limitations (i.e., few reproductive males and delayed calving). Current threats to its survival and recovery include: contaminants, vessel traffic, and reduction in prey availability. Chinook salmon populations have declined due to degradation of habitat, hydrology issues, harvest, and hatchery introgression; such reductions may require an increase in foraging effort. In addition, these prey contain environmental pollutants (e.g., flame retardants; PCBs). These contaminants become concentrated at higher trophic levels and may lead to immune suppression or reproductive impairment (70 FR 69903). The inland waters of Washington and British Columbia support a large whale watch industry, commercial shipping, and recreational boating; these activities generate underwater noise, which may mask whales' communication or interrupt foraging. The factors that originally endangered the species persist throughout its habitat: contaminants, vessel traffic, and reduced prey. The DPS's resilience to future perturbation is reduced as a result of its small population size (N = 80); however, it has demonstrated the ability to recover from smaller population sizes in the past and has shown an increasing trend over the last several years. NMFS was petitioned to delist the DPS based on new information, which indicated that there may be more paternal gene flow among populations than originally detected (Pilot et al. 2010). On August 5, 2013, NMFS found that delisting was not warranted (78 FR 47277). The recent decline, unstable population status, and population structure (e.g., few reproductive age males and non-calving adult females) continue to be causes for concern. The relatively low number of individuals in this population makes it difficult to resist/recover from natural spikes in mortality, including disease and fluctuations in prey availability.

Critical habitat

On November 29, 2006, NMFS designated critical habitat for the Southern Resident killer whale (71 FR 69054). The critical habitat consists of approximately 6,630 km^2 in three areas: the

Summer Core Area in Haro Strait and waters around the San Juan Islands; Puget Sound; and the Strait of Juan de Fuca. It provides the following physical and biological features: water quality to support growth and development; prey species of sufficient quantity, quality and availability to support individual growth, reproduction and development, as well as overall population growth; and inter-area passage conditions to allow for migration, resting, and foraging.

6 Environmental Baseline

By regulation, environmental baselines for 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 several activities affecting the survival and recovery of ESA-listed SR killer whales in the action area.

A number of human activities have contributed to the current status of these species in the action area. Although some of those activities, such as intentional shooting and live captures for public display, occurred in the past, have since ceased, and no longer appear to affect this whale population, the effects of these types of exploitations persist today. Other human activities, such as commercial fishing and vessel operations, are ongoing and continue to affect these species.

The following discussion summarizes the natural and human phenomena in the action area that may affect the likelihood these species will survive and recover in the wild. These include climate variability, fisheries interactions, ship strikes, noise, prey availability, disease and parasitism, contaminants, and scientific research.

6.1 Natural Mortality

As apex predators, sources of natural mortality in SR killer whales are likely limited. Possible sources can still include disease and parasitism. While disease is not known to limit any killer whale population and no epidemics are known in the SR killer whale DPS, killer whales may be vulnerable to disease outbreaks given their distribution patterns and strong social networks (Altizer et al. 2003, Guimaraes Jr. et al. 2007). A variety of pathogens have been identified in killer whales, and there are other pathogens in sympatric marine mammal species that could be transmittable to killer whales (Gaydos et al. 2004). The limited testing evidence available suggests that to date, killer whales have not been affected by morbilliviruses in Washington State or elsewhere in the range of this species (Van Bressem et al. 1999). In 2007, a captive male killer whale died from West Nile virus (Leger et al. 2011). Other diseases, such as Brucella spp. and cetacean poxvirus, may impact killer whale populations by lowering reproductive success or causing greater mortality among calves (Gaydos et al. 2004). High contaminant loads may affect immune function in SR killer whales, thus increasing susceptibility to disease, and the cohesive social structure and close spatial proximity of all the individuals in the DPS would also have implications should an outbreak occur (NMFS 2008). Although the consequences of disease and parasitism are a concern, they do not appear to be significant impediments to recovery of SR killer whales at this time (NMFS 2008). In the North Pacific region, about 10 killer whales strandings are reported annually, and it is likely that deaths go unobserved as more carcasses sink rather than wash ashore (Barbieri et al. 2013).

6.2 Climate Change

Climatic variability and change may be affecting SR killer whales in the action area; however, the effects of climate change on any marine species are not definitively known. Gaps in information on species movements and distribution, the difficulty involved with studying highly mobile marine mammals, as well as insufficient historical information and long-term data sets on habitat and distribution all complicate any potential conclusions on the effects of climate change for such species (Kintisch 2006, Simmonds and Isaac 2007). Possible effects of climatic variability for marine species include the following: alteration of ecological community composition and structure, possibly resulting in species relocating from areas they currently use in response to changes in oceanic conditions; changes to migration patterns or community structure; changes to species abundance; increased susceptibility to disease and contaminants; alterations to prey composition and availability; and altered timing of breeding (Macleod et al. 2005, Robinson et al. 2005, Kintisch 2006, McMahon and Hays 2006). Such changes could affect reproductive success and survival, and therefore would have consequences for the recovery of marine mammal species (Robinson et al. 2005, Learmonth et al. 2006, Cotte and Guinet 2007).

Naturally occurring climatic patterns, such as the Pacific Decadal Oscillation and El Niño and La Niña events, are identified as major causes of changing marine productivity and may also influence SR killer whale prey abundance in the action area (Mantua et al. 1997, Francis et al. 1998, Beamish et al. 1999, Hare et al. 1999, Benson and Trites 2002, Dalton et al. 2013). Prey species such as salmon are probably most affected through changes in food availability and survival at sea (Benson and Trites 2002), with cooler periods promoting coastal biological productivity in the action area and warmer phases having the opposite effect (Hare et al. 1999, NMFS 2008). Changing ocean temperatures could cause shifts in the ranges and movements of marine species (Dalton et al. 2013), which could also directly influence salmon abundance in the Strait of Juan de Fuca and the vicinity of the San Juan Islands. In return years when ocean conditions are cooler than usual, the majority of sockeye salmon returning to the Fraser River do so via this route, but when warmer conditions prevail, migration patterns shift to the north through Johnstone Strait (Groot and Quinn 1987).

Anthropogenic sources of climate change, such as the continuing buildup of human-produced atmospheric carbon dioxide, are predicted to have major environmental impacts along the west coast of North America during the 21st century and beyond (NMFS 2008).Warming trends in water and air temperatures are ongoing and are projected to disrupt annual cycles of rain and snow, alter prevailing patterns of wind and ocean currents, and result in higher sea levels (Glick 2005, Snover et al. 2005). These changes, together with increased acidification of ocean waters, are expected to have substantial effects on marine productivity and food webs, including populations of salmon and other killer whale prey (NMFS 2008). Although no formal predictions are available on the effects of such climate change for the SR killer whale DPS, it is likely any changes in weather and oceanographic conditions resulting in effects on salmon populations would have consequences for the whales (NMFS 2008).

6.3 Prey Availability

SR killer whales predominantly prey upon salmonids, particularly Chinook salmon. Maintaining a robust prey resource is essential to SR killer whale recovery; the U.S. recovery goal of 2.3% annual growth over 28 years would imply a 75% increase in energetic requirements (Williams et al. 2011b). Limited prey availability can have detrimental effects for SR killer whales, including requiring the whales to spend more time and energy foraging, possibly causing negative effects on reproductive rates and morality. Inadequate prey is a source of stress for SR killer whales, and a comparatively greater one than vessel traffic (Ayres et al. 2012). Nutritional stress has also been thought to be a contributing factor to slower growth rates in SR killer whales (Fearnbach et al. 2011). Prey availability is also a possible influencing factor in the interconnectivity of SR killer whale social network (Foster et al. 2012).

Human activities have had a profound impact on the abundance of many prey species, including salmon, in the northeastern Pacific during the past 150 years. Salmon populations have declined due to habitat loss and degradation from modern land use (e.g., agriculture, hydropower, and urban development), overharvest, and hatchery practices. In addition, climate variability and change, aquaculture of Atlantic salmon, and competition with other non-native species all have the potential to affect Pacific salmon populations, and in turn impact killer whale populations (NMFS 2008). Since the early 1990s, 28 evolutionarily significant units (ESUs) of salmon and steelhead in Washington, Oregon, Idaho and California have been listed under the ESA, including Puget Sound Chinook salmon.

It is difficult to assess whether SR killer whales have adequate prey resources to support their survival and recovery. There is insufficient information on the food habits and seasonal ranges of killer whales, uncertainties in the historical and current abundance of many localized populations of prey, and the cyclic nature of large-scale changes in ocean conditions (NMFS 2008). Despite these limitations, some general trends are apparent, including the significant reduction in natural breeding populations of most salmonid species between the 1800s and the mid-1990s (NMFS 2008). Many salmon runs have continued to decrease since then, but others have partially recovered. However, by comparing Puget Sound Chinook salmon abundance averages for 2001-2010 to 1979-1988, abundance has decreased ~38%, while total abundance coast-wide has decreased 16% (Marmorek and Hall 2012).

During the summer (May-September), while SR killer whales spend time in Puget Sound, the Salish Sea and the Strait of Juan de Fuca, Fraser River Chinook salmon make up the majority of their diet (Ford and Ellis 2006, Hanson et al. 2010). It has been thought that due to the higher lipid content and larger size than other salmonids, SR killer whales selectively forage for Chinook salmon, and consume a larger proportion of larger, older (4-5 years) fish (Ford and Ellis 2006, Hanson et al. 2010, Marmorek and Hall 2012). Year-round, SR killer whales range throughout the waters of Washington, Oregon, northern California and British Columbia, and there is uncertainty about their winter foraging ecology. Carbon and nitrogen stable isotope and contaminant fingerprint analyses show that the SR killer whale's diet is comprised of Chinook salmon from a wide range of sources outside the Puget Sound and Fraser River area (Marmorek and Hall 2012). Future declines in Fraser River Chinook salmon populations, or other Chinook salmon populations within the SR killer whale's foraging range would likely hinder SR killer whale recovery. A 50% reduction in killer whale calving has been correlated with years of low Chinook salmon abundance (Ward et al. 2009).

6.4 Pollution and Contaminants

Persistent organic pollutants (POPs) is a collective term for environmental contaminants like dioxins, furans, PCBs, PBDEs, dichlorodiphenyltrichloroethane (DDT), hexachlorocyclohexanes (HCHs), and hexachlorobenzenes (HCBs). These chemicals are used (or have previously been used) in pesticides, industrial manufacturing, and pharmaceutical production, to name a few applications. A common characteristic of POPs is their high lipid solubility, aiding in their absorption in the fatty tissues of living organisms. In addition, POPs are semi-volatile, and can travel great distances in the atmosphere (Ritter et al. 2007). POPs tend to persist over long periods in the environment, and can bioaccumulate in fatty tissues, and be transmitted from mother to offspring (Haraguchi et al. 2009, Krahn et al. 2009). Even though a POP can be banned, its characteristics allow it to persist in the environment, remaining in soil, the atmosphere, and the fatty tissues of organisms. (Ritter et al. 2007).

Because they were in the pesticides and industrial products used so extensively after World War Two, organochlorines (e.g., PCBs, DDT) are a principal contaminant threat (Ross et al. 2000, CBD 2001, Krahn et al. 2002, Cullon et al. 2009, Krahn et al. 2009). Organobromines like PBDEs are also a threat; unlike many organochlorines, which have been banned or restricted, organobromines are currently used in fire retardants (Ritter et al. 2007). With up to 1,000 new chemicals entering the global marine environment annually, it is difficult to monitor levels and sources of all contaminants (Grant and Ross 2002). Marine ecosystems receive pollutants from a variety of local, regional and international sources (Grant and Ross 2002, Garrett 2004). In Washington, most of the human population is concentrated in the Puget Sound basin, primarily along its coast or adjacent to major rivers that discharge into the sound (Grant and Ross 2002). Hotspots for contaminants in the action area are centered near these urban areas where industrial and domestic activities are concentrated; however, because of the properties of POPs, contamination can extend widely, and into nursery areas for many species.

The relative contribution of any one source in contaminating killer whales with POPs is poorly understood (NMFS 2008). As a long-lived, top marine predator, SR killer whales bioaccumulate POPs in their tissues and blubber, potentially leading to numerous adverse health effects such as skeletal deformity, reproductive dysfunction, impaired immune function, and enzyme disruption (Krahn et al. 2009). Levels of contaminants in wild individuals are much higher than those found in captive killer whales (Bennett et al. 2009).

Numerous factors can affect concentrations of POPs in marine mammals, such as age, sex and birth order, diet, and habitat use (Mongillo et al. 2012). In marine mammals, POP contaminant load for males increases with age, whereas females pass on contaminants to offspring during pregnancy and lactation (Addison and Brodie 1987, Borrell et al. 1995). POPs can be transferred from mothers to juveniles at a time when their bodies are undergoing rapid development, putting juveniles at risk for immune and endocrine system dysfunction later in life (Krahn et al. 2009). Upon examining blubber biopsy samples from adult and juvenile SR killer whales, researchers found that juveniles had statistically higher levels of contaminants than the adult males; these contaminants included PBDEs, HCHs, and HCBs. Furthermore, nine out of 12 of the blubber samples exceeded the health effects threshold for total PCBs, and the four juveniles had PCB levels that exceeded threshold levels by factors of 2-3.6 (Krahn et al. 2009).

Habitat use and distribution patterns can strongly influence contaminant load levels. When PCB concentrations were compared between Northern Resident (NR) and SR killer whales, SR males had PCB concentrations that were almost four times higher than NR males; this was attributed to the two populations eating prey from different regions with higher contaminant concentrations (Ross et al. 2000). Even within the SR killer whale subpopulation, the distributions of the individual pods and their respective prey sources can influence their exposure to contaminants. Individual SR killer whales of different pods exhibited varying contaminant levels, with samples from the J-pod SR killer whales having lower DDT/PCB ratios than the K- and L-pod individuals. J-pod generally stays in Puget Sound and Georgia Basin, while K- and L-pods travel to California to forage, where prey has higher DDT/PCB ratios (Krahn et al. 2009).

The link between POP concentration and prey resource is crucial to understanding contaminant loads and bioaccumulation. Primarily, SR killer whales eat Chinook salmon; coastal Chinook populations had higher concentrations of POPs than salmonids with an oceanic distribution (O'Neill et al. 2006). In examining POP concentrations in Chinook salmon, Cullon et al. (2009) found that fish from urban areas near Seattle and Puget Sound had lower lipid content and higher levels of POPs than did Chinook from sites further north in Johnstone Strait. However, returning adult Chinook salmon had higher POP concentrations than the out-migrating smolts and juveniles, indicating that the vast majority (97-99%) of POPs in Chinook salmon are acquired while at sea (Cullon et al. 2009). As adults, Chinook migrate inland to waters that are heavily contaminated. SR killer whales are then intercepting these fish that are potentially more contaminated and less lipid-rich (Cullon et al. 2009).

To predict concentrations of PCBs and PBDEs in SR killer whales into the future, Mongillo et al. (2012) used models to generate concentration estimates for different age, sex and birth order of SR killer whales under different diet scenarios (i.e., killer whales eating Chinook populations from various locations having different contaminant levels). Concentrations of PBDEs appeared to be accumulating at an exponential rate, likely due to the fact that PBDEs are still used today. Under all diet scenarios, the model predicted that PCB concentrations would be above health-effect thresholds for marine mammals. Predicted concentrations of PCBs are expected to slowly decline in the future, although several generations of SR killer whales will continue to be exposed to PCBs because they persist in the environment (Mongillo et al. 2012).

Because POPs are both ubiquitous and persistent in the environment, SR killer whales will continue to be exposed to POPs for all of their lives. The purported effects of POPs to SR killer whales are sub-lethal and long-term in nature, and include impacting reproduction, immune function, and endocrine activity. These are effects that would become more apparent as time goes on. At present, however, the effects of POPs in SR killer whales are not currently well known.

6.5 Oil Spills

Exposure to petroleum hydrocarbons released into the environment via oil spills and other discharge sources represents a serious and potentially catastrophic risk for SR killer whales. Cetaceans have a thickened epidermis that greatly reduces the likelihood of petroleum toxicity from skin contact with oiled waters (Geraci 1990, O'Shea et al. 1991). Likely pathways of exposure of killer whales to hydrocarbons include inhalation of vapors at the water’s surface and ingestion during feeding (NMFS 2008). Marine mammals are generally able to metabolize and excrete limited amounts of hydrocarbons, but acute or chronic exposure poses greater toxicological risks. Acute exposure of marine mammals to petroleum products can cause changes in behavior and reduced activity, inflammation of the mucous membranes, lung congestion, pneumonia, liver disorders, and neurological damage (Geraci 1990). In addition, oil spills have the potential to adversely impact prey populations, and therefore may affect SR killer whales indirectly by reducing food availability.

The substantial volume of shipping traffic and the presence of refineries in the action area creates the risk of a catastrophic oil spill that could affect SR killer whales and their prey. Due to its proximity to Alaska’s crude oil supply, Puget Sound is one of the leading petroleum refining centers in the United States, with about 15 billion gallons of crude oil and refined petroleum products transported through it annually in 2005; this amount increased to about 22 billion gallons in 2010 (Puget Sound Action Team 2005; Puget Sound Partnership 2011). Inbound tankers carry crude oil to several major refineries in the area (5 in Washington, and 2 in British Columbia) (EIA 2013), while outbound tankers move refined oil products to destinations along the U.S. west coast (Neel et al. 1997). In 2008, a total of 539 tank ships (i.e., tank vessel transporting oil) entered Puget Sound through the Strait of Juan de Fuca, Strait of Georgia, and

Haro Strait, with 843 tank ships leaving Washington waters for U.S. and Canadian ports (WSDOE 2009).

In general, the Strait of Juan de Fuca and areas near Washington's major refineries (in Anacortes, Ferndale, Blaine, and Tacoma) are considered the locations most at risk for major spills in the action area. Since the 1960s, there have been at least nine major oil spills of at least 100,000 gallons in the action area—four involving vessels, four involving refineries, and one from pipelines discharging gasoline into marine waters (Neel et al. 1997, NMFS 2008). The largest of these spills discharged an estimated 2.3 million gallons. Major oil spills are, of course, a substantial threat, but smaller spills can be more common and pose a significant cumulative threat (Clark 1997). In October 2011, in the space of less than a week, three separate accidents released over 500 gallons of oil and diesel fuel into Puget Sound (Puget Sound Partnership 2011[4]). Small but chronic releases of petrochemicals originate from numerous sources, including the dumping of tank washings and ballast water by tankers, the release of bilge and fuel oil from general shipping, and the disposal of municipal and industrial waters. Chronic oil pollution kills large numbers of seabirds (e.g., (Wiese and Robertson 2004)); however, its impact on the SR killer whale population is poorly documented (NMFS 2008). In addition, the long-term effects of repeated ingestion of sub-lethal quantities of petroleum hydrocarbons on marine mammals are not well understood, either. As a result, the magnitude of the risks posed by oil discharges in the proposed action area is difficult to precisely quantify or estimate.

6.6 Alternative Energy Projects

There has been an increasing interest in the action area in pursuing renewable energy projects to harness energy from waves, tides and marine currents (NMFS 2008); however, the impacts to marine species such as SR killer whales from these alternative energy sources remain largely unknown. Buoys moored to capture wave energy may generate sound or electromagnetic fields that have the potential to affect marine life, and multiple anchored and connected buoys may also present an entanglement or collision risk. Underwater turbines to harness tidal or current energy may also present risks associated with fast moving blades or combined fields of large diameter turbines (NMFS 2008).

The Federal Energy Regulatory Commission (FERC) has issued several preliminary permits for ocean current, wave and tidal energy projects, including proposed tidal energy projects in Washington. In the last few years, several different tidal energy projects have been proposed in the Puget Sound area. Most were either not pursued because the projects were not economically or technologically feasible, or the companies surrendered their preliminary permits for the projects or let them expire.[5] Currently, FERC is considering two proposals for alternative tidal energy projects in the action area: Admiralty Inlet and Deception Pass. Admiralty Inlet is in Puget Sound, and Deception Pass is in the vicinity of the San Juan Islands, both locations in

[4] http://www.psp.wa.gov/pressreleases/101811_spills.html
[5] pstidalenergy.org

areas commonly used by SR killer whales. Other energy projects in the area under FERC consideration include hydroelectric dams and construction of natural gas storage facilities; these projects typically take place inland or on rivers and out of the range of SR killer whales.

Operation of underwater turbines causes received sound pressure levels above 120dB, which is considered Level B harassment for marine mammals (FERC 2013), and thus has the potential to take endangered SR killer whales. Acoustic devices like hydrophones can be mounted on the base of the turbine and used to detect changes in SR killer whale vocalization and behavior during operation (FERC 2013). Monitoring for effects on marine mammals, including killer whales, will be an important part of these early projects to help determine the impact of alternative energy projects (NMFS 2008).

6.7 Intentional Shooting

Large, highly-visible predators like SR killer whales have historically generated a variety of emotional responses from the public. Individuals like fishermen and sportsmen have a higher potential for interacting with SR killer whales, and may perceive competition over prey resources or damage caused to fishing gear. Whalers or sealers in the past may have also believed that killer whales scared off other marine mammals that were potentially harvestable (NMFS 2008). As a result, killer whales were the focus of widespread persecution, most often taking the form of intentional shooting.

Deliberate shootings of killer whales were probably once relatively common in Washington (Scheffer and Slipp 1948, Pike and Macaskie 1969, Haley 1970, Olesiuk et al. 1990, Baird 2001). Fisheries department personnel from British Columbia were seen to opportunistically shoot killer whales (NMFS 2008). Due to the whale's size, most bullet wounds are probably non-fatal, but accurate information on injury and mortality is difficult to obtain. About 25% of the killer whales captured in Puget Sound for aquaria through 1970 bore bullet scars, indicating that shooting occurred until fairly recently (Hoyt 1990, NMFS 2008).

Animosity toward killer whales has subsided in recent decades, but often persists where interference with fishing activities occurs (Klinowska 1991, Matkin and Saulitis 1997, Reeves et al. 2003). Today, deliberate killings are not considered a significant source of mortality at a population level throughout the northeastern Pacific (Young et al. 1993, Carretta et al. 2001), but incidents may go unreported (NMFS 2008). Even though there are no reports of deliberate killings, even a single intentional shooting could be significant given the relatively small population.

6.8 Live Captures

In 1961, a disoriented killer whale was captured in California, and was displayed in Marineland of the Pacific for a short time before it died (Bigg 1975, NMFS 2008). Subsequent attempts by other aquaria to display killer whales, combined with the animal's growing popularity, led to an increased interest and effort in capturing killer whales from the wild for public display. When the public began to oppose live-captures, the practice declined, with only 8 killer whales removed after 1971. British Columbia prohibited killer whale live-captures in 1975, and the Washington State Senate requested a moratorium from the U.S. government on live-capture of killer whales in 1976 following a lawsuit and public controversy (NMFS 2008).

With the exception of one killer whale captured in Japan in 1972, all killer whales captured from 1962-1976 from the wild for public display came from British Columbia and Washington (Hoyt 1990, NMFS 2008). In total, between 275-307 killer whales (SR, Northern Residents, and transients) were captured in Washington and British Columbia from 1962-1977; 55 were retained for captivity, and between 23-25 died during capture. The remainder were either released or escaped. There is some speculation that there were additional deaths during live-capture activities that were never made public (NMFS 2008a).

In particular, the SR killer whale population was heavily impacted by live-captures, with the majority (47 or 48 animals) of the retained or killed individuals being SR killer whales. Of the remaining 19 captured killer whales, 15 were Northern Resident whales, and 4 were transient killer whales (Olesiuk et al. 1990, NMFS 2008). In total, 47-48 SR killer whales were live-captured; at least 11 (possibly 12) died, and 36 were retained for public display. The majority of SR killer whales captured were immature individuals (17 males, 10 females, and 3 unidentified). The remaining whales were mature adults, with 7 (or 8) males removed, 9 females and one of unknown sex (NMFS 2008). In January 2014, NMFS reached a positive finding on the petition to include the captive "Lolita" as part of the endangered SR DPS (79 FR 4313). Lolita was captured in 1970, and is the only SR killer whale captured in the wild still alive in captivity.

Within the SK killer whale population, live-capture activities skewed the population structure, as collections (and any subsequent deaths) were biased toward immature animals (63% of the total) and males (57% of identified animals). Only 15 of these whales were subsequently identified by pod, with nine animals coming from K pod, five from L pod, and one from J pod (Baird 2001). The selective removal of younger animals and males produced a skewed age and sex composition in the SR killer whale DPS, which probably affected its ability to recover (Olesiuk et al. 1990, NMFS 2008).

6.9 Commercial Fishing Operations

Commercial fishing has been a threat to many whale species over the years. For SR killer whales, threats from commercial fishing presently take on two principal forms: the use of acoustic harassment devices and entanglement in fishing gear.

6.9.1 Acoustic Harassment Devices

To deter harbor seals and sea lions from salmon aquaculture farms, owners used acoustic harassment devices which emit loud signals intended to scare away these predators. These devices are also known to cause strong avoidance responses in cetaceans (e.g., killer whales) (Olesiuk et al. 2002, NMFS 2008). When in operation, a signal is detectable for up to 50km, and corresponds with declines in presence of resident and transient killer whales in passages and inlets near aquaculture farms near Vancouver Island (Morton and Symonds 2002). The Canadian Department of Fisheries and Ocean is no longer authorizing the use of acoustic harassment devices for use at aquaculture facilities because of the effects from to cetaceans causing disturbance and displacement (P. Cottrell, DFO, pers. comm. to C. Cairns, NMFS, April 24, 2014).

In the early 1990s, acoustic harassment devices were installed in numerous aquaculture facilities in the Salish Sea. The effectiveness of such devices diminishes over time as the pinnipeds begin to ignore or tolerate the signals (NMFS 1997). Aquaculture facilities have largely switched to using physical barrier nets around the containment enclosures to reduce predation by pinnipeds, and acoustic harassment devices are not being used in local aquaculture operations (B. Norberg, NMFS West Coast Regional Office, pers. comm. to C. Cairns, NMFS HQ, April 24, 2014). Currently only one is known to be in use in Washington, and is operated by NMFS at the Hiram M. Chittenden Locks and fish ladder (NMFS 2008). Research has demonstrated that the signal emitted by the acoustic harassment device falls to ambient levels within 1km of the Locks, and cetacean movement in Puget Sound does not appear to be affected by it (B. Norberg, NMFS West Coast Regional Office, pers. comm. to C. Cairns, NMFS HQ, April 24, 2014).

6.9.2 Entanglement

Entanglement in fishing gear is a frequently documented source of human-caused mortality for cetaceans. Entanglement can also make whales more vulnerable to dangers like predation and ship strikes, by restricting agility and swimming speed. There is a concern that many marine mammals that die from entanglement tend to sink rather than strand ashore, thus making it difficult to accurately determine the frequency of such mortalities.

For killer whales, however, drowning from accidental entanglement in fishing gear appears to be a minor source of mortality (NMFS 2008). Typically, killer whales are able to avoid nets by swimming around or underneath them (Jacobsen 1986 (Matkin 1994, NMFS 2008). Historically, there have been reports of killer whale mortality from entanglement (Scheffer and Slipp 1948), but more recently, reported interactions are minor and infrequent (Guenther et al. 1995). In the most recent NMFS bycatch report, there were no reported instances of killer whale bycatch (NMFS 2013). Fisheries observers have monitored the set gillnet fishery in northern Washington since 1988, with no coverage between 1998-2002; no killer whale take or mortality occurred (NMFS 2012).

6.10 Vessels

Threats to SR killer whales from vessels can take several forms, including: injury and mortality from vessel strikes, vessel presence causing disruption in behavior, noise and acoustic masking (see discussion below), and pollutant exposure from vessel exhaust emissions.

6.10.1 Strikes

The threat to whales from ship strikes has increased over the past 100 years as vessels have become larger, faster and more prevalent (Douglas et al. 2008). Nationwide, the average vessel size per call has increased 6.3% from 2006-2011 (average in 2011 was 53,832 deadweight tonnage); and the number of vessel calls at U.S. ports increased 7.9% over the same period (7,836 vessels made 68,036 calls) (Transportation 2013). For major ports in the region of the action area such as Vancouver, Seattle and Tacoma, the Strait of Juan de Fuca and Puget Sound are main thoroughfares for shipping traffic. There are thousands of commercial vessels (including container ships, cruise ships and barges) entering these ports each year. From 2008-2012, Tacoma reported between 1,019 and 1,365 vessel calls, and Seattle had between 1,420 and 1,827 vessel calls annually (Tacoma 2013). The port of Vancouver had 2,833 vessel arrivals in 2010, 3,024 in 2011, and 3,080 in 2012 (Vancouver 2012).

With these levels of vessel traffic, collisions with ships are a threat to many large whale species, particularly as commercial shipping lanes cross important breeding and feeding habitats (Williams and O'Hara 2010). Several species of listed large whales have been found in the Salish Sea and the waters of Washington State, dead from apparent ship strikes; these include fin whales, blue whales and sei whales (Douglas et al. 2008).

Ship strikes of SR killer whales do occur and can result in serious injury and mortality. 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 killer whale mortality from a ship strike was reported for Washington and British Columbia from 1960-1990 (Baird 2001). More recently, in British Columbia, there were 10 known killer whale ship strikes from 1995-2007, two of them fatal, and with one individual struck and died the following year (Williams and O'Hara 2010). Sometimes killer whales have been noted to make full recoveries from severe injuries, as a female killer whale did who had wounds from a propeller blade extending nearly to her backbone (Ford et al. 2000). In March 2006, a SR killer whale known as L98 was struck and killed by a tug boat in Nootka Sound. L98 had been exhibiting unusual behavior, interacting with vessels and remaining by himself (NMFS 2008). There have also been several reports in recent years of Northern Resident killer whales being struck and injured by boats (NMFS 2008).

6.10.2 Vessel Presence and Whale Watching

The presence of vessels, as well as the density and proximity of those vessels, can cause changes in the behavior of killer whales. The inland waters of Washington State host a variety of both commercial and recreational boat traffic. Boat density influences killer whale foraging behavior; in one study, killer whales spent less time foraging when there was a higher density of boats, and were more likely to spend more time foraging when there were five or fewer boats present (76 FR 20870).

The number of commercial whale watching operations in British Columbia and Washington has increased since 1976, with 39 whale-watching companies operating 74 vessels in the Salish Sea in 2005 (Lachmuth et al. 2011). Due to their popularity and local abundance in the area, SR killer whales are the primary target of these operations. Pods of SR killer whales can also attract a large number of recreational vessels. In a study, the maximum number of vessels following a single pod of SR killer whales ranged from 72-120 annually; the majority was recreational vessels (Lachmuth et al. 2011). The Whale Museum estimates that more than half a million people annually go whale watching in British Columbia and Washington, with another 3,000-8,000 recreational boats viewing killer whales annually (whalemuseum.org). In addition, private floatplanes, helicopters, and small aircraft regularly take advantage of whale watching opportunities (MMMP 2002). The highest density of whale watching vessels occurs during summer months of May-September (Koski 2004, Giles and Koski 2012).

This increase and intensity in whale watching has resulted in exposure of SR killer whales to vessel traffic and sound. Whale watching activities can affect SR killer whales by disturbing their normal activities (like feeding or swimming) or displacing them. In addition, there is the concern that whales may habituate to increased vessel traffic and become more vulnerable to ship strikes (Wiles 2004, NMFS 2008). Whale watching activities have been cited as a possible important factor in the recent decline of the DPS (Bain 2002, Krahn et al. 2002, Wiles 2004, NMFS 2008), although this decline did not appear to follow a simple cause-and-effect relationship with the expansion of whale watching (NMFS 2008).

Several studies have specifically examined the effects of whale watching on marine mammals, and investigators have observed a variety of short-term responses from animals, ranging from no apparent response to changes in vocalizations, duration of time spend at the surface, swimming speed, swimming angle or direction, respiration rate, dive time, feeding behavior, and social behavior (NMFS 2008). Responses appear to be dependent on factors such as vessel proximity, speed, and direction, as well as the number of vessels in the vicinity (see 76 FR 20870 for a review). In 2005, a commercial whale watching vessel struck a SR killer whale, inflicting a minor injury, which subsequently healed (NMFS 2008). Although mechanisms are in place to regulate the industry, concerns remain over persistent exposure to vessel noise, proximity to whales, which can cause behavioral changes, stress, or potentially the loss of habitat (Kruse 1991, Kriete 2002, Williams et al. 2002a, Foote et al. 2004, Bain et al. 2006, NMFS 2008, Wiley et al. 2008, Noren et al. 2009). As SR killer whales are normally exposed to high levels of whale watching, and vessel traffic in general, engine exhaust has been assessed as a possible threat and may contribute to health effects (Lachmuth et al. 2011).

6.11 Noise

All marine mammals present in the action area, including SR killer whales, are regularly exposed to several sources of natural and anthropogenic sounds. Anthropogenic noises that could affect ambient noise arise from activities that occur in and near the sea, any combination of which can contribute to the total noise at any one place and time. These noises include those coming from activities like transportation, dredging, construction, oil, gas, and mineral exploration in offshore areas, seismic surveys, sonars, explosions, and ocean research activities (Richardson et al. 1995).

Transportation, including commercial and recreational vessel traffic, airplanes and helicopters, all contribute to sound in the ocean (NRC 2003). The military uses sound to test the construction of new vessels, as well as for naval operations. In some areas where oil and gas production takes place, noise originates from the drilling and production platforms, tankers, vessel and aircraft support, seismic surveys, and the explosive removal of platforms (NRC 2003).

Researchers have described behavioral responses from marine mammals due to these noises, which included cessation of feeding, resting, or social interactions. Many contend that anthropogenic sources of noise have increased ambient noise levels in the ocean over the last 50 years (NRC 1994, Richardson et al. 1995, NRC 2000, 2003, 2005). Much of this increase is due to increased shipping as ships become more numerous and of larger tonnage (NRC 2003).

Anthropogenic sound can drown out the clicks, calls, and whistles killer whales use to communicate with one another during foraging and the echolocation signals used to navigate (Bain and Dahlheim 1994, Gordon and Moscrop 1996, Erbe 2002, Williams et al. 2002a, Williams et al. 2002b, NMFS 2008, Holt et al. 2009). Killer whales have a wide frequency range of hearing (from 1-100 kHz) (Szymanski et al. 1999), and although large vessels emit predominantly low frequency sound, studies report broadband noise from large cargo ships with significant levels above 2 kHz, and thus may interfere with important biological functions of killer whales (Holt 2008, NMFS 2008).

Talus (2000) studied vocal behavior of resident killer whales off British Columbia in the presence of boat noise to examine possible masking effects. The author found that although discrete calls were stable and did not show much evidence of change in the spectral characteristics examined, killer whale call rates decreased by about 50 percent in the presence of boat noise. Possible explanations for this reduced call rate include whales calling less while listening to the location of boats or calling less to hear other whales over the noise (Talus 2000). The author noted that killer whales may have habituated to vessel noise in this area, but that unknown negative effects from exposure to this noise were still possible (e.g., elevated stress levels, reduced time spent in optimal foraging areas).

SR killer whales have been documented to increase their call amplitude by 1dB for every 1dB of background noise, leading the authors to speculate that at some level, background noise could completely obstruct SR killer whale calls (Holt et al. 2009). Background noise can also impede the prey sharing that occurs when killer whales are foraging; evidence demonstrates that killer whales communicate within their pod to coordinate feeding activities (Holt et al. 2011) (see also 76 FR 20870 for review).

The issue of noise in the marine environment and its potential effects to marine life has come under scrutiny in recent years and is likely to continue to receive attention. In 2005, a U.S. vessel participating in sonar exercises apparently caused significant behavior changes in killer whale activity in the area, such that the whales vacated the area (NMFS 2005). Although such activities are now receiving close scrutiny, the potential remains for these disruptions to occur, or even the potential for auditory trauma, stranding, and death. The International Maritime Organization recently adopted guidelines providing recommendations on minimizing ship noise through proper vessel maintenance and guidance on designing quieter ships (IMO 2013). Although the impacts of noise on marine mammals is receiving attention and regulating bodies are working to mitigate those effects, sources of marine noise are likely to persist or increase into the future.

6.12 Scientific Research

SR killer whales have been the subject of scientific research activities in the action area, as authorized by NMFS permits. After the listing of SR killer whales as endangered under the ESA, NMFS issued three new scientific research permits, amended three existing permits and renewed one additional permit to authorize a variety of research activities targeting these whales (NMFS 2006). In subsequent years, additional research permits have authorized take of SR killer whales. Table 3 shows the number and type of takes authorized by these ten active permits over the years 2014-2019, which represents the timeframe Permit No. 17344 would be valid. No mortalities or serious injuries are authorized for SR killer whales under these permits.

The Permits Division authorizes takes in their research permits for killer whale stocks range-wide, transients, Northern Residents, Alaska Residents, and Southern Residents under the ESA and MMPA, as applicable. These permits authorize SR killer whale takes all throughout the killer whale's range, including the Gulf of Alaska, the Pacific Ocean, and the U.S. West coast from Alaska to Hawaii. These takes include a variety of research activities such as incidental harassment, aerial surveys, vessel surveys, photo identification, observation and monitoring, in addition to research activities that involve direct or very close contact with the whale, such as blubber or skin biopsy, breath sampling, and suction cup or dart tagging. Including Dr. Wasser's current permit (No. 10045), there are 6 scientific research permits that authorize fecal collection from SR killer whales in Washington.

NMFS issues scientific research permits that are valid for 5 years. When current permits expire, the researchers often apply for a new permit to continue their research, meaning that the overall number of research permits may not necessarily decrease. Furthermore, applications for new research permits are reviewed and considered for issuance on an on-going basis, so the number of research-related directed takes is subject to change over the period of time when Permit No. 17344 would be valid.

The authorized takes listed in Table 3 represent the authorized takes for only the SR killer whale DPS in Washington. The types of activities listed in Table 3 have been condensed for brevity's sake; see APPS for a complete list of all activities authorized under each permit. These numbers represent substantial effort relative to the number of individuals in the DPS. As such, repeated disturbance of individuals is probable under those 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.

SR killer whales are present in an action area that borders two countries, and can subjected to impacts from scientific research originating from Canada in addition to research permits issued under the ESA. The Northeast Pacific SR population of killer whales is categorized as endangered under Canada's Species at Risk Act (SARA). Similar to section 10 of the ESA, the Canadian federal government can issue licenses for scientific research on imperiled wildlife species. In Canada, researchers must obtain a permit if the project would involve close approach or physical contact with the whales from the Department of Fisheries and Ocean (FOCA 2011). Activities authorized under these permits are similar to those conducted under ESA permits (e.g., vessel surveys, photo identification, fecal collection, skin and blubber biopsies) and contain protective measures like those found in ESA permits (e.g., minimum approach distance, limited approach duration, using approved research protocols). From 2008-2011, there were 4 SARA permits issued for research on SR killer whales; two were active for the whole time span, and the other two were valid for less than one year. Currently, there are two active SARA permits authorizing research on SR killer whales in Canadian waters (K. Leslie, Fisheries and Oceans Canada, pers. comm. to C. Cairns, NMFS HQ, May 28, 2014).

While the total authorized take numbers for research on SR killer whales far exceeds the number of individuals in the DPS, it should be pointed out that the number of actual takes that occur can often be far less than what is authorized. For instance, in 2012-2013, The Whale Museum (Permit No. 16160) had 29 out of 200 authorized takes. During that same time, the Cascadia Research Collective (Permit No. 16111) had no takes of SR killer whales; from 2011-2012, Permit No. 15530 also had no SR killer whale takes. Neither one of the NMML permits had SR killer whale takes in 2011 (Permit No. 13430) or in 2012 and 2013 (Permit No. 14245) (NMFS, unpublished data). Numerous factors can impact a researcher's ability to conduct the authorized research, such as loss of or reduced funding changing the priorities of the project, or technical and logistical difficulties. A further discussion of the Applicant's actual take numbers under Permit No. 10045 can be found below (see Table 3).

Table 3 Authorized takes for scientific research on SR killer whales within the action area occurring while proposed Permit No. 17344 is valid (2014-2019)

Permit Holder	Permit No.	Action Area	Procedures†	Authorized Takes (n)	Start	End
University of WA	10045	WA; Puget Sound, Georgia Basin	Vessel Survey; Fecal Sample Collection; Photo-id	100	2008	2014
NMML (Cetacean Research)	14245	Pacific Ocean; AK-HI	Harass, Aerial Survey; Photo-id	500	2011	2016
			Harass, Vessel Survey; Photo-id; Fecal Sample Collection	490		
			Suction Cup Instrument Attachment; Blubber Biopsy; Fecal Sample Collection	10		
Cascadia Reseach Collective	15330	Pacific Ocean; AK-HI	Vessel Survey; Suction Cup Instrument Attachment; Fecal Sampling; Photo-id	30	2010	2016
			Harass, Vessel and Aerial; Photo-id; Fecal Sample Collection; Exhaled Air Sample	1000		

Center for Whale Research	15569	Pacific Ocean; AK-CA	Vessel and Aerial Survey; Photo-id; Fecal Sample Collection	8500	2012	2017
Navy's Marine Species Monitoring	16239	Pacific Ocean; AK-HI	Harass, Vessel and Aerial; Photo-id; Fecal Sample Collection	86	2013	2018
Scripps Institute of Oceanography	17312	Pacific Ocean; AK-HI	Vessel Survey; Photo-id; Fecal Sample Collection	5	2013	2018
NMML (Pinniped Assessment)	13430	Pacific Ocean; OR-WA	Incidental Harassment (Playback Experiments)	100	2010	2015
Cascadia Reseach Collective	16111	Pacific Ocean; AK-CA	Aerial and Vessel Survey; Count; Photo-id	300	2012	2017
The Whale Museum	16160	WA; Inland waters	Vessel Survey; Photo-id	200	2012	2017

*Permit No.10045 is currently held by the Applicant, and the proposed Permit No. 17344 would replace it upon issuance.
†Description of procedures listed here is an abbreviated list. See https://apps.nmfs.noaa.gov/index.cfm for a complete list of all procedures authorized under each permit.

6.13 Conservation and Management Efforts

In 2011, NMFS established regulations prohibiting vessels from approaching killer whales within 200 yds (189.2 m) and from parking in the path of whales when in inland waters of Washington State (76 FR 20870). Certain exceptions to these regulations apply, such as to government vessels engaged in official business, cargo vessels in shipping lanes, fishing vessels actively fishing, and vessel maneuvers necessary for safety reasons.

The Soundwatch Boater Education Program, established by the Whale Museum in 1993, serves to educate recreational boaters by having volunteer crews on the water, monitoring boating activity near whales, and providing boaters with advice and educational materials to minimize impacts to whales. Although Soundwatch has no law enforcement capability, violations are reported to local law enforcement officials.[6]

On August 2, 2012, NMFS was petitioned to delist the DPS based on new information, which indicated that there may be more paternal gene flow among populations than originally detected (Pilot et al. 2010). On August 5, 2013, NMFS found that delisting was not warranted (78 FR 47277).

6.14 Integration of the Environmental Baseline

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 killer whales. The effects of climatic variability on this species in the action area and the availability of its prey remain largely undetermined; however, it is likely that any changes in weather and oceanographic conditions resulting in effects on salmon populations would have consequences for SR killer whales.

The baseline also includes human activities resulting in disturbance, injury, or mortality of individuals. These activities include live-captures for public display, which affected SR killer whales in the past but no longer occurs at present, as well as intentional shooting, which no longer affects these whales as significantly as in the past. However, effects from these activities may still persist today. Current anthropogenic activities and effects on individuals in the action area are thought to include habitat degradation (e.g., contaminants, oil spills, underwater sound, changes in prey availability), interactions with fishing gear and with vessels (including ship strikes), whale watching, alternative energy projects, and scientific research on SR killer whales. Conservation and management efforts are ongoing and have a positive effect on the status of endangered SR killer whales within the action area.

SR killer whales may be affected by the proposed activities authorized by Permit No. 17344. These whales are, or have been, exposed to the components of the environmental baseline. The activities discussed in the above section likely have some level of effect on SR killer whales in the proposed action area; however, the combined consequences of those effects on the status, trend, or demographic processes that drive the status and trends of this DPS remain largely unknown.

7 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. The proposed permit issued by the Permits Division would expose SR killer whales to actions that constitute "take." In this section, we

[6] See whalemuseum.org

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. The purpose of this assessment is to determine if it is reasonable to expect that the research, as conducted under the permit, can be expected to have direct or indirect effects on endangered SR killer whales that 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, and therefore species 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 by causing disruption of behavioral patterns, including, but limited to, migration, breathing, nursing, breeding, feeding, or sheltering [16 U.S.C. 1362(18)(A)]. For this Opinion, we define harassment similarly: 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.

7.1 Stressors

During the course of the consultation, we identified the following potential stressors from vessel activity: vessel approach, vessel strike, vessel noise, and vessel discharge. The Applicant has conducted vessel-based photo-identification and fecal sample collection on SR killer whales under Permit No. 10045 since 2008, and has produced multiple reports from this research. As summarized below, we determined the following possible stressors would be negligible: vessel strike, vessel noise, and vessel discharge.

The probability of vessel strike is remote and would pose a negligible risk to SR killer whales, given the experience of the Applicant in detecting these species and conducting these surveys. We expect the Applicant would be able to locate, identify, and avoid SR killer whales during transit. We expect the Applicant to comply with the permit terms and conditions pertaining to vessel operation that are protective of the SR killer whales.

Vessel noise is also expected to pose only a negligible risk to SR killer whales. Behavioral responses to vessels are analyzed further in the Response Analyses (section 7.3) of this Opinion. The larger concern, with regard to vessel noise, is the cumulative effects of the Applicant's vessel in contributing to the totality of noise in the Salish Sea. Cumulative noise is discussed in the Cumulative Effects (section 8.0) and integrated into the Exposure Analysis (section 7.2) of this Opinion.

Vessel discharges in the form of fuel/contaminant spills are expected to be negligible as well. Given the experience of the Applicant in conducting these surveys and navigating the action area, it is unlikely the Applicant would run aground while boating and discharge fuel/contaminants in the water.

The assessment for this consultation identified vessel approach as a possible stressor associated with the proposed permit activities, which will be analyzed further.

7.2 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. This Exposure Analysis identifies, 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 Permits Division proposes to issue a five-year permit for scientific research to Samuel Wasser, Ph.D. Most of the activities would be conducted year round in waters of the state of Washington, including the Salish Sea, and offshore waters. Table 1 identifies the numbers of SR killer whales that Dr. Wasser would be authorized to approach, photograph/video, collect fecal samples from a vessel annually under the proposed five-year permit. Individuals of either sex or age may be taken, although mother-calf pairs would be treated with caution. A total of 480 SR killer whales would be permitted to be exposed to the suite of procedures covered under the proposed permit annually.

The research vessel will approach the whale closer than 100 yds for the sighting and photo-identification portion of the research. After sighting, the vessel follows the whale from 200 yds away using the scat detection dogs to locate and collect the sample. Under Permit No. 10045, the majority (97%) of fecal samples were collected at distances greater than 100 m from the whale (Figure 6). Therefore, it is probable that the take would most often occur during the photo-identification, but could potentially happen during fecal collection. Permit conditions restrict the number of approaches during a single day to three, and the authorized takes would be limited to six per individual whale.

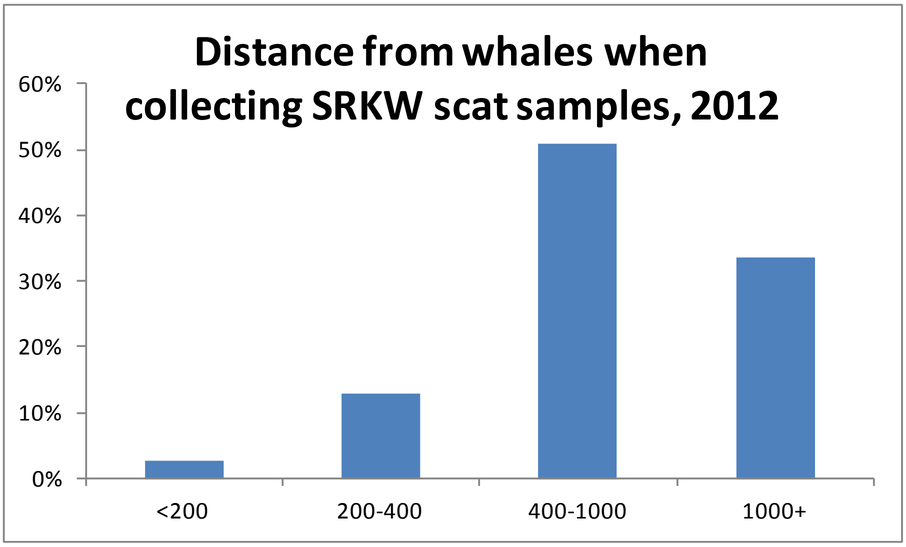

Figure 6 Percentage of fecal samples collected at distance (m) from the nearest killer whale. Obtained from the Applicant's 2012 annual report.

Table 4 shows the number of SR killer whales taken under Dr. Wasser's previous permit, No. 10045. According to reports submitted by Dr. Wasser, the researchers have approached (and in one case exceeded), the authorized take numbers each year. The SR killer whale population has fluctuated since 2008, and the Permits Division authorizes more takes than the current population estimates to allow researchers flexibility should the population increase. Given the researcher's past performance, and that the entire SR killer whale population is reliably in the action area during the proposed sampling season, it is likely that the proposed take numbers for Permit No. 17344 will be met, and that most, if not all, of the individuals in the SR killer whale DPS will be exposed to the research activities.

Table 4 Actual take of SR killer whales under Permit No. 10045, 2008-2013.

Year	Est. Pop Size*	Authorized Take	Actual Take	Take Activity
2008	85	100	105	Photo-id; fecal sample collection
2009	85	100	88	Photo-id; fecal sample collection
2010	86	100	85	Photo-id; fecal sample collection
2011	87	100	80	Photo-id; fecal sample collection
2012	85†	100	82	Photo-id; fecal sample collection
2013	80**	100	Not Available	Photo-id; fecal sample collection

*According to the NMFS SAR that year
†NMFS SAR Draft 2013
**Center for Whale Research estimate (April 2014)

7.3 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 on directly listed animals themselves. For the purposes of consultation, our assessments try to detect potential lethal, sub-lethal (or physiological), or behavioral responses that might reduce the fitness of individuals. Ideally, response analyses would consider and weigh evidence of adverse consequences as well as evidence suggesting the absence of such consequences.

Evidence indicates that wild animals respond to human disturbance in the same way they respond to predators (Lima 1998, Gill et al. 2001, Frid and Dill 2002, Frid 2003, Beale and Monaghan 2004, Romero 2004). These responses may manifest themselves as stress responses, interruptions of essential behavioral or physiological events, alteration of an animal's time budget, or some combination of these responses (Frid and Dill 2002, Romero 2004, Walker et al. 2005).

7.3.1 Response to Close Approaches by Vessels

For all research activities, the presence of vessels can lead to disturbance of marine mammals, although the animals' reactions are generally short term and low impact. Short-term behavioral disturbance in response to vessel activity and noise are reported for several whale species (Malme et al. 1984, Malme et al. 1989, Richardson et al. 1995). Whales have been observed to react in a variety of ways to close vessel approaches. Reactions range from little to no observable change in behavior to momentary changes in swimming speed, pattern, orientation, diving, time spent submerged, foraging and respiratory patterns (Hall 1982, Baker et al. 1983, Au and Green 2000, Jahoda et al. 2003, Koehler 2006, Scheidat et al. 2006). Responses may also include aerial displays like tail flicks and lobtailing and may possibly influence distribution (Watkins 1981, Baker et al. 1983, Bauer and Herman 1986, Clapham and Mattila 1993, Jahoda et al. 2003).

The type and duration of the whale's response can be influenced by several factors, including some having to do with the vessel and local conditions, and others having to do with the whale itself. Changes in whale behavior can correspond to vessel speed, size and distance from the whale, as well as the number of vessels operating in the proximity (Baker et al. 1988). Furthermore, detection of vessel noise by the whale can be dependent on weather, vessel engine type and size, oceanography, species sensitivity, habituation, and ambient noise conditions, among others.

Individual factors pertaining to the whale's physical or behavioral state can cause differences in the whale's response to vessels. These can include the age or sex of the whale, the presence of offspring, whether or not habituation to vessels has occurred, individual differences in reactions to stressors; vessel speed, size, and distance from the whale; and the number of vessels operating in the proximity (Baker et al. 1988, Wursig et al. 1998, Gauthier and Sears 1999, Hooker et al. 2001, Lusseau 2004, Koehler 2006, Richter et al. 2006, Weilgart 2007). Observations of large whales indicate that cow-calf pairs, smaller pods, and pods with calves appear to be particularly responsive to vessel approaches (Hall 1982, Bauer 1986, Bauer and Herman 1986, Clapham and Mattila 1993).

Researchers have noted that different approach techniques have a major influence on the whale's response to vessels (Hall 1982, Bauer 1986, Bauer and Herman 1986, Clapham and Mattila 1993). Responses are reported to be generally minimal to non-existent when close vessel approaches are slow and careful, leading researchers to conclude that experienced, trained personnel approaching whales slowly would result in fewer individuals exhibiting responses that might indicate stress (Weinrich et al. 1991, Clapham and Mattila 1993). Such concerns and rationale led NMFS to implement vessel approach guidelines for SR killer whales in Washington in 2011 (76 FR 20870). To protect other whale species from negative effects from close vessel approach, NMFS has established similar guidelines limiting approach distances to 100 yds for endangered humpback whales in Hawaii (60 FR 3775) and Alaska (66 FR 29502), and 500 yds for North Atlantic right whales (62 FR 6729), with an additional speed restriction of 10 knots implemented in 2008 (73 FR 60173).

Patterns of disturbance in response to vessel activity indicate such approaches may have metabolic consequences or be stressful for cetaceans (Baker et al. 1983, Bauer and Herman 1986, Baker and Herman 1989, Jahoda et al. 2003). For SR killer whales specifically, available information indicates that individuals exposed to the vessel approaches could be affected by the action. These responses may manifest themselves as stress responses, interruptions of essential behavioral or physiological events, alteration of an animal's time budget, or some combinations of these responses (Sapolsky et al. 2000; Frid and Dill 2002; Romero 2004; Walker et al. 2005). Behavioral responses that result in a reduced amount of time spent at the surface, less time foraging, or more erratic swimming may suggest an increase in metabolic rates indicative of a stress response to close vessel approaches (Williams et al. 2002a, Lusseau et al. 2009, Williams et al. 2011a). However, it is difficult to quantify the magnitude or duration of possible stress responses that would allow us to make inferences about possible fitness consequences for individual SR killer whales. Efforts to separate the relative stress response from inadequate prey and vessel traffic indicate that limited prey availability correlated more strongly with the concentration of stress hormones in SR killer whale fecal samples (i.e., fecal thyroid and glucocorticoids) than did presence of vessels (Ayres et al. 2012).

The action area comprises the Salish Sea, and, as has been discussed previously, this is an area which is subject to a high amount of boating activity, both recreational and commercial. In addition, the research would primarily take place during summer months when the SR killer whales are most likely to be present, following the Fraser River Chinook salmon migration. This also coincides with the time of year when there is likely to be the highest seasonal boat density.

In the 2011 Final Rule for protective regulations for killer whales regarding vessel approaches in the inland waters of Washington State, NMFS provided a summary of various studies examining the effects of vessels on killer whales to justify prohibiting vessels from approaching killer whales within 200 yds (76 FR 20870). Numerous researchers have documented changes in killer whale behavior from vessel approaches within 100 yds. These changes include changes in swimming and respiratory patterns, a reduction in the time spent foraging, and increased surface behaviors (e.g., tail slaps) (Williams et al. 2002a, Williams et al. 2002b, Bain et al. 2006, Lusseau et al. 2009). The proximity of the boats to the killer whales also influenced the reaction, as Noren et al. (2007, 2009) observed the highest frequency of surface activity when vessels were within 75-99 m. For greater vessel distances (200-400 yds), researchers noted similar reactions from killer whales, but to a lesser degree (Noren et al. 2007, Lusseau et al. 2009, Noren et al. 2009, Williams et al. 2009). Consequences of these changes in behavior include the killer whales swimming faster, changing direction more often, covering more distance over a less direct route, less time spent foraging, and an overall greater amount of time spent travelling (Williams et al. 2002a, Lusseau et al. 2009, Williams et al. 2011a). Long-term effects from such changes in behavior are difficult to determine, but could include physiological consequences (in the form of increased energetic cost) and reduced foraging, leading to nutritional stress and possibly a loss of reproductive success (Williams et al. 2006). NMFS determined that the regulation prohibiting vessel approaches closer than 200 yds would reduce the risk of vessel strikes, the degree of behavioral disruption, and the amount of noise that masks communication and echolocation in SR killer whales (76 FR 20870).

Upon issuance, Permit No. 17344 would allow researchers to approach SR killer whales closer than 200 yds, and the permit would contain conditions designed to minimize the effects of approach. For Dr. Wasser's previous Permit No. 10045, researchers typically positioned the boat a quarter-mile to a half-mile from the whales, and rarely witnessed any change in behavior when the boats are within 100 yds of the whales. Reports for Permit No. 10045 indicated that killer whales responded to the close approach of a research vessel a small number of times. For example, in 2008, eight behavioral responses were noted; in 2009, five behavioral responses were observed; two changes in 2010, and two in 2011. Other close-approach research studies describe killer whales exhibiting behavioral reactions during two of 27 close approaches, both of which involved apparent avoidance of the research vessel (Baird and Hanson 2004). Based on available information, we would expect most of the whales exposed to close vessel approaches would exhibit no visible response. For the smaller portion that would exhibit observable responses, we expect those to be short-term behavioral reactions to the close approach.

To minimize the effects of close approach, the permit requires researchers to exercise caution when approaching animals and to retreat if behaviors indicate the approach may be interfering with reproduction, feeding, or other vital functions. Additional conditions require researchers to exercise caution while closely approaching females with calves (six months of age or older) to minimize or avoid any startle response. Researchers must terminate efforts if there is evidence they are interfering with pair-bonding or nursing, and must not position the vessel between the mother and its calf. Calves less than six months old or females associated with those calves would not be approached. Researchers would also apply "good practice" measures to minimize potential risks associated with close approaches. These include avoiding making sudden changes in vessel speed or pitch, avoiding the use of reverse gear, not approaching whales head-on, and discontinuing efforts if the animal displays avoidance behaviors, such as a change in direction of travel or departures from normal breathing or diving patterns. Although threshold levels at which underwater anthropogenic sound negatively impacts hearing and behavior are poorly understood (NMFS 2008), the proposed activities would be conducted to minimize the effects of vessel noise on SR killer whales. Given the directional nature of killer whale hearing and evidence that effects on odontocetes depend greatly on the direction of arrival of the noise (having the least effect from the side or behind killer whales), we expect the manner of vessel approaches conducted under the proposed permit would minimize risk posed by vessel noise (Bain and Dahlheim 1994; Talus 2000). The permit conditions, the experience of the researchers, and best practices for close approaches would help minimize any risk of vessel collisions occurring during the proposed studies. Assuming an animal is no longer disturbed after it returns to pre-approach behavior, we do not expect long-term consequences for the individuals affected.

Permit conditions also address the potential for repeat disturbance of these species. Available information suggests the cumulative effect of close approaches could be greater than the effect of each individual approach (e.g., Weinrich et al. 1992; Beale and Monaghan 2004). To minimize repeated disturbances to individual whales, the proposed permit limits takes by harassment (i.e., due to close approach) to three per individual in one day, and no more than six per individual each year. The permit also requires coordination of the proposed activities with other permit holders conducting similar activities on the same species in the same locations or times of year to avoid unnecessary disturbance.

8 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 by this Opinion. Future federal actions 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.

During this consultation, NMFS searched for information on future state, tribal, local or private actions reasonably certain to occur in the action area. We did not find any information about non-Federal actions other than what has already been described in the Environmental Baseline, which we expect will continue into the future. Anthropogenic effects include vessel traffic, whale watching, noise, climate change, prey availability, pollution, and scientific research. An increase in these activities could result in an increased effect on ESA-listed species; however, the magnitude and significance of any anticipated effects remain unknown at this time.

9 Integration and Synthesis of the Effects

The proposed Permit No. 17344 would authorize up to 480 “takes” due to close vessel approaches during the first year of the permit, and no more than 600 approaches annually in subsequent years, depending on the total abundance of the SR killer whale DPS. This corresponds to each individual in the DPS being closely approached no more than six times per year. For the proposed permit, a close vessel approach is defined as a continuous sequence of maneuvers, including drifting or parking in a whale’s path, directed toward an animal(s) for the purposes of conducting authorized research, which involves one or more instances of coming to within 100 yds (91 m). Approaches would be conducted using slow speeds and from oblique angles, and whales would be approached to between 50–100 ft (15–30 m) for fecal sample collection, and at the greatest distance possible for photo-identification.

At present, several factors (see Environmental Baseline section 6) may be affecting SR killer whale survival and recovery in the action area. Natural factors include natural morality, disease and parasites. Past and present anthropogenic effects potentially affecting SR killer whales in the action area include intentional shootings, live captures for public display, pollution, climate variability, noise, commercial fishing operations, and scientific research.

After reviewing the available information, we determined the proposed activities to be conducted under Permit No. 17344 are likely to produce one stressor for SR killer whales that required further analysis: close approach by research vessels and associated behavioral reactions. Negligible stressors were determined in Effects of the Action: Stressors (section 7.1) to be vessel strike, vessel noise, and vessel discharges. It is expected that SR killer whales would not be exposed to close vessel approaches ("taken") more than 600 times over the life of the permit and no more than six times in any one year. It is possible that an individual could be taken more than six times per year, or that the total annual take limit could be exceeded (in fact, this has occurred once under Permit No. 10045). The takes that would be authorized under the proposed Permit No. 17344, combined with the amount of currently authorized research takes for SR killer whales, far exceeds the total number of individuals in the DPS. However, in many instances, the currently-permitted researchers have reported far fewer annual takes than have been authorized (see Environmental Baseline, section 6.12).

All currently permitted scientific research activities are non-lethal. Due to multiple approach possibilities and lack of available information, it is difficult to quantify and assess the effects of possible repeat disturbance by these researchers on SR killer whales. The Permits Division limits repeated harassment by requiring (to the extent practicable) coordination among permitted research as a permit condition and specifying daily and annual exposure limits for individuals during research activities. In our Conservation Recommendations, we posed recommendations for the Permits Division to further coordinate multiple research projects, and to provide better assessments of the cumulative impacts of these research projects on this single DPS.

Based on the relatively small DPS size, and the Applicant's past performance under Permit No. 10045, we expect that most, if not all of the individuals in the SR killer whale DPS would be exposed to the research activities. Any age and either sex of SR killer whale may be exposed to activities under the proposed permit. The action area includes foraging, calving, and migration areas for SR killer whales. Proposed research activities would occur in the Salish Sea year-round, mainly between May to October annually for five years. Given the location and timing of the proposed research activities, we expect foraging, calving, and migrating whales to be present in the action area. The duration of each close approach would vary, but is not expected to exceed 20 minutes.

The anticipated responses of SR killer whales to activities conducted under proposed Permit No. 17344 were described in detail in the Effects of the Action: Response Analyses (section 7.3). Possible responses resulting from exposure to close vessel approaches range from no response to sub-lethal (or physiological), short-term behavioral responses.

Based on the available information, we conclude the way a close vessel approach is conducted significantly influences SR killer whale response. With slow, careful approaches and alert observers, we expect fewer SR killer whales to exhibit responses that might indicate stress, but that some of these approaches might still be stressful for some individuals and may interrupt behaviors such as foraging or migration. The permit contains conditions to minimize these impacts.

We believe short-lived stress responses due to close approach by research vessels are possible for a few individuals, as are short-term interruptions in behaviors such as foraging. Assuming an animal is no longer disturbed after it returns to its pre-approach behavior, we do not anticipate that these brief disruption to lead to reduced opportunities for foraging or reproduction for targeted individuals. Overall, no individual whale is expected to experience a fitness reduction, and therefore no fitness consequence would be experienced at a population or species level.

10 Conclusion

After reviewing the current Status of Listed Resources, the Environmental Baseline for the Action Area, the anticipated effects of the proposed activities, and the Cumulative Effects, it is NMFS' Opinion that the activities authorized by the proposed issuance of scientific research Permit No. 17344, as proposed, is not likely to jeopardize the continued existence of SR killer whales.

11 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 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 to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

As discussed in the accompanying Opinion, only the species targeted by the proposed research activities would be harassed as part of the intended purpose of the proposed action. Therefore, NMFS does not expect the proposed action would incidentally take threatened or endangered species.

12 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 research permits that may affect endangered whales as well as reduce harassment related to authorized activities:

1) *Cumulative impact analysis*. The Permits Division should encourage the marine mammal research community, working with the Marine Mammal Commission as applicable, to identify a research program with sufficient power 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) *Coordination meetings*. The Permits Division should continue to work with NMFS Regional Offices and Science Centers to conduct meetings among permit holders conducting research within a region and future applicants to ensure that the results of all research programs or other studies on specific threatened or endangered species are coordinated among the different investigators.

3) *Data sharing*. The Permits Division should continue to encourage permit holders planning to be in the same geographic area during the same year 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 the NMFS ESA Interagency Cooperation 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 ESA Interagency Cooperation Division of any conservation recommendations they implement in their final action.

13 Reinitiation Notice

This concludes formal consultation on the proposal to issue scientific Permit No. 17344 to Samuel Wasser, Ph. D. authorizing research on endangered SR killer whales in the waters of Washington State. 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 this action. In instances where the amount or extent of authorized take is exceeded, the NMFS Permit Division must immediately request reinitiation of Section 7 consultation.

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