BEFORE THE SECRETARY OF COMMERCE

PETITION TO REVISE THE CRITICAL HABITAT DESIGNATION FOR THE SOUTHERN RESIDENT KILLER WHALE (*ORCINUS ORCA*) UNDER THE ENDANGERED SPECIES ACT

Credit: NOAA Northwest Fisheries Science Center,
http://www.nwfsc.noaa.gov/research/divisions/cb/ecosystem/marinemammal/satellite_tagging/winter_cruise.cfm

CENTER FOR BIOLOGICAL DIVERSITY

PETITIONER

JANUARY 16, 2014

NOTICE OF PETITION

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The Center for Biological Diversity ("the Center") is a non-profit, public interest environmental organization dedicated to the protection of native species and their habitats through science, policy and environmental law. The Center has over 625,000 members and online activists throughout the United States. The Center and its members are concerned with the conservation of endangered species, including the Southern Resident killer whale, and the effective implementation of the Endangered Species Act.

ACTION REQUESTED

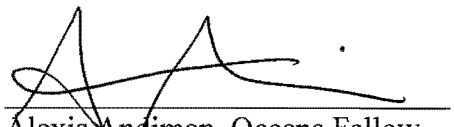
Pursuant to section 4(b)(3)(D) of the Endangered Species Act ("ESA"), 16 U.S.C. § 1533(b)(3)(D); the ESA's implementing regulations, 50 C.F.R. § 424.14(a); and section 553(e) of the Administrative Procedure Act ("APA"), 5 U.S.C. § 553(e), the Center for Biological Diversity hereby petitions the Secretary of Commerce, through the National Marine Fisheries Service ("NMFS"), to revise the critical habitat designation for the Southern Resident killer whale (*Orcinus orca*), as codified at 50 C.F.R. § 226.206, to include inhabited marine waters along the West Coast of the United States that constitute essential foraging and wintering areas for this critically imperiled species.

This petition sets in motion a specific process, placing definite response requirements on NMFS. Specifically, the agency must issue an initial finding as to whether the petition "presents substantial scientific information indicating that the revision may be warranted." 16 U.S.C. § 1533(b)(3)(D)(i). NMFS must make this initial finding "[t]o the maximum extent practicable, within 90 days after receiving the petition." *Id.* Within 12 months of receiving this petition, NMFS must determine how it will proceed with the requested revision, moving forward with a

proposed rule to revise critical habitat for the Southern Resident killer whale if the agency finds that such an action is warranted. *Id.* § 1533(b)(3)(B).

As described in this petition, the areas of the Pacific Ocean we propose for critical habitat designation meet all the criteria for such designation as defined at 16 U.S.C. § 1532(5) and 50 C.F.R. §§ 424.02 & 424.12. The best available science, including NMFS's own documents, clearly demonstrate that revising the existing critical habitat designation for Southern Resident killer whales to include Pacific Ocean waters is warranted. As such, NMFS must promptly make a positive initial finding on the petition and commence a proposed rulemaking to revise critical habitat for the Southern Resident killer whale. In the event that NMFS determines that some portions of the requested critical habitat revision do not meet the criteria for such designation, we request, in the alternative, that NMFS identify and designate appropriate offshore waters as critical habitat.

Dated this 16th day of January, 2014



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INTRODUCTION

The Center for Biological Diversity ("the Center") requests that the National Marine Fisheries Service ("NMFS") revise the Southern Resident killer whale's critical habitat to include Pacific Ocean waters off the coasts of Washington, Oregon and California.

Since the mid- to late-1800s, the Southern Resident population of killer whales has drastically declined, from an estimated 200 individuals, historically, to only 81 remaining members, as of September 2013. Although NMFS has recognized that these whales are at risk of extinction and has designated critical habitat throughout much of their summer range, the population has nonetheless exhibited a slow rate of recovery. Recent scientific research reveals that a variety of human activities threaten the whales year-round, leading to prey limitations, toxic contamination, ocean noise and other disturbances.

Southern Resident killer whales depend on Pacific Ocean offshore waters, but none of these waters are currently included as part of their critical habitat. In 2006, NMFS expressed its intent to revise the critical habitat designation for Southern Residents upon receiving sufficiently detailed information concerning the population's winter behavior and coastal range. Due in large part to the research efforts of the agency's Northwest Fisheries Science Center ("NWFSC"), specific descriptions of the whales' seasonal use of offshore habitat are now available. Accordingly, this petition requests that NMFS revise and expand the population's critical habitat to include offshore waters.

I. Legal and Factual Background

A. The Importance of Critical Habitat under the Endangered Species Act

In 1973, Congress enacted the ESA, recognizing that untempered economic growth and development had rapidly eliminated or imperiled many species "of esthetic, ecological, educational, historical, recreational and scientific value to the Nation and its people."[1] The statute aims "to provide a program for the conservation of … endangered species and threatened species," as well as "a means whereby *the ecosystems upon which [these] species depend* may be conserved."[2]

The legislative history of the ESA reveals that Congress believed habitat preservation to be an essential component of conservation:

> [C]lassifying a species as endangered or threatened is only the first step in insuring its survival. Of equal or more importance is the determination of the habitat necessary for that species' continued existence…. If the protection of endangered and threatened species depends in large measure on the preservation of the species' habitat, then *the ultimate effectiveness of the Endangered Species Act will depend on the designation of critical habitat.*[3]

[1] 16 U.S.C. § 1531(a)(1), (3) (2012).
[2] *Id.* § 1531(b) (emphasis added).
[3] H.R. Rep. No. 94-887, at 3 (1976) (emphasis added).

Thus, "to the maximum extent prudent and determinable," the statute requires the Secretary of Commerce, through her agent NMFS, to designate any areas "then considered to be critical habitat," upon listing a species as threatened or endangered.[4] Designations must be based on "the best scientific data available" and account for economic, national security and other impacts.[5] These standards also govern subsequent revisions of critical habitat, which may occur "from time-to-time … as appropriate."[6]

In relevant part, the ESA defines critical habitat as "the specific areas within the geographical area occupied by the species … on which are found those physical or biological features … essential to the conservation of the species and … which may require special management considerations or protection."[7] Features essential to a species' conservation may include:

> (1) Space for individual and population growth, and for normal behavior;
> (2) Food, water, air, light, minerals, or other nutritional or physiological requirements;
> (3) Cover or shelter;
> (4) Sites for breeding, reproduction, rearing of offspring, germination, or seed dispersal; and generally;
> (5) Habitats that are protected from disturbance or are representative of the historic geographical and ecological distribution of a species.[8]

Accordingly, in designating critical habitat, NMFS must specifically identify "the principal biological or physical constituent elements within the defined area that are essential" to the species' conservation.[9] These "primary constituent elements" ("PCEs") "may include, but are not limited to[:] roost sites, nesting grounds, spawning sites, feeding sites, seasonal wetland or dryland, water quality or quantity, host species or plant pollinator, geological formation, vegetation type, tide, and specific soil types."[10]

The ESA allows individuals to petition for revision of critical habitat.[11] Within 90 days of receiving a petition for critical habitat revision, NMFS "shall make a finding as to whether the petition presents substantial scientific information indicating that the revision may be warranted."[12] Within 12 months of receiving a petition, "the Secretary shall determine how he intends to proceed with the requested revision, and shall promptly publish notice of such intention in the Federal Register."[13]

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[4] 16 U.S.C. § 1533(a)(3).
[5] *Id.* § 1533(b)(2).
[6] *Id.* § 1533(a)(3).
[7] *Id.* § 1532(5)(A)(i), (ii).
[8] 50 C.F.R. § 424.12(b) (2012).
[9] *Id.*
[10] *Id.*
[11] 16 U.S.C. § 1533(b)(3)(D)(i); *see also* 5 U.S.C. § 553(e) (providing that "each agency shall give an interested person the right to petition for the issuance, amendment, or repeal of a rule").
[12] 16 U.S.C. § 1533(b)(3)(D)(i).
[13] *Id.* § 1533(b)(3)(D)(ii).

Critical habitat designation provides endangered and threatened species with several important protections. Pursuant to section 7 of the ESA, federal agencies must consult with NMFS to ensure that they do not authorize, fund, or carry out any action likely either to "jeopardize the continued existence" of a protected species, or to "result in the destruction or adverse modification" of that species' critical habitat.[14] Thus, critical habitat designations assist federal agencies in determining whether consultation is required for actions beyond those that result in direct mortality or injury to members of a protected species. In addition, the designation of critical habitat highlights geographic areas that require special consideration, allowing agencies to identify and avoid conflicts between protected species and proposed projects early in the planning process. Critical habitat designations also help to focus federal, state and private conservation and management activities, including recovery efforts, in the areas that most require protection.

The benefits stemming from critical habitat designation are not merely speculative. Evidence suggests that species with critical habitat are more than twice as likely to exhibit improving population trends compared to those without designated critical habitat.[15] The Southern Resident killer whale will benefit from the protection of its foraging and wintering areas off the coasts of Washington, Oregon and California. NMFS must promptly designate these areas as critical habitat.

B. Listing of the Southern Resident Killer Whale under the Endangered Species Act

In 2001, the Center filed a citizen petition to list the Southern Resident killer whale as an endangered species.[16] On July 1, 2002, NMFS determined that listing was "not warranted" because the petitioned whales did not constitute a distinct population segment ("DPS") under the ESA.[17] Specifically, NMFS found that the Southern Resident population of killer whales was not "significant" to the global *Orcinus orca* taxon, even though the agency's own experts concluded that this taxonomy was outdated.[18]

The Center partnered with nearly a dozen other conservation groups to challenge NMFS's "not warranted" determination.[19] On December 17, 2003, the U.S. District Court for the Western District of Washington found that NMFS had ignored the best available science, which indicated the existence of "unrecognized species or subspecies of killer whales within the

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[14] *Id.* § 1536(a)(2).
[15] Martin F. J. Taylor et al., *The Effectiveness of the Endangered Species Act: A Qualitative Assessment*, 55 BIOSCIENCE 360, 362 (2005).
[16] *See* Ctr. for Biological Diversity et al., Petition to List the Southern Resident Killer Whale (*Orcinus orca*) as an Endangered Species Under the Endangered Species Act (May 1, 2001).
[17] 12-Month Finding for a Petition To List Southern Resident Killer Whales as Threatened or Endangered Under the Endangered Species Act, 67 Fed. Reg. 44,133, 44,134 (July 1, 2002).
[18] *Id.* at 44,137 ("[NMFS's Biological Review Team] concluded that the current designation of one global species for killer whales is likely inaccurate because available data suggest that present taxonomy does not reflect current knowledge and additional species/subspecies of killer whales should be 'officially' recognized.").
[19] *See* Ctr. for Biological Diversity v. Lohn, 296 F. Supp. 2d 1223 (W.D. Wash. 2003).

currently recognized taxon," and ordered the agency to reexamine its decision.[20] NMFS subsequently determined that Southern Residents killer whales are "in danger of extinction" and listed this population as an endangered DPS.[21] At the time of listing, the agency did not designate critical habitat, but expressed its intent to initiate further rulemaking for this purpose.[22]

C. History of Critical Habitat for the Southern Resident Killer Whale

In 2006, NMFS designated three specific portions of the inland marine waters of Washington State, encompassing approximately 2,560 square miles, as critical habitat for the Southern Resident killer whale: the "core summer area," Puget Sound and the Strait of Juan de Fuca.[23] The agency determined that these areas contain essential habitat features, including: "(1) [w]ater quality to support growth and development; (2) [p]rey species of sufficient quantity, quality and availability to support individual growth, reproduction and development, as well as overall population growth; and (3) [p]assage conditions to allow for migration, resting, and foraging."[24] Specifically, the core summer area, consisting of the waters surrounding the San Juan Islands, the U.S. portion of the Georgia Strait and areas offshore of Skagit and Whatcom counties, constitutes a "primary feeding area" for Southern Resident killer whales, which congregate in this region from June to August to forage on migrating salmon.[25] Similarly, the presence of Southern Residents in Puget Sound coincides with fall salmon runs.[26] Whales use the third area of designated critical habitat, the Strait of Juan de Fuca, primarily as a transit corridor between inland and coastal waters.[27]

Although NMFS concluded in 2006 that coastal and offshore waters are "occupied" by Southern Resident killer whales and "important" to their survival, the agency declined to designate these areas as critical habitat due to uncertainty concerning the population's regional distribution and behavior.[28] Instead, NMFS explained that it had begun "an active research program" and pledged to "consider new information as it becomes available to inform future considerations of critical habitat for Southern Residents."[29]

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[20] *Id.* at 1232.
[21] Endangered Status for Southern Resident Killer Whales, 70 Fed. Reg. 69,903, 69,910 (Nov. 18, 2005).
[22] *Id*. at 69,912.
[23] Designation of Critical Habitat for Southern Resident Killer Whale, 71 Fed. Reg. 69,054, 69,066, 69,068 (Nov. 29, 2006).
[24] *Id.* at 69,061. Although NMFS acknowledged that "[c]ontinuous sounds may interfere with the whales' echolocation and communication," the agency then "lack[ed] sufficient information to include sound as a PCE of killer whale critical habitat." *Id.* at 69,055. As discussed below, recent research clarifies that excessive anthropogenic noise might disrupt important Southern Resident behaviors, thereby reducing the value of certain habitat areas. *See infra* Part III.C.
[25] Designation of Critical Habitat for Southern Resident Killer Whale, 71 Fed. Reg. at 69,062.
[26] *Id.* at 69,063.
[27] *Id*.
[28] *Id*.
[29] *Id*. at 69,063-64.

D. Revision of Critical Habitat Is Necessary

Since 2003, NMFS has received significant congressional funding to study Southern Resident killer whales, and the NWFSC, in collaboration with various private partners, has gained substantial insight into the population's winter range and foraging activities.[30] As NMFS recently acknowledged, "new information … confirms that … [S]outhern [R]esidents spend substantial time in coastal areas of Washington, Oregon and California and utilize salmon returns to these areas."[31] In light of this recent research, which represents "the best scientific data available,"[32] NMFS must revise the whales' critical habitat designation to include inhabited marine waters along the West Coast of the United States.

The NWFSC has employed a variety of techniques to enhance understanding of the Southern Resident population's offshore habitat use, including a coastal sighting network, passive acoustic recorders and multiple research cruises.[33] These efforts have been "very successful."[34] Notably, a team of scientists recently tracked a group of Southern Residents from late December 2012 to March 2013, collecting nearly daily location data as the whales traveled through more than 23,580 square kilometers of marine habitat between Point Reyes, California, and Cape Flattery, Washington.[35] Acoustic recordings further demonstrate that the population consistently occurs in this region between January and June.[36] Researchers have also observed whales engaging in foraging-like behavior at the mouth of the Columbia River in late March, coincident with the arrival of Chinook salmon,[37] and determined that portions of the population

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[30] *See, e.g.*, NOAA Fisheries Serv., *Southern Resident Killer Whales Research Update* (2011).
[31] Michael J. Ford, Nat'l Marine Fisheries Serv., *Status Review Update of Southern Resident Killer Whales* 26 (2013) [hereinafter *Status Review Update*]. In fact, evidence indicates that Southern Residents spend the majority of time in coastal and offshore waters. *Cf.* M. Bradley Hanson, et al., *Assessing the Coastal Occurrence of Endangered Killer Whales Using Autonomous Passive Acoustic Recorders*, 134 J. OF THE ACOUSTICAL SOC'Y OF AMERICA 3486, 3486 (2013) [hereinafter *Coastal Occurrence*] (explaining that "on average the whales occur in inland waters less than half of the days each year").
[32] *See* 16 U.S.C. § 1533(b)(2).
[33] *See* NOAA Fisheries Serv., *supra* note 30, at 3.
[34] *See, e.g.*, *id.* (explaining that passive acoustic recorders "have been very successful in detecting and recording Southern Resident killer whales … in offshore locations[,] … provid[ing] additional information on the timing and duration of the whale's [sic] movements through these areas" and that "research cruises have been very successful[,] … locat[ing Southern Residents] along the Washington and Oregon coasts on 3 of the past 4 cruises conducted by NWFSC scientists").
[35] Bradley M. Hanson et al., Abstract, *Informing Southern Resident Killer Whales Critical Habitat Designation in Their Winter Range along the U.S. West Coast* (forthcoming).
[36] *See Coastal Occurrence*, *supra* note 31, at 3490-91.
[37] Jeannette E. Zamon et al., *Winter Observations of Southern Resident Killer Whales (*Orcinus orca*) Near the Columbia River Plume during 2005 Spring Chinook Salmon (*Oncorhynchus tshawtscha*) Spawning Migration*, 88 NW. NATURALIST 193, 196 (2007); *see also Coastal Occurrence*, *supra* note 31, at 3493 ("[T]he timing of [Southern Resident killer whale] occurrence off the Columbia appears to coincide with the return of spring Chinook to the Columbia River."); see *also* Hanson et al., *supra* note 35 (In March, "[a]reas of focused use [for

exhibit contaminant concentrations consistent with the consumption of Columbia River and California Chinook.[38]

New research also identifies varied and significant threats to Southern Resident killer whales throughout their range, including inadequate prey, toxic contamination, ocean noise and vessel disturbances.[39] In light of these risks, the whales' coastal and offshore habitat may be more essential to their survival and recovery than previously realized.[40] Although existing critical habitat helps to preserve the population's summer range, NMFS must also protect essential winter foraging areas from further anthropogenic interference and degradation.

II. Natural History of the Southern Resident Killer Whale

A. Taxonomy and Description of the Southern Resident Killer Whale

Killer whales are the largest and perhaps the most strikingly pigmented cetacean in the family Delphinidae, which includes 17 genera of marine dolphins. Three forms, or ecotypes, of killer whales occur in the northeastern Pacific Ocean: "residents," "transients," and "offshores." Although experts traditionally regarded killer whales as a global taxon, recent studies demonstrating distinct genetic and morphologic variations between populations indicate that multiple species and subspecies exist worldwide.[41] According to NMFS' biologists, North Pacific resident killer whales constitute a "single unnamed subspecies," of which Southern Residents are a discrete and significant component.[42] The Southern Resident population itself consists of three distinct pods: J, K and L.

Southern Resident killer whales] were adjacent to numerous coastal rivers, particularly the Columbia River.").

[38] Margaret M. Krahn et al., *Persistent Organic Pollutants and Stable Isotopes in Biopsy Samples (2004/2006) from Southern Resident Killer Whales*, 54 MARINE POLLUTION BULLETIN 1903, 1909 (2007) [hereinafter *Persistent Organic Pollutants*]; *see also* Margaret M. Krahn et al., *Effects of Age, Sex and Reproductive Status on Persistent Organic Pollutant Concentrations in "Southern Resident" Killer Whales*, 58 MARINE POLLUTION BULLETIN 1522, 1527 (2009) [hereinafter *Age, Sex and Reproductive Status*] (concluding, on the basis of blubber biopsy samples, that certain Southern Resident killer whales "travel to California to forage, where high levels of DDT are found in prey," and noting that "[t]hese results have been substantiated by multiple sightings of [Southern Residents] in waters off the coast of central California").

[39] *See* sources cited *infra* Part III.

[40] *See, e.g.*, Katherine L. Ayres et al., *Distinguishing the Impacts of Inadequate Prey and Vessel Traffic on an Endangered Killer Whale (*Orcinus orca*) Population*, 7 PLOS ONE e36842, at *8-*9 (2012) (concluding that the Southern Resident population becomes "somewhat food limited during the course of the summer" and, therefore, that "the early spring period when the whales are typically in coastal waters might be a more important foraging time than was previously believed").

[41] Nat'l Marine Fisheries Serv., *Recovery Plan for Southern Resident Killer Whales (Orcinus* orca*)* II-1-2 (2008) [hereinafter *Recovery Plan*].

[42] *Id.* at II-2; *see also Status Review Update*, *supra* note 31, at 23-27 (recounting recent scientific developments concerning genetic, behavioral and cultural diversity among killer whales and

Killer whales are black dorsally and white ventrally, with a conspicuous white patch located slightly above and behind the eye. A highly variable gray or white saddle is usually present behind the dorsal fin. The shape of this saddle varies among individuals, pods and from one side to the other on a single animal. Sexual dimorphism occurs in body size, flipper size and the height of the dorsal fin. Among North Pacific killer whales, Southern Residents are recognizable by their distinctive dorsal fin shape and saddle patch pigmentation pattern.[43]

The average life expectancy for Southern Resident killer whales is approximately 27.6 years for males and 50 years for females.[44] Southern Residents exhibit a substantially lower probability of survival than do other North Pacific killer whale populations.[45] Moreover, life expectancy varies among Southern Resident pods, perhaps as a result of differences in geographic range and associated fluctuations in prey availability, exposure to contaminants and human activity levels.[46] For example, females in L pod have a median life expectancy of slightly over 20 years, approximately 10 years less than their counterparts in J and K pods.[47] These individuals also display relatively high concentrations of dichloro-diphenyl-trichloroethane ("DDT") in their blubber, consistent with winter migrations through central California and the increased consumption of Columbia River and California Chinook.[48] Evidence indicates that seasonal mortality among Southern Residents, including neonates, is highest during the winter and early spring, when the whales are in their coastal habitat.[49]

B. Distribution

Killer whales have the largest distribution of any marine mammal. Although researchers have identified the species in various habitats worldwide, including tropical regions and open ocean areas, these whales are most abundant in coastal waters and at high latitudes. In the northeastern Pacific Ocean, killer whales occur along the North American coast and continental

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concluding that "all available information clearly indicates that the [S]outhern [R]esidents are a distinct population" within the North Pacific resident taxon).

[43] Alexandre N. Zerbini et al., *Estimating Abundance of Killer Whales in the Nearshore Waters of the Gulf of Alaska and Aleutian Islands Using Line-Transect Sampling*, 150 MARINE BIOLOGY 1033, 1036 (2006).

[44] Ctr. for Biological Diversity et al., *supra* note 16, at 18.

[45] Eric J. Ward et al., *Effects of Multiple Levels of Social Organization on Survival and Abundance*, 25 CONSERVATION BIOLOGY 350, 353 (2011).

[46] *Id.*; *see also* Nw. Fisheries Sci. Ctr., *2014 Southern Resident Killer Whale Tagging*, http://www.nwfsc.noaa.gov/research/divisions/cb/ecosystem/marinemammal/satellite_tagging/blog2014.cfm (last visited Jan. 6, 2014) (explaining, on the basis of data derived from passive acoustic recorders, that "J pod does not appear to travel very far south along the Washington coast nor do they go to Oregon and California like K and L pods").

[47] Ward, *supra* note 45, at 353.

[48] *Persistent Organic Pollutants*, *supra* note 38, at 1909. In general, DDT is more prevalent among marine species from waters off the coast California than in comparable species from elsewhere in the northeastern Pacific Ocean, a phenomenon known as the "California signature." *Id.* at 1904.

[49] *Recovery Plan*, *supra* note 41, at II-42.

slope, extending from Alaska to California. The Southern Resident population ranges from the north end of the Queen Charlotte Islands, British Columbia, to Monterey Bay, California.[50]

As NMFS recognized in designating critical habitat for the Southern Resident killer whale, this population resides in the inland marine waters of British Columbia and Washington State from late spring to early autumn, congregating along major corridors for migrating salmon.[51] New evidence indicates that the Southern Residents' range spans the coastal waters of Washington, Oregon and California during the winter months.[52] For example, a team of scientists recently tracked these whales as they travelled extensively between Cape Flattery, Washington, and Point Reyes, California, from December 2012 to March 2013.[53] During this period, the whales generally confined their offshore movements to the continental shelf and slope, ranging to a maximum distance of 76 km offshore.[54] In addition, the whales focused their habitat use in areas adjacent to coastal rivers,[55] a behavior consistent with previously documented winter foraging patterns.[56]

C. Feeding and Prey Selection

As top level marine predators, killer whales consume over 140 species of fish, squid, mammals, reptiles and birds worldwide.[57] However, most populations have evolved specialized

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[50] Nw. Fisheries Sci. Ctr., *Southern Resident Killer Whale Tagging*, http://www.nwfsc.noaa.gov/research/divisions/cb/ecosystem/marinemammal/satellite_tagging/index.cfm (last visited Dec. 3, 2013); *but see Coastal Occurrence*, *supra* note 31, at 3493 (reporting that a Southern Resident killer whale sighting in southeast Alaska "represented an extension of this population's previously known range").

[51] Designation of Critical Habitat for Southern Resident Killer Whale, 71 Fed. Reg. 69,054, 69,061 (Nov. 29, 2006); *see also* Indep. Sci. Panel of the Bilateral Sci. Workshop to Evaluate the Effects of Salmon Fisheries on S. Resident Killer Whales, *The Effects of Salmon Fisheries on Southern Resident Killer Whales: Final Report of the Independent Science Panel* 28 (2012) [hereinafter *Final Report*] (explaining that, "[d]uring the April-June period," most sightings of Southern Resident killer whales occur "in coastal waters off northern Oregon and Washington and outside waters of Vancouver Island").

[52] *See, e.g*, *Coastal Occurrence*, *supra* note 31, at 3490-91 (reporting that passive acoustic recorders located between Cape Flattery, Washington, and Pt. Reyes, California, regularly detected Southern Resident vocalizations during the period from January to June, 2006-2011); *see also Final Report*, *supra* note 51, at 17 ("[D]ata from acoustic monitoring, photo-identification and contaminant signatures in blubber suggest some individuals spend substantial time in coastal waters off the coasts of Washington, Oregon and northern California.").

[53] Hanson et al., *supra* note 35.

[54] *Id.*

[55] *Id.*

[56] *See* Zamon et al., *supra* note 37, at 196; *see also Coastal Occurrence*, *supra* note 31, at 3493 (explaining that the occurrence of Southern Residents "off the Columbia River and Westport[, Washington,] in March" coincides with "the peak number of [Chinook salmon] in the ocean near Westport and the Columbia River mouth").

[57] Rüdiger Riesch et al., *Cultural Traditions and the Evolution of Reproductive Isolation: Ecological Speciation in Killer Whales?*, 106 BIOLOGICAL J. OF THE LINNEAN SOC'Y 1, 2 (2012).

diets and hunting skills, which are likely transmitted from generation to generation through social learning.[58] For example, in the inland marine waters of British Columbia and Washington State, residents use cooperative techniques and exploit submarine topography to concentrate and capture salmon,[59] while transients travel in smaller groups and employ stealthy foraging tactics better suited to the pursuit of wary marine mammals.[60] Unique hunting traditions operate as social isolating mechanisms, leading sympatric populations to become genetically and ecologically distinct.[61] Although specialization enhances hunting efficiency with respect to the preferred prey species, these adaptations impair a predator's ability to switch to alternative food sources in times of shortage.[62] For this reason, killer whale populations depend on a far narrower range of prey resources than the species is theoretically capable of consuming.[63]

During the summer months, Southern Resident killer whales preferentially consume Chinook salmon (*Oncorhynchus tshawytscha*), perhaps as a result of this species' large size and high mass-specific caloric content.[64] Additional prey species include chum (*O. keta*), coho (*O. kisutch*), steelhead (*O. mykiss*), sockeye (*O. nerka*) and various non-salmonids, such as Pacific herring (*Clupea pallasi*) and quillback rockfish (*Sebastes maliger*).[65] New evidence indicates that the whales' winter diet also consists primarily of Chinook, including fish originating in Puget Sound, as well as in the Klamath and Columbia Rivers.[66] This report is consistent with the

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[58] *Recovery Plan*, *supra* note 41, at II-16-17.

[59] Shannon Marie McCluskey, Space Use Patterns and Population Trends of Southern Resident Killer Whales (*Orcinus orca*) in Relation to Distribution and Abundance of Pacific Salmon (*Oncorhynchus* spp.) in the Inland Waters of Washington State and British Columbia 12 (2006) (unpublished M. Sc. thesis, University of Washington).

[60] *Recovery Plan*, *supra* note 41, at II-20.

[61] John K. B. Ford et al., *Linking Killer Whale Survival and Prey Abundance: Food Limitation in the Ocean's Apex Predator?*, 6 BIOLOGY LETTERS 139, 141 (2010).

[62] *Id.*

[63] *Id.*; *see also Final Report*, *supra* note 51, at 17 ("[I]t is biologically plausible for reduced Chinook salmon abundance to cause nutritional stress and impede recovery of the [Southern Resident killer whale] population.").

[64] Ayres et al., *supra* note 40, at *2. Specifically, Ayres et al. estimate that Fraser River Chinook comprise 80-90% of the Southern Residents' diet between May and September. *Id.* at *5.

[65] *Recovery Plan*, *supra* note 41, at II-18.

[66] Nw. Fisheries Sci. Ctr., *Cruise Report: Winter 2013 Southern Resident Killer Whale and Ecosystems*, http://www.nwfsc.noaa.gov/research/divisions/cb/ecosystem/marinemammal/satellite_tagging/winter_cruise.cfm (last visited Nov. 8, 2013); *see also Coastal Occurrence*, *supra* note 31, at 3493 (explaining that acoustic recordings "add[] credence to previous suggestions of the potential importance of Columbia River spring Chinook in the diet of at least some [Southern Resident] pods"); *see also* M. Bradley Hanson et al., *Pacific Orca Distribution Survey (PODS) Conducted Aboard the NOAA Ship* McArthur II *in March-April 2009* (Nat'l Marine Fisheries Serv., Final Cruise Report 2009-002, June 2010) (reporting that scale samples collected after a Southern Resident killer whale "predation event" in March 2009 matched Columbia River Chinook); *see also* Ayres et al., *supra* note 40, at *9 ("[T]he available information … suggest[s] that the whales may be feeding on Columbia River salmon."); *see also* Ford et al., *supra* note 61, at 141 (hypothesizing that Southern Residents "are dependent on Chinook salmon as their primary year-round food resource").

results of earlier studies and observations, demonstrating that certain Southern Residents regularly prey on high trophic level species, exhibit contaminant levels consonant with the consumption of Columbia River and California Chinook,[67] and engage in foraging-like behavior at the mouth of the Columbia River in late March, during the period when spring Chinook return to the region to spawn.[68]

According to recent estimates, Southern Resident killer whales must consume between 41,376 and 269,458 kilocalories per day, depending on age and sex.[69] Thus, if preying only on Chinook, the November 2008 population might have required as many as 951 fish each day, or approximately 347,000 fish annually.[70] Assuming the whales instead subsisted exclusively on chum, consumption would have increased significantly, potentially totaling 1,466,581 fish in a single year.[71] Given the total area of the Southern Residents' foraging ground and the energetic cost of searching for prey, these maximum consumption estimates likely represent the *minimum* number of fish required to meet the population's metabolic demands. Moreover, new research suggests that Southern Residents may require consistent Chinook availability, rather than "high numbers of fish that are only available for a short period of time," indicating that coastal foraging might be especially important to the population's survival and recovery.[72]

D. Reproduction

Southern Resident killer whales are polygamous. Paternity often occurs across pods, with prospective mating partners relying on dialectical differences to determine their degree of relatedness, thereby reducing the risk of inbreeding.[73] Females generally achieve sexual maturity by age 10 and, on average, bear healthy calves every 7.7 years, ultimately producing between 2.2 and 4.1 surviving offspring during their reproductive lifespans.[74] Calves are typically born in the autumn and winter months, and are first sighted during annual summer surveys.[75]

Various environmental and ecological factors may influence reproductive performance among Southern Residents and result in increased rates of calf mortality. For example, scarcity of prey and the accumulation of certain contaminants are correlated with decreased fecundity.[76] In addition, high levels of anthropogenic sound may mask vocalizations, which are likely

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[67] *See Persistent Organic Pollutants*, *supra* note 38, at 1909; *see also Age, Sex and Reproductive Status*, *supra* note 38, at 1527.
[68] *See* Zamon et al., *supra* note 37, at 196.
[69] Dawn P. Noren, *Estimated Field Metabolic Rates and Prey Requirements of Resident Killer Whales*, 27 MARINE MAMMAL SCI. 60, 72 (2011).
[70] *Id.* at 73.
[71] *Id.*
[72] Ayres et al., *supra* note 40, at *9.
[73] *Recovery Plan*, *supra* note 41, at II-39.
[74] *Id.* at II-41, II-59.
[75] Eric J. Ward et al., *Quantifying the Effects of Prey Abundance on Killer Whale Reproduction*, 46 J. OF APPLIED ECOLOGY 632, 633 (2009) [hereinafter *Prey Abundance*].
[76] *Id*.

integral to social cohesion and reproductive success.[77] In recent years, L pod has experienced lower reproductive rates and lower survival among viable offspring than either J or K pod.[78]

E. Abundance and Population Trends

Genetic and cultural evidence suggests that more than 200 Southern Resident killer whales inhabited the North Pacific Ocean before the mid- to late-1800s, when Euro-American settlement began to degrade natural resources and reduce the region's carrying capacity for whales.[79] According to modeled estimates and photo-identification studies, the population has undergone several additional declines since 1960, punctuated by periods of limited growth. During this time, the number of Southern Resident killer whales has varied widely, fluctuating between a low of 67 individuals in 1971 and a high of 98 in 1995.[80] The population experienced a sharp downturn between 1996 and 2001, rapidly decreasing from 97 individuals to 78.[81] When NMFS designated critical habitat in 2006, the Southern Resident population totaled 90 individuals.[82] As of September 2013, 81 whales remained.[83]

In contrast to previous declines, which researchers traced to distorted age- and sex-structures resulting from the mid-century practice of live-capture for aquaria, the population downturn of the early 2000s coincided with an "unprecedented" span of poor survival, affecting nearly all age groups and both sexes, as well as an extended period of poor reproduction.[84] These trends were especially pronounced among the members of L pod.[85] Moreover, although J and K pods have since begun to rebound, respectively achieving and approaching their largest sizes since the mid-1970s, L pod has declined to historic lows, totaling only 36 individuals in September 2013.[86] Researchers have attributed the most recent reductions and slow rate of recovery among Southern Resident killer whales to a variety of anthropogenic and ecological factors, including inadequate prey, exposure to persistent organic pollutants and vessel disturbance.[87]

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[77] Marla M. Holt et al., *Speaking Up: Killer Whales (Orcinus orca) Increase Their Call Amplitude in Response to Vessel Noise*, 125 J. OF THE ACOUSTICAL SOC'Y OF AMERICA EL27, EL28 (2009).
[78] *Recovery Plan*, *supra* note 41, at II-62.
[79] *Id.* at II-54. NFMS has estimated a minimum historical population of 140 whales. *Id.* at II-55-56.
[80] *Id.* at II-55. Slight discrepancies in annual counts reflect differences in reporting times. *Id.* at II-56.
[81] *Age, Sex and Reproductive Status*, *supra* note 38, at 1522.
[82] *Recovery Plan*, *supra* note 41, at II-55.
[83] Ctr. for Whale Research, *Southern Resident Killer Whale*s, http://www.whaleresearch.com/#!orcas/cto2 (last visited Oct. 30, 2013).
[84] *Recovery Plan*, *supra* note 41, at II-58.
[85] *Id.*
[86] Ctr. for Whale Research, *Southern Resident Killer Whales*, http://www.whaleresearch.com/#!orcas/cto2.
[87] *See, e.g.*, Ayres et al., *supra* note 40, at *2.

III. Threats to Southern Resident Killer Whales

A. Prey Unavailability

As described above,[88] Southern Resident killer whales are dietary specialists, who depend on adequate populations of Chinook salmon for their survival, social cohesion and reproductive success.[89] During the past century and a half, human activities, including overfishing, artificial propagation and habitat degradation, have profoundly reduced the regional abundance of these prey species, thereby contributing to Southern Resident population declines.[90] Even in areas where wild and farmed salmon stocks remain relatively numerous, patterns of seasonal availability may have changed, thus depriving killer whales of traditionally important prey.[91] Although Southern Residents might previously have altered their foraging range or expanded their diet in response to local depletion, recent widespread reductions in prey availability have likely foreclosed these survival strategies.[92]

In the northeastern Pacific region, most Chinook salmon stocks are at a fraction of their historical levels.[93] For example, the Columbia River basin once supported between 10 and 16 million fish, including a significant proportion of Chinook.[94] However, in the 1990s, regional returns averaged only 1.1 million salmon, representing a 90 percent decline from the population's former abundance.[95] Similarly, in California's Central Valley, previously robust Chinook runs are now severely diminished or altogether absent.[96] These local declines are not anomalous: throughout the western United States, every naturally spawning salmon population is currently listed under the ESA, a candidate for federal protection or likely to become endangered without specific intervention.[97]

Although hatchery production has partially compensated for these declines, artificial propagation also contributes to the depletion of wild salmon stocks.[98] For example, hatchery fish may introduce disease, alter the distribution of deleterious genes and increase competition for

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[88] *See supra* Part II.C.
[89] Ayres et al., *supra* note 40, at *2. *See also Recovery Plan*, *supra* note 41, at II-75 ("Reductions in prey availability may force whales to spend more time foraging and might lead to reduced reproductive rates and higher mortality.").
[90] *Recovery Plan*, *supra* note 41, at II-86; *see also* Nat'l Marine Fisheries Serv., *Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation: F/NWR/2010/06051* 143 (2011) [hereinafter, *Biological Opinion*] (finding that decreased Chinook abundance resulting from proposed fishing operations would "reduce the whale population by -0.5 to -1.3 whales").
[91] *Id.* at II-83.
[92] *Id.* at II-77; *but cf. Coastal Occurrence*, *supra* note 31, at 3493 (concluding that Southern Residents might recently have extended their foraging range to southeast Alaska because "Columbia River spring Chinook were scarce").
[93] Ayres et al., *supra* note 40, at *2.
[94] *Recovery Plan*, *supra* note 41, at II-82.
[95] *Id.*
[96] *Id.*
[97] *Id.*
[98] *Id.* at II-81.

food and other resources.[99] Recent declines in the physical size of five wild salmon species, including Chinook, may also be attributable to the influence of aquaculture.[100] Smaller fish likely reduce foraging effectiveness, requiring Southern Residents to expend more effort in consuming an amount of prey sufficient to satisfy their metabolic demands.[101] Moreover, size reductions amplify the effects of population declines, further limiting the biomass of salmon resources available to killer whales.[102]

Global warming and increasing ocean acidification, both effects of anthropogenic greenhouse gas pollution, pose additional threats to salmon recovery.[103] For example, rising ocean temperatures and changing wind patterns have reduced productivity in the California Current ecosystem, negatively impacting certain Chinook populations.[104] Moreover, climate change is likely to affect patterns of precipitation and snowmelt, altering traditional flows and the availability of food and habitat in rivers and streams essential to salmon migration and reproduction.[105] Given the clear correlation between declines in Chinook populations and mortality among Southern Residents,[106] any reduction in salmon abundance will likely have negative consequences for the whales.[107]

B. Toxic Contamination

Southern Resident killer whales are among the world's most chemically contaminated marine mammals.[108] Researchers have expressed specific concern about this population's exposure to high levels of organochlorines, including DDT, polychlorinated biphenyls ("PCBs") and polybrominated biphenyl ethers ("PBDEs"), which are associated with a broad array of negative health effects.[109] Since the 1920s, industrial and agricultural operations have released vast quantities of these highly persistent compounds, which often collect in oceans and enter the marine food chain.[110] Lipophilic organochlorines bioaccumulate through trophic transfer, ultimately concentrating in the fatty tissues of top-level predators, such as killer whales.[111]

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[99] *Id*.
[100] *Id.*
[101] *Id.*
[102] *Id.* at II-81-82.
[103] *Id.* at II-84.
[104] *See, e.g.*, Brian K. Wells et al., *Population Dynamics of Chinook Salmon* Oncorhynchus tshawytscha *Relative to Prey Availability in the Central California Coastal Region*, 457 MARINE ECOLOGY PROGRESS SERIES 125, 132 (2012) (describing a "probable connection between wind, habitat, prey resources, and Chinook salmon productivity").
[105] *Recovery Plan*, *supra* note 41, at II-84.
[106] *See, e.g.*, Ford et al., *supra* note 61, at 141.
[107] *Recovery Plan*, *supra* note 41, at II-84.
[108] *Id.* at II-91; *see also Prey Abundance*, *supra* note 75, at 636 ("Southern Residents are known to carry higher contaminant loads [than Northern Residents].").
[109] *See, e.g.*, *Age, Sex and Reproductive Status*, *supra* note 38, at 1522; *see also Recovery Plan*, *supra* note 41, at II-87 ("Organochlorines are frequently considered to pose the greatest risk to killer whales.")
[110] *Recovery Plan*, *supra* note 41, at II-87.
[111] *Id.*

Southern Residents acquire organochlorines through the consumption of contaminated prey, including Chinook salmon from Puget Sound, the Columbia River and central California.[112] Current levels of exposure to toxic pollution will likely rise during the coming decades, as human population growth, increased urbanization and intensified land use further contaminate coastal ecosystems.[113]

Within the Southern Resident population, the highest levels of organochlorines appear in calves, adult males and post-reproductive females.[114] Although juveniles of both sexes accumulate contaminants continuously until achieving sexual maturity and adult males continue to collect organochlorines throughout the remainder of their lives, reproductive females transfer a significant portion of their own burden to their calves during gestation and nursing.[115] As a result, mothers exhibit lower concentrations of contaminants than do their weaned offspring.[116] When lactation ceases and upon reproductive senescence, a female's organochlorine levels once again begin to rise.[117]

Long-term accumulation of organochlorines may lead to a variety of physiological responses, including increased risk of infection and dysfunction of the immune, reproductive and endocrine systems.[118] Indeed, researchers have suggested that immune suppression resulting from high levels of toxic contamination might have contributed to the increased mortality of Southern Residents in the mid-1990s.[119] Moreover, based on a threshold for PCB-related health effects in marine mammals, experts conclude that a large proportion of the Southern Resident population, particularly the young whales, currently risks serious complications arising from toxic contamination.[120]

C. Ocean Noise

Southern Resident killer whales employ their highly developed acoustic sensory system to navigate, locate prey and communicate with kin, mates and other conspecifics.[121] For example, individuals exchange calls to maintain cohesion and coordination during foraging activities.[122] Increased levels of anthropogenic sounds have the potential to impair these

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[112] *Id.* at II-96. These populations exhibit higher concentrations of DDT than do comparable salmon from British Columbia. *Id.* Puget Sound, in particular, is a major source of PCB and PBDE contamination. *Id.*

[113] *Id.*

[114] *Age, Sex and Reproductive Status*, *supra* note 38, at 1526.

[115] *Recovery Plan*, *supra* note 41, at II-92.

[116] *Id.*

[117] *Age, Sex and Reproductive Status*, *supra* note 38, at 1525.

[118] *Id.* at 1522.

[119] *Id.* at 1526.

[120] *Id.*; *see also Recovery Plan*, *supra* note 41, at II-93 ("[I]t is likely that all [Southern Residents] exceed the toxicity levels believed to cause health problems in other marine mammals.").

[121] *Recovery Plan*, *supra* note 41, at II-104.

[122] Marla M. Holt, *Sound Exposure and South Resident Killer Whales (*Orcinus orca*): A Review of Current Knowledge and Data Gaps* 6 (Nat'l Marine Fisheries Serv., Technical Memorandum NMFS-NWFSC-89, Feb. 2008).

communications, mask echolocation signals and permanently damage hearing sensitivity among Southern Residents,[123] thereby threatening the population's continued survival and reproductive success.[124] A variety of human activities, including dredging, drilling, construction, seismic testing and sonar use,[125] as well as global shipping operations,[126] contribute to ocean noise. Moreover, certain vessels emit sounds that directly overlap with the frequency of killer whale calls, significantly reducing the range at which echolocation can detect salmon in the water column.[127]

In extreme cases, exposure to high-intensity anthropogenic noise can lead to mass strandings or otherwise injure marine mammals.[128] More frequently, sound exposure results in physiological symptoms of stress, leading to hormonal changes and the increased production of cells related to immune function.[129] As global shipping activities steadily increased in recent decades, researchers began to take note of chronic ocean noise, which results from activities that collectively raise background levels by at least an order of magnitude over ecologically significant areas for prolonged periods of time.[130] Recent evidence suggests that chronic ocean noise may interfere with 97% of killer whale communication calls.[131] Individual whales may attempt to compensate for background noise by altering their signal's amplitude, duration, repetition rate, or frequency.[132] However, these adaptations might have energetic costs, increase stress levels or degrade communication so as to require increased physical activity.[133] Although it is difficult to relate small but consistent behavioral changes to population level effects, the

[123] *Recovery Plan*, *supra* note 41, at II-104; *see also* R. Williams et al., *Acoustic Quality of Critical Habitats for Three Threatened Whale Populations*, ANIMAL CONSERVATION 1, 2 (forthcoming) ("A species' acoustic 'communication space' (the predicted space over which animals can communicate) is decreased with the introduction of anthropogenic sound.").
[124] Holt et al., *supra* note 77, at EL28; *see also* Rob Williams et al., *Severity of Killer Whale Behavioral Responses to Ship Noise: A Dose-Response Study*, MARINE POLLUTION BULLETIN 1, 1 (forthcoming 2013) [hereinafter *Severity*] (explaining that "[t]here is no evidence that killer whales can adjust their echolocation patterns to compensate for masked signals used in foraging").
[125] *Recovery Plan*, *supra* note 41, at II-103.
[126] *See, e.g.*, *Severity*, *supra* note 124 ("Global shipping represents a large and growing contributor to ocean ambient soundscapes.").
[127] Holt, *supra* note 122, at 52.
[128] *Id.* at 32.
[129] *Id.* at 33.
[130] Williams et al., *supra* note 123, at 1.
[131] *Id.* at 6. This figure represents acoustic communication space lost in the "noisiest sites in British Columbia." *Id.* Researchers estimate less dramatic effects "[a]t closer distances and in the higher frequencies." *Id.*
[132] Holt et al., *supra* note 77, at EL28.
[133] *Id.* at EL30-31.

potential that increased ocean noise will amplify other threats to Southern Resident recovery is a matter of significant concern.[134]

Global warming and ocean acidification also contribute to rising levels of ambient noise, further impairing Southern Resident behavior and communication.[135] Specifically, increasingly acidic seawater reduces the occurrence of certain charged molecules, such as borate ions, which absorb energy from passing sound waves.[136] Thus, as pH levels decrease, ocean noise encounters fewer impediments and, ultimately, travels farther.[137] Researchers predict that ocean acidification will reduce the intrinsic ability of surface seawater to absorb sound at frequencies important to marine mammals by 40% before 2050.[138] In addition, rising global temperatures contribute to decreased sound absorption in the lower frequency range, amplifying the effects of increased acidification.[139]

D. Vessel Disturbances

U.S. seaports currently handle more than two billion tons of cargo each year, a total likely to double within the decade.[140] Much of this volume passes through increasingly busy shipping lanes off the coast of California,[141] posing a variety of risks to whales. For example, vessels occasionally collide with Southern Residents, resulting in injury or death.[142] In addition, exhaust emissions from marine engines deteriorate air quality, increasing the population's exposure to toxic contaminants.[143] Evidence indicates that killer whales might be especially sensitive to air pollution due to their respiratory anatomy, physiology and behavior.[144]

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[134] Holt, *supra* note 122, at 48. In contrast to the U.S., Canada recognizes "[a]coustic degradation of critical habitat … as a threat to killer whale recovery, and it is illegal to introduce sufficient noise in critical habitats to 'destroy' it." Williams et al., *supra* note 123, at 2.
[135] Keith C. Hester et al., *Unanticipated Consequences of Ocean Acidification: A Noisier Ocean at Lower pH*, 35 GEOPHYSICAL RES. LETTERS L19601, L19603-04 (2008).
[136] Peter G. Brewer et al., *Ocean Acidification and the Increasing Transparency of the Ocean to Low-Frequency Sound*, 22 OCEANOGRAPHY 86, 87 (2009).
[137] *Id.*
[138] *Id.*
[139] Hester et al., *supra* note 134, at L19604.
[140] Am. Ass'n of Port Auths., *U.S. Public Port Facts*, http://www.aapa-ports.org/Industry/content.cfm?ItemNumber=1032 (last visited Nov. 6, 2013).
[141] According to the U.S. Census Bureau, the ports of Long Beach, Los Angeles and Oakland, California, are among the five busiest in the country, measured by volume of container traffic. U.S. Census Bureau, *Statistical Abstract of the United States* 683 (131st ed. 2012).
[142] David Lusseau et al., *Vessel Traffic Disrupts the Foraging Behavior of Southern Resident Killer Whales* Orcinus orca, 6 ENDANGERED SPECIES RESEARCH 211, 212 (2009).
[143] Cara L. Lachmuth et al., *Estimation of Southern Resident Killer Whale Exposure to Exhaust Emissions from Whale-Watching Vessels and Potential Adverse Health Effects and Toxicity Thresholds*, 62 MARINE POLLUTION BULLETIN 792, 792 (2011).
[144] *Id.* at 802. Specifically, researchers predict that killer whales may suffer the detrimental effects of exhaust gas when exposed to as little as 39% of the human toxicity dose. *Id.*

Southern Residents respond to approaching vessels by employing various evasion tactics,[145] including faster swimming speeds, less predictable travel paths and altered patterns of surface behavior.[146] Avoidance techniques often vary between individuals and encounters. Specifically, reactions may depend on the number of vessels present, as well as their proximity, activity, size and "loudness."[147] Certain behavioral responses, such as tail slaps, pectoral fin slaps, leaps and jumps,[148] may involve increased energy expenditure.[149] Moreover, the presence of vessels may temporarily disrupt feeding, potentially reducing total energy acquisition.[150] Boat traffic likely harms all killer whales, including those who exhibit no signs of disturbance.[151] Specifically, Southern Residents forced to tolerate unfavorable conditions in traditional foraging areas nonetheless experience the detrimental effects of increased human activity.[152]

IV. Requested Revision of Critical Habitat

A. Areas Proposed for Designation

We request that the critical habitat designation for the Southern Resident killer whale be revised to include the region between Cape Flattery, Washington, (48° N, 124° W), and Point Reyes, California, (37° N, 123° W), extending from the coast to a distance of approximately 76 kilometers offshore.[153] As described above, scientific evidence confirms that Southern Residents use this area extensively during the winter and early spring for essential behaviors including feeding, calf rearing, and seasonal movements. Because we recognize that NMFS is continuing to analyze data describing the Southern Resident population's use of coastal and offshore waters, we request that the agency refine this proposal, as necessary, to include additional inhabited zones or to focus specifically on areas of concentrated use.

B. Proposed Primary Constituent Elements

Pursuant to the ESA, critical habitat must contain "physical or biological features … essential to the conservation of the species[,] which may require special management

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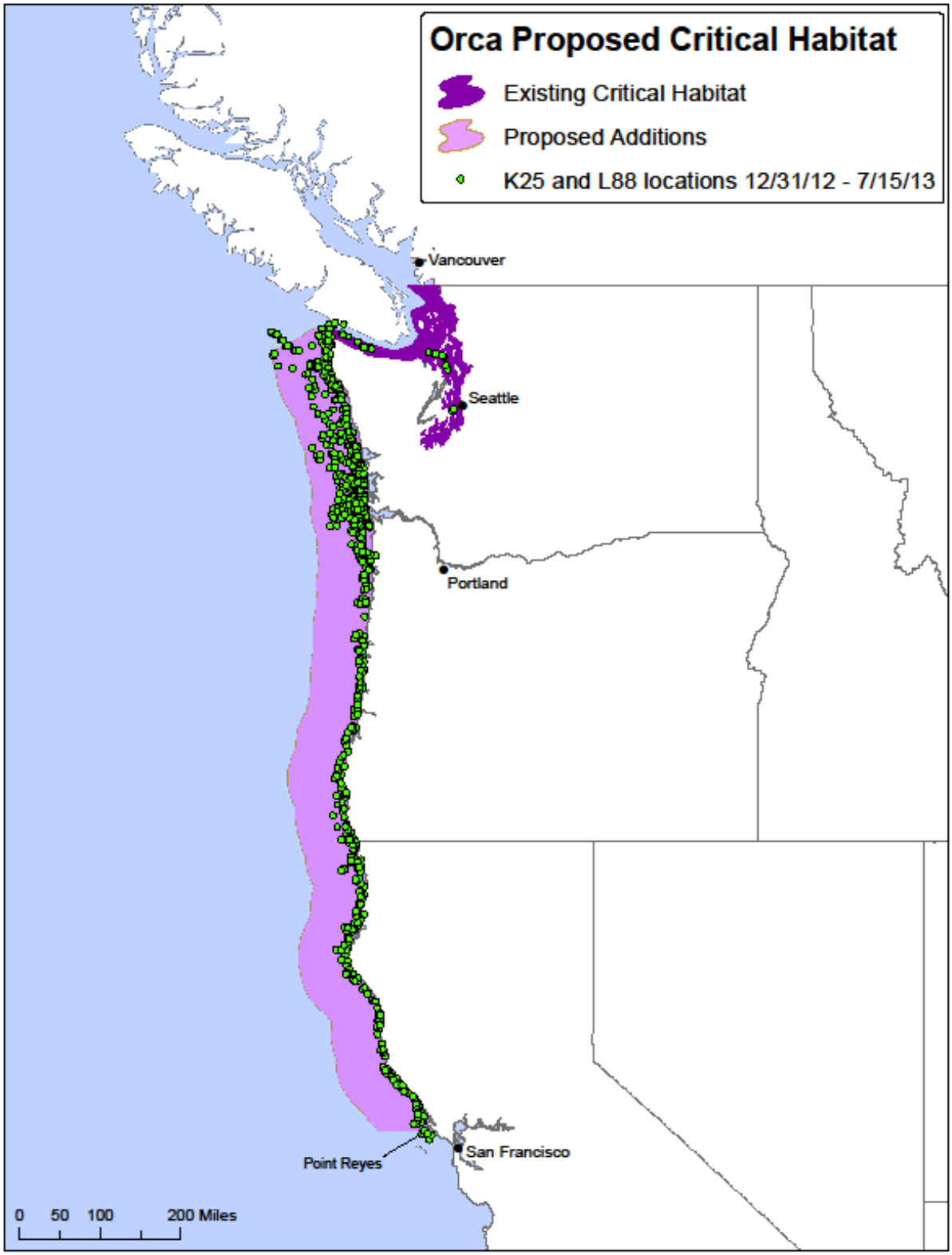
[145] Rob Williams et al., *Effects of Vessels on Behavior Patterns of Individual Southern Resident Killer Whales* Orcinus orca, 6 ENDANGERED SPECIES RESEARCH 199, 206 (2009).
[146] *Recovery Plan*, *supra* note 41, at II-106-07.
[147] *Id.* at II-107.
[148] D.P. Noren et al., *Close Approaches by Vessels Elicit Surface Active Behaviors by Southern Resident Killer Whales*, 8 ENDANGERED SPECIES RESEARCH 179, 180 (2009). These behaviors might represent attempts to communicate with conspecifics despite elevated background noise levels. *Id.*
[149] Lusseau, *supra* note 142, at 212.
[150] *Id.* (noting that "[w]hales were significantly less likely to be foraging and significantly more likely to be traveling when boats were around"); *see also Severity*, *supra* note 124 ("[K]iller whales spend less time feeding in the presence of boats than during no-boat control conditions.").
[151] Noren, *supra* note 148, at 189-90.
[152] *Id*.
[153] *See* Figure, *infra* p. 18.

Figure: Proposed Critical Habitat



considerations or protection."[154] Commonly referred to as "primary constituent elements" ("PCEs"), these features may include, but are not limited to:

> (1) [s]pace for individual and population growth, and for normal behavior; (2) [f]ood, water, air, light, minerals, or other nutritional or physiological requirements; (3) [c]over or shelter; (4) [s]ites for breeding, reproduction, or rearing of offspring; and generally; (5) [h]abitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of the species.[155]

In designating critical habitat, NMFS must "focus on" those characteristics of the relevant area that are required for conservation, such as feeding sites and water quality.[156] Based on the natural history of Southern Resident killer whales and their habitat needs, NMFS has identified the following essential features of the population's summer habitat: "(1) [w]ater quality to support growth and development; (2) [p]rey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth; and (3) [p]assage conditions to allow for migration, resting, and foraging."[157] As the scientific research set forth throughout this petition makes clear, each of these primary constituent elements is also an essential characteristic of the whales' Pacific Ocean habitat.

Moreover, in revising the critical habitat designation for Southern Resident killer whales, NMFS must also preserve waters in which anthropogenic noise does not exceed levels that inhibit communication, disrupt foraging activities, or result in hearing loss or habitat abandonment. In its 2004 proposed critical habitat rule, NMFS identified "[s]ound levels that do not exceed thresholds that inhibit communication or foraging activities or result in temporary or permanent hearing loss" as a primary constituent element of Southern Resident killer whale critical habitat.[158] Despite receiving "many" comments concerning "the potential for sound to startle or even physically injure killer whales," as well as evidence demonstrating that "killer whales abandon certain habitats when confronted with introduced noise," in its final rule, the agency concluded that it "lack[ed] sufficient information to include sound as a PCE."[159] Nonetheless, NMFS expressed its intention "to consider sound in … future revisions of critical habitat."[160]

Since 2006, researchers have gathered substantial information demonstrating that excessive anthropogenic noise compromises vulnerable marine ecosystems, impeding the survival and recovery of imperiled species.[161] Indeed, as NMFS recently acknowledged, the best

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[154] 16 U.S.C. § 1532(5).
[155] 50 C.F.R. § 424.12(b).
[156] *Id.*
[157] *Id.* § 226.206.
[158] Proposed Threatened Status for Southern Resident Killer Whales, 69 Fed. Reg. 76,673, 76,681 (Dec. 22, 2004).
[159] Designation of Critical Habitat for Southern Resident Killer Whales, 71 Fed. Reg. 69,054, 69,054-55 (Nov. 29, 2006).
[160] *Id.* at 69,055.
[161] *See, e.g.*, Christine Erbe et al., *Mapping Cumulative Noise from Shipping to Inform Marine Spatial Planning*, 132 J. OF THE ACOUSTICAL SOC'Y OF AMERICA EL423, EL423 (2012)

scientific data now available indicates that sound is an essential characteristic of cetacean habitat.[162] As discussed above,[163] Southern Residents rely on sound to navigate, locate prey and communicate with conspecifics.[164] A variety of human activities, including shipping operations, have the potential to impair these functions by generating additional ocean noise, resulting in the acoustic degradation of killer whale habitat.[165] Global warming and increasing ocean acidification, both products of anthropogenic greenhouse gas emissions, also contribute to rising levels of ambient noise.[166] Among Southern Resident killer whales, exposure to excessive sound levels can lead to injury, including permanent damage to hearing sensitivity, as well as physiological symptoms of stress.[167] Absent agency intervention, these effects are likely to become more frequent, as vessel traffic[168] and atmospheric carbon increase.[169] Accordingly, we petition the agency to adopt a fourth PCE for the Southern Resident killer whale for both its summer and winter range critical habitat areas providing for in-water sound levels that: (1) do not exceed thresholds that inhibit communication or foraging activities, (2) do not result in temporary or permanent hearing loss to whales, and (3) do not result in the abandonment of critical habitat areas.

C. Revision Meets the Requirements of the ESA

1. Critical Habitat Designation Is both Prudent and Determinable

Pursuant to the ESA and its implementing regulations, NMFS must designate critical habitat "to the maximum extent prudent and determinable" upon listing a species as threatened or endangered.[170] Thereafter, the agency may revise this designation "from time-to-time … as appropriate."[171] Designation is "not prudent" if "(i) [t]he species is threatened by taking or other human activity, and identification of critical habitat can be expected to increase the degree of such threat to the species, or (ii) [s]uch designation of critical habitat would not be beneficial to

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(explaining that "[a]nthropogenic ocean noise is increasingly considered a chronic, habitat-level stressor requiring area-based management tools").

[162] *See* Designation of Critical Habitat for Cook Inlet Beluga Whale, 76 Fed. Reg. 20,180, 20,203 (Apr. 11, 2011) (listing "[w]aters with in-water noise below levels resulting in the abandonment of critical habitat areas" as a "physical or biological feature essential to the conservation" of Cook Inlet beluga whales, because "[a]nthropogenic noise above ambient levels may cause behavioral reactions in whales (harassment) or mask communication between these animals," possibly resulting in "abandonment of habitat," and "noise may result in temporary or permanent damage to the whales' hearing").

[163] *See supra* Part III.C.

[164] *See Recovery Plan*, *supra* note 41, at II-104.

[165] *See supra* notes 125-27 and accompanying text.

[166] *See supra* notes 135-39 and accompanying text.

[167] *See supra* notes 128-29 and accompanying text.

[168] *See supra* notes 140-41 and accompanying text.

[169] *See supra* note 138 and accompanying text.

[170] 16 U.S.C. § 1533(a)(3)(A)(i); 50 C.F.R. § 424.12(a).

[171] 16 U.S.C. § 1533(a)(3)(A)(ii). NMFS' regulations do not clearly indicate whether the "prudent" and "determinable" standards also govern *revisions* to critical habitat. For the reasons set forth below, the proposed expansion easily satisfies these requirements, if applicable.

the species."[172] Critical habitat is "not determinable" if "(i) [i]nformation sufficient to perform required analyses of the impacts of the designation is lacking, or (ii) [t]he biological needs of the species are not sufficiently well known to permit identification of an area as critical habitat."[173]

In the present situation, revision is clearly "prudent." No evidence suggests that recognition of the Southern Residents' winter range would place the whales at greater risk. Moreover, NMFS has acknowledged that the petitioned areas are "important" to the population's survival and recovery.[174] As discussed above, recent research has greatly expanded our understanding of Southern Resident ecology, physiology and behavior, further illustrating the essential character of the whales' seasonal distribution.[175] Thus, the expansion of critical habitat will benefit Southern Resident killer whales.

The Southern Resident killer whales' winter range is "determinable." As discussed above, the NWFSC has been "very successful" in acquiring additional information about the population's presence in specific offshore areas, utilizing various techniques such as a land-based sighting network, passive acoustic monitoring and coastal research cruises.[176] Last winter, a satellite-tagging project yielded detailed data describing the whales' movements through their offshore habitat.[177] As NMFS has acknowledged, this "new information … confirms that the [S]outhern [R]esidents spend substantial time in coastal areas of Washington, Oregon and California and utilize salmon returns to these areas."[178] Since 2006, researchers have also gained further insight into the population's behavior, ecology, health and response to anthropogenic pressures. Thus, the agency has sufficient information concerning the whales' seasonal distribution and biological needs to identify additional critical habitat and analyze the impacts of such designation.

2. The Proposed Areas Contain Physical and Biological Features Essential to the Conservation of the Species.

In 2006, NMFS acknowledged that "some [essential characteristics], such as prey, must be present to support [Southern Resident killer] whales" in inhabited Pacific Ocean waters, but concluded that it could not designate this region as critical habitat absent "sufficient data to describe [the relevant characteristics] adequately and identify 'specific areas'" where they occur.[179] As described below, new information confirms that the whales' winter habitat exhibits

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[172] *Id.* § 424.12(a)(1).
[173] *Id.* § 424.12(a)(2).
[174] Designation of Critical Habitat for Southern Resident Killer Whale, 71 Fed. Reg. 69,054, 69,063 (Nov. 29, 2006).
[175] *See, e.g.*, Ayres et al., *supra* note 40, at *9 (concluding that Southern Residents likely require "consistent Chinook availability" throughout the year, rather than merely "high numbers of fish" during the summer months).
[176] NOAA FISHERIES SERV., *supra* note 30, at 3.
[177] Hanson et al., *supra* note 35.
[178] *Status Review Update*, *supra* note 31, at 26.
[179] Designation of Critical Habitat for Southern Resident Killer Whale, 71 Fed. Reg. 69,054, 69,063 (Nov. 29, 2006); *see also* Nw. Fisheries Sci. Ctr., *Southern Resident Killer Whale Tagging*, http://www.nwfsc.noaa.gov/research/divisions/cb/ecosystem/

multiple essential characteristics, each of which requires proper management to ensure the population's persistence and recovery throughout its range. For example, NMFS recently acknowledged that Southern Residents "utilize salmon returns to [the coastal areas of Washington, Oregon and California]."[180] In fact, scientific evidence suggests that the whales may be especially reliant on this "early spring, nutrient-rich food source."[181] Recent studies have also expanded understanding of the Southern Residents' winter range,[182] identified specific areas used for foraging[183] and migration,[184] and clarified the risks to social cohesion and individual health arising from anthropogenic noise in excess of ambient levels.[185] In short, "the best scientific data available" demonstrates that NMFS must designate additional critical habitat to protect these essential features from further anthropogenic interference and degradation.[186]

a. Space for Population Growth and Normal Behavior

As NMFS has recognized, the proposed additions to critical habitat are seasonally "occupied" by Southern Resident killer whales and "important" to the population's recovery.[187] Since 2003, the agency has employed a variety of techniques to gather substantial new information concerning the whales' use of coastal and offshore areas for normal behavior.[188]

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marinemammal/satellite_tagging/index.cfm (explaining that the agency required additional information to discern "patterns of habitat use [which would] allow for determination of essential features").

[180] *Status Review Update*, *supra* note 31, at 26.

[181] Ayres et al., *supra* note 40, at *8-*9 (concluding that "the early spring period when the whales are typically in coastal waters might be a more important foraging time than was previously believed").

[182] *See, e.g.*, Hanson et al., *supra* note 35.

[183] *See, e.g., id.* (explaining that Southern Resident killer whales congregated in areas "adjacent to numerous coastal rivers, particularly the Columbia River," in March 2013); *see also Coastal Occurrence*, *supra* note 31, at 3493 ("[T]he timing of [Southern Resident killer whale] occurrence off the Columbia appears to coincide with the return of spring Chinook to the Columbia River."); *see also* Zamon et al., *supra* note 37, at 196 (reporting that a group of Southern Residents engaged in behavior "resembling that described for Killer Whales foraging on Chinook Salmon" at the mouth of the Columbia River in March 2005, and concluding that "a March-April appearance of [k]iller [w]hales near the Columbia River may be a recurring phenomenon"); *see also* Designation of Critical Habitat for Southern Resident Killer Whale, 71 Fed. Reg. 69,054, 69,061 (Nov. 29, 2006) ("Individual knowledge of productive feeding areas and other special habitats is probably important in the selection of locations visited and is likely a learned tradition passed from one generation to the next.").

[184] *See, e.g.*, Hanson et al., *supra* note 35.

[185] *See supra* Part III.C.

[186] *See* 16 U.S.C. 1533(b)(2).

[187] Designation of Critical Habitat for Southern Resident Killer Whale, 71 Fed. Reg. at 69,063.

[188] As previously noted, NMFS has characterized these research efforts as "very successful." *See supra* notes 34, 176 and accompanying text. For example, the agency's "enhanced coastal sighting network" has yielded "valuable data," leading to an approximate 33 percent increase in annual observations of Southern Resident killer whales in Pacific Ocean waters. Nw. Fisheries Sci. Ctr., *Southern Resident Killer Whale Tagging*, http://www.nwfsc.noaa.gov/research/

Notably, as described above,[189] a recent satellite tracking project yielded nearly daily data describing the population's movements through the petitioned region from late December 2012 to March 2013, revealing specific areas important for foraging and migration.[190] In combination with other studies and observations, this project provides NMFS with detailed information concerning the Southern Resident population's established patterns of Pacific Ocean habitat use,[191] thus enabling the agency to provide additional protections.

The petitioned coastal and offshore waters also constitute space necessary for population growth. As discussed above,[192] the November 2008 Southern Resident population would likely have required *at least* 347,000 Chinook salmon, or 1,466,581 chum, to meet its annual metabolic demands.[193] Moreover, new research indicates that "the early spring period when the whales are typically in coastal waters might be a more important foraging time than was previously believed."[194] To find prey and "fulfill other life history requirements," Southern Resident killer whales "require open waterways that are free from obstruction."[195] As the number of whales increases, the Southern Resident population will need to consume additional prey during the crucial period spent in Pacific Ocean waters. However, absent an expansion of critical habitat, adequate salmon abundance to support population growth and sufficient area for migration, resting and foraging might be unavailable.[196]

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divisions/cb/ecosystem/marinemammal/satellite_tagging/index.cfm. In addition, passive acoustic recorders have detected Southern Resident activity between Cape Flattery, Washington, and Point Reyes, California, on approximately 180 occasions during the past six years. *Id.*

[189] *See supra* notes 35, 53-55, 177, 182-84 and accompanying text.

[190] *See* Hanson et al., *supra* note 35; *see also* Figure, *supra* page 18; *see also* Nw. Fisheries Sci. Ctr., *Cruise Report: Winter 2013 Southern Resident Killer Whale and Ecosystems*, http://www.nwfsc.noaa.gov/research/divisions/cb/ecosystem/marinemammal/satellite_tagging/winter_cruise.cfm (last visited Nov. 8, 2013) (reporting that a team of scientists "observed Southern Residents feeding on salmon on numerous occasions" during a research cruise last winter).

[191] For example, satellite tracking data confirms that the whales' consistently occur between Cape Flattery, Washington, and Pt. Reyes, California, each winter, a fact already established through the use of acoustic monitoring. *See* Nw. Fisheries Sci. Ctr., *Southern Resident Killer Whale Tagging*, http://www.nwfsc.noaa.gov/research/divisions/cb/ecosystem/marinemammal/satellite_tagging/index.cfm. Similarly, the recent tracking project bolsters earlier observations suggesting that Southern Residents forage on Chinook salmon at the mouth of the Columbia River each year during the early spring. *See* Zamon et al., *supra* note 37, at 196-97.

[192] *See supra* notes 70-71 and accompanying text.

[193] Noren, *supra* note 69, at 73; *see also Biological Opinion*, *supra* note 90, at 85 (explaining that, during some seasons, the prey available to Southern Residents exceeds the total number of kilocalories required by the population only by a factor of 3.2-7.9).

[194] Ayres et al., *supra* note 40, at *9.

[195] Designation of Critical Habitat for Southern Resident Killer Whale, 71 Fed. Reg. 69,054, 69,061 (Nov. 29, 2006).

[196] *See, e.g.*, *Biological Opinion*, *supra* note 90, at 85 (reviewing the results of demographic modeling and concluding that "prey is a factor limiting killer whale population growth").

b. Food and Water

In 2006, NFMS determined that "[f]ish are the major dietary component of resident killer whales in the northeastern Pacific," and, in particular, "salmon are clearly preferred as prey."[197] As discussed above,[198] recent studies demonstrate that Southern Residents consume primarily Chinook salmon, "probably because of this species' comparatively large size, high lipid content, and *year-round availability in the whales' coastal habitat*."[199] Evidence indicates that Southern Residents require consistent salmon abundance for their survival, fecundity and social cohesion.[200] Indeed, experts have suggested that coastal foraging "might be of particular importance for the nutrition of this population."[201] In light of predation events recently reported by agency scientists,[202] there can be no doubt that the availability of food resources is an essential characteristic of inhabited Pacific Ocean waters. Moreover, as described above, new information reveals established patterns of Southern Resident habitat use, including specific areas consistently used for foraging.[203]

As NMFS has acknowledged, "[i]n addition to a sufficient biomass of prey species," Southern Residents require food sources free "of contaminants that exceed levels that can cause mortality or reproductive failure."[204] A significant proportion of this population, especially the young whales, currently risks a wide array of health effects arising from accumulated toxics, including immune dysfunction, which experts have linked to previous Southern Resident declines.[205] Exposure to pollutants will likely increase during the coming decades, as human

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[197] Designation of Critical Habitat for Southern Resident Killer Whale, 71 Fed. Reg. at 69,060.
[198] *See supra* notes 64, 66-68, 89 and accompanying text.
[199] Ford et al., *supra* note 61, at 131 (emphasis added).
[200] Ayres et al., *supra* note 40, at *2; *see also* Ford et al., *supra* note 61, at 141 (recognizing "[t]he striking correspondence between changes in Chinook salmon abundance and [Southern Resident] mortality" and concluding that "prey limitation was an important factor in recent population declines"); *see also Prey Abundance*, *supra* note 75 at 635 ("Following highly productive salmon years, the probability of calving [among Southern Resident killer whales] is 50% higher at the populations level compared to years following low salmon years."); *see also* Designation of Critical Habitat for Southern Resident Killer Whale, 71 Fed. Reg. at 69,060 ("Sufficient prey abundance is necessary to support individual growth to reach sexual maturity and reproduction, including lactation and successful rearing of calves.").
[201] Ayres et. al, *supra* note 40, at *8-*9 (explaining that Southern Residents "become somewhat food limited during the course of the summer" and thus "the early spring period when the whales are typically in coastal waters might be a more important foraging time than was previously believed").
[202] *See* Nw. Fisheries Sci. Ctr., *Cruise Report: Winter 2013 Southern Resident Killer Whale and Ecosystems*, http://www.nwfsc.noaa.gov/research/divisions/cb/ecosystem/marinemammal/satellite_tagging/winter_cruise.cfm (last visited Nov. 8, 2013).
[203] *See, e.g.*, *supra* note 183 and accompanying text.
[204] Designation of Critical Habitat for Southern Resident Killer Whale, 71 Fed. Reg. at 69,060-61.
[205] *Age, Sex and Reproductive Status*, *supra* note 38, at 1526; *see also Recovery Plan*, *supra* note 41, at II-93 ("[I]t is likely that all [Southern Residents] exceed the toxicity levels believed to cause health problems in other marine mammals.").

population growth, increased urbanization and intensified land use further contaminate coastal ecosystems.[206] To insure water quality levels suitable for the conservation of Southern Resident killer whales, NMFS must oversee the regulation, discharge and remediation of chemical compounds affecting this population's prey species and coastal habitat.

c. Sites for Breeding, Reproduction, and the Rearing of Offspring

Although "small numbers of conceptions apparently happen year-round,"[207] most Southern Resident killer whale births occur during the autumn and winter months, while the whales are in their coastal habitat.[208] Given the small number of reproductively active adults,[209] the high incidence of calf mortality,[210] especially among members of L pod,[211] and the myriad threats to this population's survival and recovery, special management considerations and protection mechanisms are likely essential to preserve this region's value as a nursery area for Southern Resident mothers and their calves.

d. Habitats that Are Protected From Disturbance and Are Representative of the Southern Residents' Historic Distribution

Few data describe the Southern Resident population's historic range.[212] However, as NMFS has acknowledged, the whales consistently "occupy [the petitioned Pacific Ocean] waters for a portion of the year."[213] As described above, human activities in this region may impede the population's continued survival and reproductive success.[214] For example, chronic ocean noise can cause strandings, injuries and physiological symptoms of stress, potentially reducing the population's ability to cope with other anthropogenic threats. In addition, vessel traffic may harm Southern Residents directly, by emitting toxic air pollutants, for example, or indirectly, by disrupting foraging behavior. To preserve the whales' coastal habitat from excessive disturbance, NMFS must participate in decisions regarding shipping activities and other modes of interference with the population's normal behavior.

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[206] *Recovery Plan*, *supra* note 41, at II-96.
[207] *Id.* at II-39.
[208] *Prey Abundance*, *supra* note 75, at 633. Evidence indicates that seasonal mortality rates among neonates also peak during this period. *Recovery Plan*, *supra* note 41, at II-42; *see also* Designation of Critical Habitat for Southern Resident Killer Whale, 71 Fed. Reg. at 69,061 ("Births occur largely from October to March, but may take place in any month, and, therefore, potentially in any part of the whales' range." (citation omitted)).
[209] *Prey Abundance*, *supra* note 75, at 633 ("[I]n the declining southern population, female fertility may be limited by the number of mature males."); *see also Recovery Plan*, *supra* note 41, at II-62 (explaining that "calf productivity in L pod has dropped by about 35 percent in the past 12 years," perhaps as a result "of the females of this pod having only one fully mature adult male from J and K pod to mate with between 1998 and 2003").
[210] *See* Ctr. for Biological Diversity et al., *supra* note 16, at 16 (reporting that Southern Resident calves have "a mortality rate of up to 50%" during their first year of life).
[211] *See, e.g.*, *Recovery Plan*, *supra* note 41, at II-62.
[212] *Prey Abundance*, *supra* note 75, at 638.
[213] Designation of Critical Habitat for Southern Resident Killer Whale, 71 Fed. Reg. 69,054, 69,063 (Nov. 29, 2006).
[214] *See supra* Part III.C.

3. The Proposed Areas Require Special Management Considerations and Protection.

The Southern Residents' coastal habitat needs special management to address ongoing threats to the killer whales. Without proper oversight, human activities will continue to degrade this region, compromising the continued existence of habitat characteristics required for the population's survival and recovery. As NMFS is aware, anthropogenic pressures have already contributed to the decline of salmon stocks throughout the northwestern United States. Nutritional stress resulting from low Chinook abundance may act synergistically with the immunosuppressive effects of toxic contaminants, present in prey species from both coastal and inland marine waters, causing Southern Residents to experience a variety of adverse health effects, including increased mortality.[215] The population may be unable to adapt to further reductions in prey availability.[216] Thus, NMFS must ensure that federal projects, including those affecting riparian habitat, fishing practices, hydropower system management and hatchery operations, do not further impair the whales' winter foraging areas.

CONCLUSION

Recent scientific studies define the boundaries of the Southern Resident killer whale's winter range and demonstrate the importance of this region to the population's continued survival and recovery. The marine waters of the West Coast of the United States satisfy the definition of "critical habitat" set out in the ESA because they contain certain physical and biological characteristics, described above, which are essential to the whales' conservation and which urgently require special management considerations and protection.[217] Thus, we request that NMFS revise the critical habitat designation for Southern Resident killer whale to include the petitioned Pacific Ocean waters.

[215] Ford et al., *supra* note 61, at 141.
[216] *Recovery Plan*, *supra* note 41, at II-77.
[217] *See* 16 U.S.C. § 1532(5).