Endangered Species Act- Section 7 Formal Consultation Biological Opinion

Effects of the 2008 Pacific Coast Salmon Plan Fisheries on the Southern Resident Killer Whale Distinct Population Segment (*Orcinus orca*) and their Critical Habitat

Lead Action Agency: Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service

Consultation Conducted by: National Marine Fisheries Service, Northwest Region

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TABLE OF CONTENTS

I. BIOLOGICAL OPINION

A. Introduction

This document constitutes the National Marine Fisheries Service's (NMFS) biological opinion (Opinion) regarding the effects of the 2008-2009 Pacific coast salmon fisheries on the Southern Resident killer whale (*Orcinus orca*) distinct population segment. The fisheries assessed by this Opinion would be conducted in the U.S. Exclusive Economic Zone (EEZ) of the Pacific Ocean. These fisheries are managed under the jurisdiction of the Pacific Fisheries Management Council (PFMC) and target primarily Chinook (*Oncorhynchus tshawytscha*) and coho salmon (*O. kisutch*), although pink salmon (*O. gorbuscha*) are taken incidentally during odd-numbered years (e.g., 2005, 2007). The Opinion was prepared by NMFS in accordance with section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531, et seq.), and implementing regulations found at 50 CFR 402. NMFS is both the action agency and the consulting agency with respect to the PFMC Fisheries.

B. Consultation History

Since 1996, NMFS has considered the effects of the PFMC fisheries on salmon species listed under the ESA and issued biological opinions based on the regulations implemented each year (see Appendix 1). The Southern Resident killer whale distinct population segment (DPS) was listed as endangered under the ESA on November 18, 2005, which became effective February 16, 2006 (70 FR 69903). Following the listing, NMFS conducted consultations to evaluate effects of the 2006-2007 and 2007-2008 PFMC fisheries on the Southern Residents DPS. Critical habitat was designated for the Southern Resident killer whales on November 29, 2006.

On April 22, 2008 PRD received a Biological Assessment from SFD regarding effects of the Pacific Coast Salmon Plan during the 2008-2009 annual regulatory cycle (NMFS 2008a). In addition, supplemental information was received April 29, 2008 (S. Bishop, pers. comm., April 29, 2008). The following listed species under the jurisdiction of NMFS may occur in the action area that would be covered by the proposed action and may be affected:

Endangered
Marine Mammals
Southern Resident killer whale
(distinct population segment) *Orcinus orca*

C. Proposed Action

NMFS proposes to implement regulations for the ocean salmon fishery within the Pacific U.S. Exclusive Economic Zone (EEZ). These ocean fisheries are primarily recreational and commercial troll fisheries that use hook-and-line gear to catch salmon and target coho and Chinook. Annual management recommendations are developed according to the PFMC's

"Pacific Coast Salmon Plan" (FMP) and apply to the period from May 1 of the current year through April 30 of the following year. The 2008 regulations, which are the subject of this Opinion, apply from May 1, 2008 through April 30, 2009. The PFMC fisheries use catch quotas and landing limits; if the fishery reaches the catch quotas or landing limits before the end of the scheduled open period, the fishery will close. SFD estimate a mortality of 93,900 Chinook and 66,150 coho, which includes fish harvested (quotas), and mortality associated with fish caught and released, and hooked but not caught.

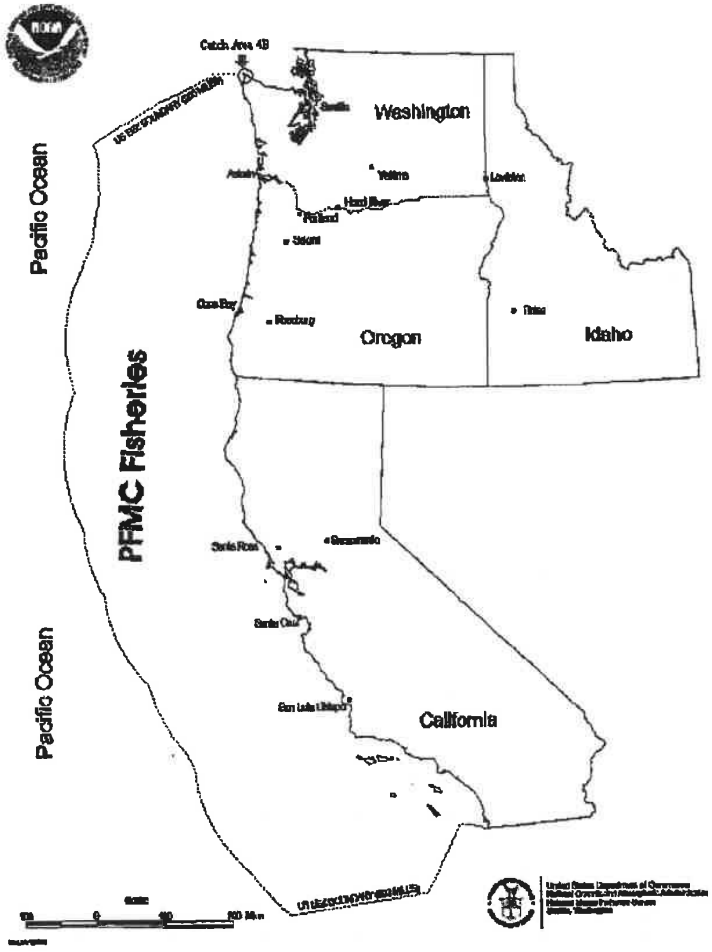
The PFMC fisheries occur within the U.S. EEZ off the West Coast including California, Oregon and Washington. A description of open fishing periods and locations for the 2008 PFMC salmon fisheries is found in Preseason Report III, Analysis of Council Adopted Management Measures for 2008 Ocean Salmon Fisheries (PFMC 2008a). The fishing periods and locations may be modified in-season in response to changes in projected salmon abundance, fishing effort or weather conditions in order to assure achievement of the management objectives and consideration for safety concerns.

The fisheries will follow the general geographic pattern described in subsection 4.1 (NMFS 2008a), and constraints affected by the fishery quotas, area allocations and management objectives of the FMP and the 2008 regulations adopted by the PFMC (PFMC 2008a). Overall, the 2008 fishing season is one of the most restricted on record, because of constraints on California and other Chinook stocks, and Columbia River coho (PFMC 2008a). A detailed description of the specific fishery locations and historical catch and effort data is found in the Review of 2007 Ocean Salmon Fisheries (PFMC 2008b).

D. Action Area

Federal regulations found at 50 CFR 402.02 define "action area" as all areas to be affected directly or indirectly by the Federal actions and not merely the immediate area involved in the action. For the purposes of this consultation, the action area encompasses the waters of the Pacific EEZ (Figure 1), which are directly affected by the federal action, and the coastal and inland marine waters of the states of Washington, Oregon, and California, which are indirectly affected by the federal action (i.e., potential reduction in available prey that would have moved into these waters if it had not been caught by the PFMC fisheries). The 2008-2009 fisheries will primarily occur off the coast of Washington. No fishing will take place South of Cape Falcon, except for a limited mark selective coho fishery off the coast of Oregon.

Figure 1. Map of the Action Area



E. Status of the Species and Critical Habitat

In this section we summarize the status of the Southern Resident killer whales and their critical habitat. This discussion and the Environmental Baseline section provide the context for our analysis of the likely effects of the proposed action on Southern Residents and their critical habitat. In addition, this section discusses the risks presently faced by this ESA-listed species, which informs our determination of whether any additional risk will "appreciably reduce" the likelihood that the Southern Residents will survive and recover in the wild. The entire Southern Resident DPS is present during most of the year in the action area. The status of the species range-wide therefore reflects the status of the species in the action area. Designated critical habitat is a smaller area, all of which lies within the action area.

1. Southern Resident killer whales

The Southern Resident killer whale DPS consists of three pods, identified as J, K, and L pods. In this section, we summarize the status of the Southern Resident killer whales throughout their range. Although the entire Southern Resident DPS has potential to occur in the coastal waters at any time during the year, occurrence is more likely from November through April. The information on the range-wide status of the species is generally representative of the status of the species in coastal waters. The final recovery plan for Southern Residents was issued in January, 2008 (NMFS 2008b). This section summarizes information taken largely from the recovery plan, as well as new data that became available more recently. For more detailed information about this population, please refer to the Final Recovery Plan for Southern Resident Killer Whales, which can be found on the internet at www.nwr.noaa.gov.

a. Status and trends

Although there is little information available regarding the historical abundance of Southern Resident killer whales, two methods have been used to estimate a historical population size of 140 to 200. The minimum estimate (~140) is the number of whales killed or removed for public display in the 1960s and 1970s added to the remaining population at the time of the captures. The maximum estimate (~200) is based on a recent genetic analysis of microsatellite DNA (68 FR 31980; May 29, 2003).

At present, the Southern Resident population has declined to essentially the same size that was estimated during the early 1960s, when it was considered as likely depleted (Olesiuk et al. 1990) (Figure 2). Since censuses began in 1974, J and K pods have steadily increased their sizes, however the population suffered an almost 20 percent decline from 1996-2001, largely driven by declines in L pod. There have been recent increases in the overall population from 2002-2006 indicating that L pod's decline may have ended, however such a conclusion is premature. The 2007 census counted 87 Southern Resident killer whales, 25 in J pod, 19 in K pod and 43 in L pod.

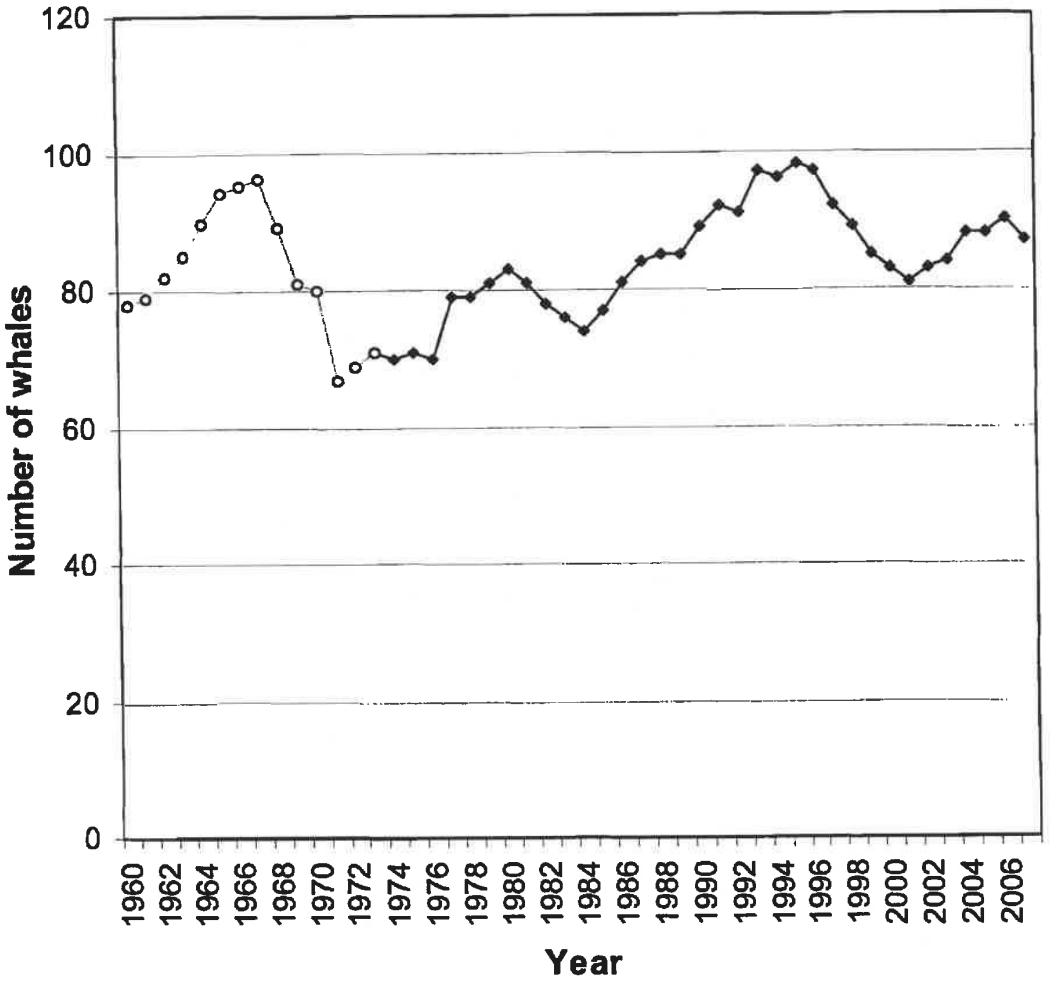


Figure 2. Population size and trend of Southern Resident killer whales, 1960-2007. Data from 1960-1973 (open circles, gray line) are number projections from the matrix model of Olesiuk et al. (1990). Data from 1974-2007 (diamonds, black line) were obtained through photo-identification surveys of the three pods (J, K, and L) in this community and were provided by the Center for Whale Research (unpubl. data). Data for these years represent the number of whales present at the end of each calendar year except for 2007, when data extend only through October.

b. Listing status

The Southern Resident killer whale Distinct Population Segment (DPS) was listed as endangered under the ESA on November 18, 2005 (70 FR 69903). The final rule included information on the population decline in the 1990s and identified several potential factors that may have caused the decline or may be limiting recovery. These are: quantity and quality of prey, toxic chemicals which accumulate in top predators, and disturbance from sound and vessel traffic. The rule also

identified oil spills as a potential risk factor for this species. Southern Residents are designated as "depleted" and "strategic" under the Marine Mammal Protection Act (MMPA) (68 FR 31980; May 29, 2003). Critical habitat for the Southern Resident killer whale DPS was proposed on June 15, 2006 (71 FR 34571) and the final designation of critical habitat was published November 29, 2006 (71 FR 69054). Critical habitat includes approximately 2,560 square miles of inland waters in three specific areas (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.

c. Range and distribution

Southern Residents are found throughout the coastal waters off Washington, Oregon, and Vancouver Island and are known to travel as far south as central California and as far north as the Queen Charlotte Islands, British Columbia (Figure 3).

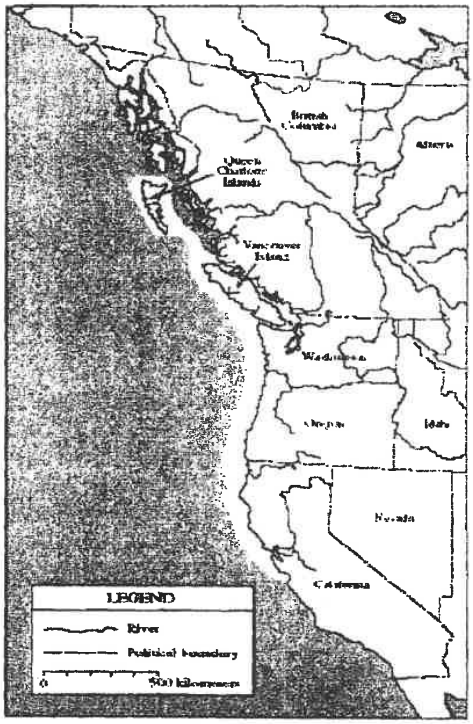


Figure 3. Geographic Range (light shading) of the Southern Resident Killer Whale DPS. Source: Wiles (2004).

There is limited information on the distribution and habitat use of Southern Residents along the outer Pacific Coast. Southern Residents are highly mobile and can travel up to 86 nmi (160 km) in a single day (Erickson 1978, Baird 2000). To date, there is no evidence that Southern Residents travel further than 50 km offshore (Ford et al. 2005).

Southern Residents spend the majority of their time from late spring to early autumn in inland waterways of Washington State and British Columbia (Strait of Georgia, Strait of Juan de Fuca, and Puget Sound) (Bigg 1982, Ford et al. 2000, Krahn et al. 2002) (Figure 4). Typically, J, K and L pods arrive in May or June and spend most of their time in the core area of Georgia Basin and Puget Sound until at least September. During this time, K and L pods make frequent trips from inland waters to the outer coasts of Washington and southern Vancouver Island, which typically last a few days (Ford et al. 2000).

Late summer and early fall movements of Southern Residents in the Georgia Basin have remained fairly consistent since the early 1970s, with strong site fidelity shown to the region as a whole, however presence in inland waters in the fall has increased in recent years (Figure 4). During early autumn, J pod in particular expands their routine movements into Puget Sound, likely to take advantage of chum and Chinook salmon runs (Osborne 1999). During late fall, winter, and early spring, the ranges and movements of the Southern Residents are less well known. Sightings

through the Strait of Juan de Fuca in late fall suggest that activity shifts to the outer coasts of Vancouver Island and Washington (Krahn et al. 2002).

The Southern Residents were formerly thought to range southward along the coast to about Grays Harbor (Bigg et al. 1990) or the mouth of the Columbia River (Ford et al. 2000). However, recent sightings of members of K and L pods in Oregon (in 1999 and 2000) and California (in 2000, 2003, 2005, 2006 and 2008) have considerably extended the southern limit of their known range (NMFS 2008b). There have been 45 verified sightings or strandings of J, K or L pods along the outer coast from 1975 to present with most made from January through April (Table 1). These include 16 records off Vancouver Island and the Queen Charlottes, 15 off Washington, 4 off Oregon, and 10 off central California. Most records have occurred since 1996, but this may be because of increased viewing effort along the coast in recent years. Sightings in Monterey Bay, California coincided with large runs of salmon, with feeding witnessed in 2000 (Black et al. 2001). L pod was also seen feeding on unidentified salmon off Westport, Washington, in March 2004 during the spring Chinook run in the Columbia River (M. B. Hanson, pers. obs., in Krahn et al. 2004).

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976				J,K								
1977												
1978			J,K									
1979											J,K	
1980												
1981				J,K								
1982						J,K				J,K		
1983										J,K	J,K	
1984						J,K						
1985						J,K						
1986					J,K							
1987										J,K	J,K	J,K
1988					J,K							
1989			J,K							J,K	J,K	J,K
1990												
1991					J,K					J,K		
1992												
1993					J,K							
1994										J,L		
1995												
1996										J,K	J,K	
1997										J,L	J,L	J,K
1998											J,K	
1999												
2000												
2001												
2002			J,K,L?									
2003												J,K
2004					J,L	J,L						J,K
2005		J?			J,L							
2006	J?											
2007	none					J,L						

Only J Pod present | Two pods present, as indicated | J, K, and L pods present | Data not available

Figure 4. Monthly occurrence of the three Southern Resident killer whale pods (J, K, and L) in the inland waters of Washington and British Columbia, 1976-2005. This geographic area is defined as the region east of Race Rocks at the southern end of Vancouver Island and Port Angeles on the Olympic Peninsula. Pods were recorded as present during a month if they were sighted on at least one day (NMFS 2008b and NWFSC unpubl. data).

Table 1. Known sightings of Southern Resident killer whales along the outer Pacific Ocean coast (NMFS 2008b).

Date	Location	Identification	Source	Comments
British Columbia outer coast				
31 Jan 1982	Barkley Sound, west coast of Vancouver Island	L pod	J. Ford, PBS/DFO	Off shore of Sound
21 Oct 1987	Coal Harbor, north Vancouver Island	Part of L pod	J. Ford, PBS/DFO	Were way up inlet a long distance from open ocean
3 May 1989	Tofino, west coast of Vancouver Island	K pod	WMSA	–
4 July 1995	Hippa Is., south Queen Charlotte Islands	Southern Resident	J. Ford PBS/DFO	Carcass found on beach, ID only by genetics
May 1996	Cape Scott, north Vancouver Island	Southern Resident	J. Ford PBS/DFO	Carcass found on beach, ID only by genetics
4 Sep 1997	Off Carmanah Point, sw Vancouver Island	L pod	Observed by P. Gearin, NMML	Identified by D. Ellifrit
14 Apr 2001	Tofino, west coast of Vancouver Island	L pod	J. Ford PBS/DFO	
27 Apr 2002	Tofino, west coast of Vancouver Island	L pod	J. Ford PBS/DFO	
12 May 2002	Tofino, west coast of Vancouver Island	L pod	J. Ford PBS/DFO	
30 May 2003	Langara Is., Queen Charlotte Islands	L pod	M. Joyce, DFO	
17 May 2004	Tofino, west coast of Vancouver Island	K and L pods	M. Joyce, DFO	
9 June 2005	West of Cape Flattery, Washington in Canadian waters	L pod	SWFSC	Whales were exiting the Strait of Juan de Fuca
7 Sep 2005	West of Cape Flattery, Washington in Canadian waters	L pod	NWFSC	Whales were exiting the Strait of Juan de Fuca
18 Mar 2006	North of Neah Bay, Washington in Canadian waters	J pod	NWFSC	Whales were exiting the Strait of Juan de Fuca
8 May 2006	Off Brooks Peninsula, west coast of Vancouver Island	L pod	J. Ford PBS/DFO	
1 Dec 2006	Johnstone Strait	L pod	J. Ford PBS/DFO	
Washington Outer Coast				
4 Apr 1986	Off Westport/Grays Harbor	L pod	J. Ford, PBS/DFO	

Date	Location	Identification	Source	Comments
13 Sep 1989	West of Cape Flattery	L pod	J. Calambokidis, Cascadia Research	
17 Mar 1996	3 km offshore Grays Harbor	L pod	J. Calambokidis, Cascadia Research	
20 Sep 1996	Off Sand Point (29 km south of Cape Flattery)	L pod	Observed by P. Gearin, NMML	Identified by D. Ellifrit
15 Apr 2002	Long Beach	L60	D. Duffield, Portland State Univ.	Stranded whale identified by K. Balcomb, CWR
11 Mar 2004	Grays Harbor	L pod	B. Hanson, NWFSC	Whales were exiting Strait of Juan de Fuca
13 Mar 2004	Off Cape Flattery	J pod	B. Hanson, NWFSC	
22 Mar 2005	Fort Canby-North Head	L pod	J. Zamon, NWFSC	
23 Oct 2005	Off Columbia River	K pod	SWFSC, Cscape	
29 Oct 2005	Off Columbia River	K and L pods	SWFSC, Cscape	
1 Apr 2006	Westport	L pods	PAL	
6 Apr 2006	Westport	K and L pods	Cascadia Research	
13 May 2006	Westport	K and L pods	PAL	
26 May 2006	Westport	K pod	PAL	
29 May 2006	Westport	K pod	PAL	
Oregon				
Apr 1999	Off Depoe Bay	L pod	J. Ford, PBS/DFO	
Mar 2000	Off Yaquina Bay	L pod	J. Ford, PBS/DFO	Seen week of Mar 20
14 Apr 2000	Off Depoe Bay	Southern Residents	K. Balcomb, CWR	
30 Mar 2006	Off Columbia River	K and L pods	B. Hanson, NWFSC	
California				
29 Jan 2000	Monterey Bay	K and L pods	N. Black, MBWW	Seen and photographed feeding on fish
13 Mar 2002	Monterey Bay	L pod	N. Black, MBWW	
16 Feb 2005	Farallon Is	L pod	K. Balcomb, CWR	
26 Jan 2006	Pt. Reyes	L pod	S. Allen	
24 Jan 2007	San Francisco Bay	K pod	N. Black, MBWW	
18 Mar 2007	Fort Bragg	L pod		Reported on CWR website
24-25 Mar 2007	Monterey	K and L pods		Reported on CWR website
30 Oct 2007	Bodega Bay	L pod	Cascadia Research	
27 Jan 2008	Monterey	L pod	N. Black/K. Balcomb	
2 Feb 2008	Monterey	K and L pods	N. Black/K. Balcomb	

d. Life history

Southern Resident killer whales are known to consume 22 species of fish and one species of squid (Scheffer and Slipp 1948, Ford et al. 1998, 2000, Ford and Ellis 2006, Saulitis et al. 2000). A long-term study of resident killer whale diet identified salmon as their preferred prey (96 percent of prey consumed during spring, summer and fall) (Ford and Ellis 2006). Feeding records for Southern and Northern Residents show a strong preference for Chinook salmon (72 percent of identified salmonids) during late spring to fall (Ford and Ellis 2006). Chum salmon (23 percent) are also taken in significant amounts, especially in autumn. Other salmon eaten include coho (2 percent), pink (3 percent) steelhead and sockeye (*O. mykiss*, *O. nerka* < 1 percent). The non-salmonids included Pacific herring, sablefish, Pacific halibut, and quillback and yelloweye rockfish. Chinook were preferred despite the much lower abundance of Chinook in the study area in comparison to other salmonids, probably because of the species' large size, high fat and energy content and year-round occurrence in the area. Killer whales also captured older (i.e., larger) than average Chinook (Ford and Ellis 2006).

Ongoing research continues to identify prey of Southern Residents through direct observation and scale sampling. More recently, researchers have started collecting fecal samples for analysis to address the potential biases of scale sampling. Although studies and analyses are not yet complete, preliminary results of ongoing sampling efforts are the best available information on diet composition of Southern Residents. When Southern Residents are generally concentrated in their "core summer area" (San Juan Islands) from May to September, their diet consists of approximately 86 percent Chinook salmon and 14 percent other salmon species (n=125 samples; Hanson et al. 2007, NWFSC unpubl. data). During all months combined their diet is approximately 69 percent Chinook and 31 percent other salmon species (n=160 samples). Sampling indicates an apparent shift to chum salmon in fall months when some Southern Residents are sighted inside Puget Sound (Hanson et al. 2007, NWFSC unpubl. data). Early results from genetic analysis of fecal and prey samples indicate that Southern Residents consume Fraser River origin Chinook, as well as salmon from Puget Sound, Washington and Oregon coasts, the Columbia River, and Central Valley California (Hanson et al. 2007 and NWFSC unpubl. data). As further data are analyzed, they will provide information on which specific runs of salmon the whales are consuming in certain locations and seasons.

There are no fecal or prey samples or direct observations of predation events (where the prey was identified to species) when the whales are in coastal waters. Although less is known about diet preferences of Southern Residents off the Pacific Coast, it is likely that salmon are also important during late fall and winter when Southern Residents more predictably occur in coastal waters. Based on the best available information, Southern Residents may also prefer Chinook salmon when available in coastal waters. Chemical analyses also support the importance of salmon in the year-round diet of Southern Residents (Krahn et al. 2002, 2007). Krahn et al. (2002), examined the ratios of DDT (and its metabolites) to various PCB compounds in the whales, and concluded that the whales feed primarily on salmon throughout the year rather than other fish species. Krahn et al. (2007) analyzed stable isotopes from tissue samples collected in 1996 and 2004/2006. Carbon and nitrogen stable isotopes indicated that J and L pods consumed prey from

similar trophic levels in 2004/2006 and showed no evidence of a large shift in the trophic level of prey consumed by L pod between 1996 and 2004/2006.

The size of individual prey likely influences the relationship of prey needed by the whales relative to prey available. We are not able to assess the potential differences in biomass of individual Chinook available to Southern Residents, and thus rely on abundance as a proxy measure. Southern Resident killer whales consume both natural and hatchery salmon (DFO unpubl. data). There is no information available suggesting that Southern Residents would be affected differently by consuming natural or hatchery salmon (i.e., no known differences in size, energy content, contaminant level, or behavior or location in the ocean).

Researchers have estimated the energy requirements of killer whales and caloric values for salmon to calculate the number of fish needed per day. Salmon differ significantly in size across species and runs, and prey preference among salmon would affect annual consumption rates. Fewer salmon per day would be required from a larger preferred prey species such as Chinook salmon. We provide an estimate of the biological requirements of Southern Residents using the best available information on metabolic needs of the Southern Resident population and the caloric content of salmon, as described in more detail below (see G. Biological Requirements).

e. Impacts of human activity

Several anthropogenic factors have affected the status of the Southern Resident population and are identified as potential threats to the recovery of this species (NMFS 2008b). The primary risk factors identified in the Southern Resident recovery plan are prey availability, environmental contaminants, vessel effects and sound, and oil spills (NMFS 2008b). Research has yet to identify which threats are most significant to the survival and recovery of Southern Residents. It is likely that multiple threats are acting in concert to impact the whales.

Prey Availability

Healthy killer whale populations depend on adequate prey levels. It is uncertain to what extent long-term or more recent declines in salmon abundance contributed to the decline of the Southern Resident DPS, or whether current levels are adequate to support the survival and recovery of the Southern Residents. When prey is scarce, whales must spend more time foraging than when it is plentiful, leading to relatively lower reproductive rates and relatively higher mortality rates. Food scarcity would cause whales to draw on fat stores, mobilizing contaminants stored in their fat. Human influences have had profound impacts on the abundance of many prey species in the northeastern Pacific during the past 150 years. Foremost among these, many wild stocks of salmon have declined significantly over that period due to overfishing, poor artificial propagation practices, and degradation of freshwater and estuarine habitats through urbanization, dam building, and forestry, agricultural, and mining practices (National Research Council 1996, Slaney et al. 1996, Gregory and Bisson 1997, Lichatowich 1999, Lackey 2003, Pess et al. 2003, Schoonmaker et al. 2003). Populations of other marine species have similarly declined or fluctuated greatly through time.

Salmon declines over the past 150 years are particularly prevalent in Washington, Oregon, Idaho, California, and southern British Columbia due to greater human impacts on freshwater and estuarine habitats as well as ocean productivity cycles, whereas populations in Alaska have been little affected (Riddell 1993, Slaney et al. 1996, Nehlsen 1997, Wertheimer 1997, Yoshiyama et al. 1998, Kope and Wainwright 1998, Lackey 2003, Schoonmaker et al. 2003). Coastal Chinook stocks increased from the mid-1960s through the 1970s following a decline in the 1990s, possibly as a result of increased coastal water temperatures related to El Niño events (run-reconstruction in, Johnson et al. 1997). Wild Chinook runs in the Puget Sound region were fairly stable from 1968 until a sharp decline beginning in 1991, as a result of poor ocean survival, habitat alterations, and harvest pressures (run-reconstruction in, Johnson et al. 1997).

Since the late 1990s, Canadian and U.S. managers have taken actions to reduce fishery impacts in response to the declines. While wild stocks have declined in many areas, hatchery production has been generally strong, contributing a significant component of the Chinook returning to the Puget Sound region (i.e., 74 percent of the total Chinook salmon return to Puget Sound from 2000-2004 originated from hatcheries, data from WDFW 2005 Stock Strength Summaries [T. Tynan, pers. comm.. March 13, 2008]). Recently, wild Chinook escapement has been relatively stable in the Georgia Basin (2000-2005, NMFS 2007b), as is also true of Chinook runs in Puget Sound (1999-2005, T. Tynan, pers. comm., March 19, 2008).

Among naturally spawning salmon and steelhead, 30 of the 52 ESUs/DPSs in the western contiguous United States are currently listed as threatened or endangered, or are candidates for listing under the Federal Endangered Species Act. Half or more of all Chinook, steelhead, and chum ESUs/DPSs are listed. Some of the remaining 22 ESUs/DPSs are predicted to become endangered unless specific recovery actions can be accomplished. In addition to naturally produced salmon, killer whales are likely to consume hatchery salmon when available.

Recreational and commercial fisheries can affect the amount of prey immediately available to the whales in a given year if the fishery removes fish that would otherwise have been available as prey for whales. Fisheries can also affect future abundance of prey if the fishery affects the productivity of a fish population. Commercial and sport fisheries that affect prey resources available in the range of Southern Residents other than the action include fisheries in Southeast Alaska, northern British Columbia, western coast of Vancouver Island, inland Johnston Strait, Georgia Strait and Puget Sound fisheries.

Contaminants

Many types of chemicals are toxic when present in high concentrations, including organochlorines, polycyclic aromatic hydrocarbons (PAHs), and heavy metals. Emerging contaminants such as brominated flame retardants (BFRs) and perfluorinated compounds are increasingly being linked to harmful biological impacts as well.

Persistent contaminants, such as organochlorines, are ultimately transported to the oceans, where they enter the marine food chain. Organochlorines are also highly fat soluble, and accumulate in the fatty tissues of animals (O'Shea 1999, Reijnders and Aguilar 2002). Bioaccumulation through trophic transfer allows relatively high concentrations of these compounds to build up in top-level marine predators, such as marine mammals (O'Shea 1999). Killer whales are

candidates for accumulating high concentrations of organochlorines because of their high position in the food web and long life expectancy (Ylitalo et al. 2001, Grant and Ross 2002). Their exposure to these compounds occurs exclusively through their diet (Hickie et al. 2007).

High levels of persistent organic pollutants (POPs) such as PCBs and DDT are documented in Southern Resident killer whales (Ross et al. 2000, Ylitalo et al. 2001). These and other chemical compounds have the ability to induce immune suppression, impair reproduction, and produce other adverse physiological effects, as observed in studies of other marine mammals (review in NMFS 2008b). Immune suppression may be especially likely during periods of stress and resulting weight loss, when stored organochlorines are released from the blubber and become redistributed to other tissues (Krahn et al. 2002). Although the ban of several contaminants, such as DDT, by Canada and the United States in the 1970s resulted in an initial decline in environmental contamination, Southern Residents may be slow to respond to these reductions because of their body size and the long duration of exposure over the course of their life spans (Hickie et al. 2007).

Vessels and Sound

Vessels have the potential to affect whales through the physical presence and activity of the vessel, increased underwater sound levels generated by boat engines, or a combination of these factors. Vessel strikes are rare, but do occur and can result in injury or mortality. In addition to vessels, underwater sound can be generated by a variety of other human activities, such as dredging, drilling, construction, seismic testing, and sonar (Richardson et al. 1995, Gordon and Moscrop 1996, National Research Council 2003). Impacts from these sources can range from serious injury and mortality to changes in behavior.

Killer whale mortalities from vessel strikes have been reported in both Northern and Southern Resident killer whale populations. Although rare, collisions between vessels and killer whales could result in serious injury. Other impacts from vessels are less obvious, but may adversely affect the health of killer whales. The presence of vessels may alter killer whale behavior, including faster swimming, less predictable travel paths, shorter or longer dive times, moving into open water, and altering normal behavioral patterns at the surface (Kruse 1991; Williams et al. 2002a; Bain et al. 2006). Chemicals such as unburned fuel and exhaust may be inhaled or ingested, which could contribute to toxic loads (Bain et al. 2006). Noise from vessel traffic may mask echolocation signals (Bain and Dahlheim 1994, Holt 2008), which reduces foraging efficiency or interferes with communication. The sound from vessels may also contribute to stress (Romano et al. 2003) or affect distribution of animals (Bejder 2006).

Southern Resident killer whales are the primary driver for a multi-million dollar whale watching industry in the Pacific Northwest. Commercial whale watching vessels from both the U.S. and Canada view Southern Residents when they are in inland waters in summer months. Mid-frequency sonar generated by military vessels also has the potential to disturb killer whales. To date, there are no directed studies concerning the impacts of military mid-frequency sonar on killer whales, but observations from an event that occurred in the Strait of Juan de Fuca and Haro Strait in 2003 illustrate that mid-frequency sonar can cause behavioral disturbance (NMFS 2004a).

Killer whales rely on their highly developed acoustic sensory system for navigating, locating prey, and communicating with other individuals. Increased levels of anthropogenic sound have the potential to mask echolocation and other signals used by the species, as well as to temporarily or permanently damage hearing sensitivity. Exposure to sound may therefore be detrimental to survival by impairing foraging and other behavior, resulting in a negative energy balance (Bain and Dahlheim 1994, Gordon and Moscrop 1996, Erbe 2002, Williams et al. 2002a, 2002b). In other cetaceans, hormonal changes indicative of stress have been recorded in response to intense sound exposure (Romano et al. 2003). Chronic stress is known to induce harmful physiological conditions including lowered immune function, in terrestrial mammals and likely does so in cetaceans (Gordon and Moscrop 1996).

Oil spills

Exposure to petroleum hydrocarbons released into the marine environment from oil spills and other discharge sources represents another potentially serious health threat for killer whales in the northeastern Pacific. Oil spills are also potentially destructive to prey populations and therefore may adversely affect killer whales by reducing food availability.

Marine mammals are generally able to metabolize and excrete limited amounts of hydrocarbons, but acute or chronic exposure poses greater toxicological risks (Grant and Ross 2002). In marine mammals, acute exposure can cause changes in behavior and reduced activity, inflammation of the mucous membranes, lung congestion, pneumonia, liver disorders, and neurological damage (Geraci and St. Aubin 1990). Vapors inhaled at the water's surface and hydrocarbons ingested during feeding are the likely pathways of exposure. Matkin et al. (1994) reported that killer whales did not attempt to avoid oil-sheened waters following the Exxon Valdez oil spill in Alaska. Retrospective evaluation shows it is highly likely that oil exposure contributed to deaths of resident and transient pods of killer whales that frequented the area of the massive Exxon Valdez oil spill in Prince William Sound, Alaska in 1989 (Matkin et al. 2008). The cohesive social structure of the Southern Residents puts them at risk for a catastrophic oil spill that could affect the entire DPS when they are all in the same place at the same time.

2. Southern Resident killer whale critical habitat

The ESA defines critical habitat as specific areas: (1) within the geographical area occupied by the species at the time of listing, if they contain physical or biological features essential to conservation, and those features may require special management considerations or protection; and (2) outside the geographical area occupied by the species if the agency determines that the area itself is essential for conservation. The final designation of critical habitat for the Southern Resident killer whale DPS was published on November 29, 2006 (71 FR 69054). Critical habitat consists of three specific areas: (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. These areas comprise approximately 2,560 square miles of marine habitat. Based on the natural history of the Southern Residents and their habitat needs, NMFS identified the following physical or biological features essential to conservation: (1) Water quality to support growth and development; (2) Prey species of sufficient quantity, quality and availability to support individual growth, reproduction

and development, as well as overall population growth; and (3) Passage conditions to allow for migration, resting, and foraging.

This discussion and the Environmental Baseline section provide the context for our analysis of the likely effects of the proposed action on Southern Resident killer whales' critical habitat. In addition, this section discusses the threats presently affecting the habitat features, which inform our determination of whether any additional risk will "adversely modify" Southern Resident killer whale critical habitat. The proposed action has the potential to affect prey availability by removing potential prey that would have returned to inland waters and the whales' critical habitat. The action area includes the entire designated critical habitat.

a. Water quality

Water quality in Puget Sound in general is degraded as described in the Puget Sound Partnership Recommendations (Puget Sound Partnership 2006). For example, toxins in Puget Sound persist and build up in marine organisms including Southern Residents and their prey resources, despite bans in the 1970s of some harmful substances and cleanup efforts since.

The primary concern for direct effects on water quality is from oil spills (although oil spills can also have long-lasting impacts on other habitat features). The Environmental Protection Agency and U.S. Coast Guard oversee the Oil Pollution Prevention regulations promulgated under the authority of the Federal Water Pollution Control Act. There is a Northwest Area Contingency Plan, developed by the Northwest Area Committee, which serves as the primary guidance document for oil spill response in Washington and Oregon. In 2007 the Washington State Department of Ecology published a new Spill Prevention, Preparedness, and Response Program Annual Report describing recent accomplishments and declining trends in spill incidents per transit (WDOE 2007).

b. Prey quantity, quality and availability

As discussed above under human impacts, most wild salmon stocks throughout the Northwest are at fractions of their historic levels. Beginning in the early 1990s, 30 ESUs of salmon and steelhead in Washington, Oregon, Idaho, and California were listed as threatened or endangered under the ESA. Historically, overfishing was a major cause of decline. More recently, the major cause is loss of freshwater habitat. Poor ocean conditions over the past two decades have reduced populations already weakened by the degradation and loss of freshwater and estuary habitat, fishing, hydropower system management, and hatchery practices.

Contaminants and pollution also affect the quality of Southern Resident killer whale prey in Puget Sound. Contaminants enter marine waters and sediment from numerous sources, but are typically concentrated near areas of high human population and industrialization. Once in the environment these substances proceed up the food chain, accumulating in long-lived top predators like Southern Resident killer whales. Chemical contamination of prey is a potential threat to Southern Resident killer whale critical habitat, despite the enactment of modern pollution controls in recent decades, which were successful in reducing, but not eliminating, the

presence of many contaminants in the environment. In addition, vessels and sound may reduce the effective zone of echolocation and reduce availability of fish for the whales in their critical habitat (Holt 2008).

c. Passage

Southern Residents are highly mobile and use a variety of areas for foraging and other activities, as well as for traveling between these areas. Human activities can interfere with movements of the whales and impact their passage. In particular, vessels may present obstacles to whale passage, causing the whales to swim further and change direction more often, which potentially increases energy expenditure for whales and impacts foraging behavior.

F. Environmental Baseline

The "environmental baseline" reflects the effects of past and ongoing human and natural factors, within the action area, which in this case includes all of the designated critical habitat and most of the range of the whales. It includes the past and present impacts of all state, tribal, local, private, and other human activities in the action area, including impacts of these activities which will occur contemporaneously with this consultation. The effects of unrelated federal actions affecting the same species or critical habitat that have completed formal or informal consultations are also part of the environmental baseline.

Most of the human activities contributing to the current status of Southern Resident killer whales occur within the action area (See I.D. Action Area). The following discussion summarizes the principal human and natural factors within the action area (other than the proposed action) that are known to affect the likelihood that Southern Resident killer whales will survive and recover in the wild, and the likelihood that their critical habitat will function to support their recovery.

1. Natural Mortality

Seasonal mortality rates among Southern and Northern Resident whales are believed to be highest during the winter and early spring, based on the numbers of animals missing from pods returning to inland waters each spring. Olesiuk et al. (2005) identified high neonate mortality that occurred outside of the summer field research seasons. At least 12 newborn calves (9 in southern community and 3 in northern community) were seen outside the summer field season and disappeared by the next field season. Additionally, stranding rates are higher in winter and spring for all killer whale forms in Washington and Oregon (Norman et al. 2004). Southern Resident strandings in coastal waters offshore include three separate events (1995 and 1996 off of Northern Vancouver Island and the Queen Charlotte Islands, and 2002 offshore of Long Beach, Washington State), and the causes of death are unknown (NMFS 2008b).

In recent years, sighting reports indicate anecdotal evidence of thin killer whales returning to inland waters in the spring. For example in March 2006, a thin female from the Southern Resident population (L54) with a nursing calf was sighted off Westport, WA. The sighting

report indicated she had lost so much blubber that her ribs were showing under the skin (Cascadia Research unpubl. data.).

2. Human-Related Sources of Mortality

a. Mortality associated with depredation

Deaths from deliberate shootings were probably once relatively common in Washington and British Columbia (Scheffer and Slipp 1948, Pike and MacAskie 1969, Olesiuk et al. 1990, Baird 2001). For example, up until 1970, 25 percent of the killer whales captured in Puget Sound for aquaria bore bullet scars (Hoyt 1990). Today, there are no reports of deliberate killings associated with fishery interactions, therefore, these interactions are not currently considered significant in the northeastern Pacific (Young et al. 1993, Carretta et al. 2001).

b. Entrapment and entanglement in commercial fishing gear

Drowning from accidental entanglements in nets and longlines is a minor source of fishing-related mortality in killer whales. In Washington, Sheffer and Slipp (1948) documented several deaths of animals caught in gillnets between 1929 and 1943. More recently, one killer whale was reported interacting with a salmon gillnet in British Columbia in 1994, but did not get entangled (Guenther et al. 1995). Typically, killer whales are able to avoid nets by swimming around or underneath them (Jacobsen 1986, Matkin 1994), and not all entanglements automatically result in death.

c. Prey Availability

Chinook salmon are the preferred prey of Southern Resident killer whales in inland waters of Washington State during spring, summer and early fall. Chum salmon may also be important prey, at least during fall months inside Puget Sound. Chemical analyses support the importance of salmon in the year round diet of Southern Residents. Based on the best available information, Southern Residents may also prefer Chinook salmon when available in coastal waters. This analysis therefore focuses on effects of the PFMC fisheries on Chinook abundance in coastal and inland waters during the seasons Southern Residents are most likely to occur in the respective portions of their range. Focusing on Chinook provides a conservative estimate of potential effects of the PFMC fisheries on Southern Residents. The total abundance of all salmon and other potential prey species is difficult to quantify, but is orders of magnitude larger than the total abundance of Chinook.

When prey abundance is low, killer whales may spend more time and energy foraging than when prey abundance is high, with the potential for fitness consequences including reduced reproductive rates and higher mortality rates. Ford and Ellis (2006) correlated coastwide reduction in Chinook abundance (Alaska, British Columbia, and Washington) with decreased survival of resident whales (Northern and Southern Residents), but changes in killer whale

abundance have not been definitively linked to local areas or changes in salmon stock groups. No recent changes in salmon populations are obviously apparent that may be responsible for the recent decline in the Southern Resident population between 1996 and 2001 (NMFS 2008a). However, potential prey limitation is an area of ongoing research, and new information will be considered as it becomes available.

The availability of prey to Southern Resident killer whales is affected by a number of natural and human actions. The health and abundance of wild salmon stocks have been negatively affected by altered or degraded freshwater and estuarine habitat (i.e., hydro-power systems, urbanization, forestry and agriculture), poor artificial propagation practices, and overfishing. Predation in the ocean also contributes to natural mortality of salmon. Salmonids are prey for pelagic fishes, birds, and marine mammals. Details regarding baseline conditions of salmon in coastal and inland waters of the action area are described the biological assessment and biological opinion for salmon (NMFS 2008a, 2008c).

Salmon abundance is substantially affected by climate variability in freshwater and marine environments, particularly by conditions during early life-history stages of salmon. Sources of variability include inter-annual climatic variations (e.g., El Niño and La Niña), longer term cycles in ocean conditions (e.g., Pacific Decadal Oscillation, Mantua et al. 1997), and ongoing global climate change. For example, climate variability can affect ocean productivity in the marine environment and water storage (e.g. snow pack) and in-stream flow in the freshwater environment. Early life-stage growth and survival of salmon can be negatively affected when climate variability results in conditions that hinder ocean productivity and/or water capacity in marine and freshwater systems respectively. The availability of adult salmon – prey of Southern Residents – may be reduced in years following unfavorable conditions to the early life-stage growth and survival of salmon.

Expected Chinook salmon ocean abundance in 2008 ranges from abundances similar to those observed in 2007 to the lowest on record, depending on the area (PFMC 2008c). In total, Chinook ocean abundance in 2008 is expected to be over 1.2 million (Table 2), and Chinook and coho abundance combined is expected to be over 2.6 million (NMFS 2008a). The estimate of Chinook ocean abundance does not include all stocks available to Southern Residents, and is therefore likely an underestimate of available Chinook prey resources. Additionally, only some of the forecasts account for natural mortality, evaluated from past year bycatch levels of some fisheries (i.e., in groundfish fisheries, described in NMFS 2008a), and may account for some level of predation. Even where estimated, the level of natural mortality is likely an underestimate. Reductions from fisheries are part of the environmental baseline, with the exception of reductions from 1) the proposed fisheries (addressed in the current consultation), and 2) fisheries that will be the subject of separate consultation during the current annual regulatory cycle (U.S. Fraser Panel fisheries). Fisheries that occur outside the action area are indirectly considered in the baseline by methods used to estimate ocean abundance, and as necessary will be the subject of future consultation.

The estimated ocean escapement of Chinook stocks that return to inland waters (Puget Sound and Canadian stocks from Fraser, Georgia Strait and WCVI) is 549,600 Chinook. The escapement estimate for Puget Sound stocks is the net run size to area 4B (Strait of Juan de Fuca)

after accounting for sport fisheries catch. Escapement to inland waters would have been higher without the proposed action, as described in the effects analysis. Fisheries that occur in inland waters and overlap with the occurrence of Southern Residents in this area (other than sport catch already accounted for in the 4B net run size) also reduce the availability of prey, and are included in the baseline.

Puget Sound commercial and recreational salmon fisheries are included within the Puget Sound Harvest Management Plan which is covered under an ESA Section 4(d) approval through April 30, 2010 (70 FR 12194, March 11, 2005). The harvest plan prescribes escapement goals and exploitation rate objectives for Puget Sound Chinook that NMFS has determined will not appreciably reduce the likelihood of survival and recovery of the Puget Sound Chinook ESU. This management plan includes seasonal catch of Chinook in marine commercial and sport fisheries that overlap in space and time with the whales' occurrence within inland waters, based on available sighting data. For 2008, this includes commercial fishery related mortality of approximately 10,205 Chinook (S. Bishop, pers. comm., May 14, 2008). This estimate does not count the harvest in terminal fisheries within the inland range of Southern Residents because those occur after the fish have passed through the whales' feeding areas.

Table 2. Primary Contributing Chinook Stocks and the 2008 Expected Ocean Escapement or Abundance.

Chinook Stocks[1]	2008 Expected Abundance[2]
Canadian Stocks (Frasier, Georgia Strait and WCVI)[3]	305,000
Puget Sound	244,600
Columbia River	
Columbia Upriver Brights	162,500
Mid-Columbia Brights	54,000
Columbia Lower River Hatchery Tules	59,000
Columbia Lower River Natural Tules[4]	
Columbia Lower River Wild	3,800
Spring Creek Hatchery Tules	87,200
Snake River Fall	6,388
California	
Klamath River Fall	186,200
Sacramento River Fall and Sacramento River Winter	157,100

[1] Stocks in bold do not meet conservation objectives.
[2] Abundance represents a mix of pre-fishing abundance and escapement. Source: NMFS 2008a and supplemental information (S. Bishop, pers. comm., April 29, 2008).
[3] Not estimated with the same methods applied for U.S. stocks. Likely represents catch + escapement in Canadian waters (mostly returning to inside waters).
[4] Estimate not provided in NMFS 2008a.

d. Environmental Contaminants

Contaminants enter marine waters and sediments from numerous sources, but are typically concentrated near populated areas of high human activity and industrialization. Freshwater contamination is also a concern because it may contaminate salmon that are later consumed by the whales in marine habitats. As discussed in the Status of the Species section, recent studies have documented high concentrations of PCBs, DDTs, and PBDEs in killer whales (Ross et al. 2000, Ylitalo et al. 2001, Reijnders and Aguilar 2002, Krahn et al. 2004). Harmful contaminants are stored in blubber; however, organochlorines can be released from the blubber and become redistributed to other tissues increasing risk of immune or reproductive effects during weight loss from reductions in prey (Krahn et al. 2002).

As top predators, when killer whales consume contaminated prey they accumulate the contaminants in their blubber. When prey is scarce, killer whales metabolize their blubber and the contaminants are mobilized. In addition, nursing females transmit large quantities of contaminants to their offspring. Chinook salmon contain higher levels of some contaminants (i.e., PCBs) than other salmon species (O'Neill et al. 2005). Only limited information is available for contaminant levels of Chinook along the west coast (i.e., higher PCB and PBDE levels may distinguish Puget Sound-origin stocks, whereas higher DDT-signature may distinguish California origin stocks; Krahn et al. 2007).

e. Vessel Activities and Sound

Commercial shipping and military, recreational and fishing vessels occur in the coastal range of Southern Residents and additional whale watching, ferry operations, recreational and fishing vessel traffic in their inland range. The density of traffic is lower in coastal waters compared to inland waters of Washington State and British Columbia. Several studies in inland waters of Washington State and British Columbia have linked interactions of vessels and Northern and Southern Resident killer whales with short-term behavioral changes (Kruse 1991; Williams et al. 2002a; 2002b; Foote et al. 2004, Bain et al. 2006). Although the potential impacts from vessels and the sounds they generate are poorly understood, these activities may affect foraging efficiency, communication, and/or energy expenditure through their physical presence, increased underwater sound level, or both. Collisions of killer whales with vessels are rare, but remain a potential source of serious injury and mortality.

Vessel sounds in coastal waters are most likely from large ships, tankers and tugs, whereas vessel sounds in inland waters also come from whale watch platforms, ferry operations and smaller recreational vessels. Sound generated by large vessels is a source of low frequency (5 to 500 Hz) human-generated sound in the world's oceans (National Research Council 2003). While larger ships generate some broadband noise in the hearing range of whales, the majority of energy is below their peak hearing sensitivity. Such vessels do not target whales, move at relatively slow speed and are likely detected and avoided by Southern Residents. Commercial sonar systems designed for fish finding, depth sounding, and sub-bottom profiling are widely used on recreational and commercial vessels and are often characterized by high operating

frequencies, low power, narrow beam patterns, and short pulse length (National Research Council 2003). Frequencies fall between 1 and 500 kHz, which is within the hearing range of some marine mammals including killer whales and may have masking effects.

In inland waters, the majority of vessels in close proximity to the whales are commercial and recreational whale watching vessels and the average number of boats accompanying whales can be great during the summer months (i.e., from 1998 to 2002 an average of 18 to 22 boats were within ½ mile in inland waters from May to September; Koski 2007). Sound generated from whale watch vessels varies by vessel size, engine type, and operating speed (Holt 2008). Although investigators have documented numerous short-term behavioral responses to whale watch vessels, studies have not demonstrated the consequences of these effects on the health of the population. There is ongoing research to evaluate changes in energy expenditure from behavioral responses and effects of sound on echolocation and foraging efficiency, which may translate to fitness effects. Currently, NMFS is considering vessel management regulations to protect Southern Residents from vessel effects (72 FR 13464; March 22, 2007).

5. Non-vessel sound

Anthropogenic (human-generated) sound in the range of Southern Residents is generated by other sources besides vessels, including oil and gas exploration, construction activities, and military operations. Natural sounds in the marine environment include wind, waves, surf noise, precipitation, thunder, and biological noise from other marine species. The intensity and persistence of certain sounds (both natural and anthropogenic) in the vicinity of marine mammals vary by time and location and have the potential to interfere with important biological functions (e.g., hearing, echolocation, communication).

In-water construction activities are permitted by the Army Corps of Engineers (ACOE) under section 404 of the Clean Water Act and section 10 of the Rivers and Harbors Act of 1899 and by the State of Washington under its Hydraulic Project Approval (HPA) program. Consultations on these permits have been conducted and conservation measures have been included to minimize or eliminate potential effects of in-water activities, such as pile driving, to marine mammals. Sound, such as sonar generated by military vessels also has the potential to disturb killer whales in inland and coastal waters within their range.

g. Oil Spills

Oil spills have occurred in the range of Southern Residents in the past, and there is potential for spills in the future. Oil can be discharged into the marine environment in any number of ways, including shipping accidents, refineries and associated production facilities, and pipelines. Despite many improvements in spill prevention since the late 1980s, much of the region inhabited by Southern Residents remains at risk from serious spills because of the heavy volume of shipping traffic and proximity to petroleum refining centers in inland waters. Numerous oil tankers transit through the range of Southern Residents throughout the year. The magnitude of the risks posed by oil discharges in the action area is difficult to precisely quantify or estimate,

but may be decreasing because of new oil spill prevention procedures in the state of Washington (WDOE 2007).

The long-term effects of repeated ingestion of sub-lethal quantities of petroleum hydrocarbons on killer whales are not well understood. In marine mammals, acute exposure 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 and St. Aubin 1990). In addition, oil spills have the potential to adversely impact habitat and prey populations, and, therefore, may adversely affect Southern Residents by reducing food availability.

h. Scientific Research

Most of the scientific research conducted on Southern Resident killer whales occurs in inland waters of Washington State and British Columbia. In general, the primary objective of this research is population monitoring or data gathering for behavioral and ecological studies. In 2006, NMFS issued scientific research permits to seven investigators who intend to study Southern Resident killer whales. Research activities are typically conducted between May and October in inland waters; however, some permits include authorization to conduct research in coastal waters.

In the biological opinion NMFS prepared to assess the impact of issuing the permits, we determined that the effects of these disturbances on Southern Residents were likely to adversely affect, but not jeopardize the continued existence of, the Southern Resident killer whales (NMFS 2006). Most of the authorized takes would occur in inland waters, with a small portion in the coastal range of Southern Residents. In light of the number of permits, associated takes, and research vessels and personnel present in the environment, repeated disturbance of individual killer whales is likely to occur in some instances. In recognition of the potential for disturbance and takes, we took steps to limit repeated harassment and avoid unnecessary duplication of effort through conditions included in the permits requiring coordination among Permit Holders.

i. Summary of the Environmental Baseline

Southern Resident killer whales are exposed to a wide variety of past and present state, federal or private actions and other human activities in the coastal and inland waters area considered, as well as federal projects in this area that have already undergone formal section 7 consultation, and state or private actions that are contemporaneous with this consultation. All of the activities discussed in the above section are likely to have some level of impact on Southern Residents when they are in inland and coastal waters of their range.

Inadequate food availability, exposure to pollutants, and human disturbance have all been identified as threats to killer whales in Washington and British Columbia (Ford and Ellis 1999, Ford et al. 2000, 2005, Baird 2001, Krahn et al. 2002, 2004, Taylor 2004, Wiles 2004). Researchers are unsure about which threats are most significant. Although the three primary

factors are identified as prey availability, environmental contaminants, and vessel effects and sound, none have been directly linked to or identified as the cause of the recent decline of the Southern Resident killer whales (Krahn et al. 2002). There is limited information on how these factors or additional unknown factors may be affecting Southern Resident killer whales when in coastal waters in winter. For reasons discussed earlier, it is possible that two or more of these factors may act together to harm the whales. The small size of the population increases the level of concern about all of these risks (NMFS 2008b).

G. Biological Requirements

We consider the biological requirements or prey needs of Southern Residents coastal and inland waters of their range by combining information about the status of the species and environmental baseline. This information supports the effects analysis. The primary effect of the proposed action will be on the abundance of the killer whales' preferred prey salmon, and in particular Chinook. This section addresses the whales' biological requirements or prey needs respectively in coastal and inland waters of their range to create the context for analyzing the consequences of this effect on prey abundance. To do this, we estimated several parameters:

1) Diet composition for Southern Residents killer whales.
2) Metabolic needs of the Southern Resident killer whales.
3) Caloric content of salmon.
4) Estimated number of salmon needed by the Southern Resident killer whales.

1. Diet Composition for Southern Resident Killer Whales

Our current knowledge of diet composition is limited by small sample sizes, restricted geographic scope and seasons of sampling effort, and the methodologies of studies evaluating diet composition (Ford and Ellis 2006, Hanson et al. 2007, and NWFSC unpubl. data). In light of uncertainties and data gaps, we assumed that the entire diet of the Southern Residents consisted of salmon in both inland and coastal waters, as chemical analyses confirm the year-round importance of salmon in the whales' diet (Krahn 2002, 2007). This assumption is conservative because there are data indicating that the whales consume other fish and squid as prey items in small amounts.

Based on available data, we provided a detailed analysis to quantitatively evaluate diet composition separately for inland and coastal portions of the Southern Residents' range, and highlight assumptions made in light of uncertainties. The available sighting data for Southern Residents indicates substantially increased sightings of the whales in inland waters from May through September (The Whale Museum 2007). Thus, we evaluated scenarios for diet composition within inland waters from May to September. As discussed in the Status of the Species section, most of the available information on diet of Southern Residents is collected during summer months (primarily from May to September) in inland waters, with limited additional sampling during fall and the remainder of the year. Sampling from May to September indicates that killer whales prefer Chinook (Ford and Ellis 2006, Hanson et al. 2007, and NWFSC unpubl. data).

Most opportunistic sightings of the whales in coastal waters have been reported from January to April (Table 1, Status of the Species). Therefore, we evaluated scenarios for prey needs in coastal waters from January to April. We included a greater variety of diet scenarios in coastal waters, because there are no direct data on prey preference in this area.

The whales' occurrence and diet during fall months from October to December are variable. There are some sightings of pods (mainly K and L pods, Table 1, Status of the Species) in coastal waters during this time, and at least part of the population (J pod) is sighted intermittently in inland waters, particularly Puget Sound. Preliminary results from on-going research suggest that at least part of the Southern Resident population (J pod) may switch to chum salmon in Puget Sound in fall and winter months when adult Chinook returning to watersheds in inland waters are mostly contained within river systems (late-September to early-October.) Based on the uncertainties regarding diet and distribution we cannot estimate the whales' diet composition in coastal or inland waters for fall months.

For the cases where we do provide scenarios of diet composition (summer-inland waters and winter/spring- coastal waters), the percent of Chinook is presented as a range of fixed percents, based on the range of possibilities represented in past studies (70% Chinook, Ford and Ellis 2006), preliminary data from on-going research (86% Chinook, NWFSC unpubl. data), and to address uncertainty about diet composition in coastal waters. The remaining percent of other salmon species in the diet was allowed to vary randomly (as described in NMFS 2007a, and NMFS 2008a), because the low sample sizes of other species make it difficult to fix a likely species composition.

Scenarios included:

Summer-Inland Waters:
(1) 86 percent Chinook (NWFSC unpubl. data).
(2) 70 percent Chinook (Ford and Ellis 2006).

Winter/Spring Coastal Waters:
(1) 86 percent Chinook (NWFSC unpubl. data).
(2) 70 percent Chinook (Ford and Ellis 2006).
(3) 60 percent Chinook (range extended to account for additional uncertainty regarding diet in coastal waters).

2. Metabolic Needs of the Southern Resident Killer Whales

We calculated the metabolic needs for all individuals of the Southern Resident killer whale DPS. Recently, Noren (in review) estimated the potential range of daily energy expenditure for Southern Resident killer whales for all ages and both sexes, taking into account metabolic needs for growth and lactation. Juveniles and adolescent males in particular had higher metabolic rates than previously estimated. Noren (in review) combined this information with the population census data to estimate a minimum and maximum daily energetic requirement for all the

members of the Southern Resident DPS based on the sex, age, and estimated body mass of the 85 whales in the population at the end of 2006. We updated the range of energy expenditure provided by Noren (in review) to reflect births and deaths in the Southern Resident population since 2006 and the current population estimate from 2007 of 87 whales (NMFS 2008b, Center for Whale Research unpubl. data). With these updates, the range of daily energetic expenditure for the entire Southern Resident population is 11,880,341 kcal day^{-1} (minimum) to 14,232,857 kcal day^{-1} (maximum).

3. Caloric Content of Salmon

We estimated the caloric content of salmon, and determined how many Chinook versus other salmon were needed for the time periods of occurrence in inland (May to September, 5 months) and coastal (January to April, 4 months) waters. Caloric content and body mass information have been collected from various runs of Chinook, chum and coho (Noren in review, NWFSC unpubl. data, NMFS 2008a). We used an average body mass and caloric content estimate for Chinook salmon in inland waters that has been applied in past consultations (7.4 kg and 14,891 kcal $fish^{-1}$, NMFS 2007a). This estimate for the caloric content of Chinook (14,891 kcal $fish^{-1}$) was used to estimate the prey needs of Southern Residents in inland waters. For coastal waters, we used fisheries catch data from this area to represent Chinook body mass. This estimate incorporated dressed weight for Chinook from California, Oregon and Washington, and the average dressed weight was converted to round weight (6.7 kg, NMFS 2008a). The same regression was applied to estimate average caloric content as used in past consultations (12,034 kcal $fish^{-1}$; Ylitalo et al. unpubl. data, NMFS 2008a).

For other salmon species, we used data for body mass from fisheries catch data (NMFS 2007a, NMFS 2008a), and estimated caloric content from the aforementioned regression model (Ylitalo, unpubl. data), (chum: 5.4 kg and 6,118 kcal $fish^{-1}$; coho: 3.7 kg and 5,491 kcal $fish^{-1}$; sockeye: 2.7 kg and 4,861 kcal $fish^{-1}$; pink: 1.9 kg and 2,273 kcal $fish^{-1}$; and steelhead: 3.5 kg and 6,121 kcal $fish^{-1}$). The estimates of caloric content used represent the best available information, given limited knowledge of the distribution of salmon with different caloric values and their spatial and temporal overlap with Southern Residents in inland and coastal waters.

4. Evaluating Prey Needs of Southern Resident Killer Whales

We evaluated the prey needs of Southern Resident killer whales in inland and coastal waters by incorporating the parameters described above for the metabolic needs of the entire Southern Resident DPS and the caloric content of salmon in our scenarios of diet composition. We calculated the number of salmon the entire population needed per day by multiplying the proportion of each salmon species in the diet by the daily prey energy requirement of the Southern Resident DPS (minimum and maximum bioenergetic requirements, Noren in review), divided by the energy values per salmon species. The number of salmon needed per day was multiplied by the number of foraging days during the summer in inland waters (153 days for May through September) and during the winter/spring in coastal waters (120 days for January to April) (Table 3).

Table 3. Biological Requirements Based on Diet Composition Scenarios and Bioenergetic Needs of Southern Residents in Inland and Coastal Waters.

Scenarios	Minimum[1] salmon needs for SRKW		Maximum[2] salmon needs for SRKW	
Summer - Inland Waters[3]	**Chinook**	**Other Salmon**	**Chinook**	**Other Salmon**
86% Chinook	104,977	44,146	**125,765**	94,913
70% Chinook	85,447	52,888	102,366	113,707
Winter/Spring - Coastal Waters[4]	**Chinook**	**Other Salmon**	**Chinook**	**Other Salmon**
86% Chinook	101,405	35,493	**121,485**	42,521
70% Chinook	82,924	74,371	99,345	89,098
60% Chinook	71,078	98,967	87,285	118,564

[1] Minimum salmon based on the minimum energy requirements for the SRKW DPS stated in the metabolic needs section above.
[2] Maximum salmon based on the maximum energy requirements for the SRKW DPS stated in the metabolic needs section above.
[3] May to September.
[4] January to April.

H. Effects of the Action on Listed Species

Section 7(a)(2) of the ESA directs federal agencies 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 their critical habitat. This Opinion assesses the effects of NMFS' proposal to implement ocean salmon fishing regulations within the Pacific EEZ. This section considers the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). This assessment determines whether it is reasonable to expect that the proposed action will appreciably reduce the likelihood of Southern Residents surviving and recovering in the wild.

1. Effects on the Species

According to the Biological Assessment prepared by NMFS, the proposed 2008 PFMC fisheries may affect listed Southern Residents through direct effects of vessel operation and indirect effects from reduction of prey availability. This section evaluates the direct and indirect effects of the proposed action on the ESA listed Southern Resident DPS, as well as the effects of other activities that are interrelated or interdependent with that action. We will then determine how the effects of the proposed action interact with the environmental baseline (50 CFR 402.02).

a. Effects of vessel operation

Although the proposed action involves regulations for fisheries in the entire EEZ off the U.S. West Coast, the potential for direct effects to Southern Residents from vessel operations are limited by fisheries time and area closures during the 2008 regulatory cycle. The 2008 PFMC salmon fisheries will occur primarily from May through September, north of Cape Falcon (Figures 5 and 6; NMFS 2008a and 2008c). Fisheries south of Cape Falcon were proposed for closure with the exception of a limited fishery on marked coho (mainly June to August) (Figures 5 and 6). There may be additional reductions in the length of the 2008 season because PFMC fisheries use catch quotas and landing limits. If the fishery reaches the catch quotas or landing limits before the end of the scheduled open period, the fishery will close early.

The ocean fisheries that open during the 2008 regulatory cycle will primarily be recreational and commercial troll fisheries using hook and line gear to target Chinook and coho salmon[1]. A small setnet fishery also occurs near the Cape Flattery area, usually taking fewer than 100 salmon a year. Marine net fisheries also occur in Willapa Bay and Grays Harbor (these fisheries are onshore or in inside waters where Southern Residents have not been sighted). The number of commercial and charter vessels participating in the fishery has declined substantially from the 1980s due to increasing fishery restrictions to protect wild salmon stocks, and falling market prices for salmon (NMFS 2008a). During the 2008 regulatory cycle, substantial time and area closures will further reduce the number of vessels participating in the fisheries.

[1] Pink salmon are also caught in odd-numbered years.

Southern Residents mainly occur in inland waters from May through September during the majority of the 2008 PFMC fishing season. In past years there have been occasional sightings of Southern Residents in coastal waters during this time. Very little fishing will occur in 2008 from October through April, when Southern Residents are more likely to occur in coastal waters (Figure 4). Based on the distances from shore that vessels typically fish North of Cape Falcon (mostly within 20 miles of shore, with the exception of some commercial troll areas), there is potential for interaction with Southern Residents, which are typically sighted within 10 miles of shore. However, based on limited potential for temporal overlap, there is a low potential for direct interaction between the PFMC fishery and Southern Resident killer whales. Further, as described in the Environmental Baseline section, direct impacts such as vessel strikes or any potential for entanglement are rare and have not been observed in association with this fishery. In addition, recreational and commercial troll boats operate at slow speeds or in idle when actively fishing, which does not appear to disrupt the whales' behavior (Krahn et al. 2004).

Figure 5. Final regulation schedule adopted by the Pacific Fisheries Management Council for 2008 salmon fisheries by month and area. Open fishing periods are indicated in white. Southern Resident killer whale sightings are indicated by pod (K or L).

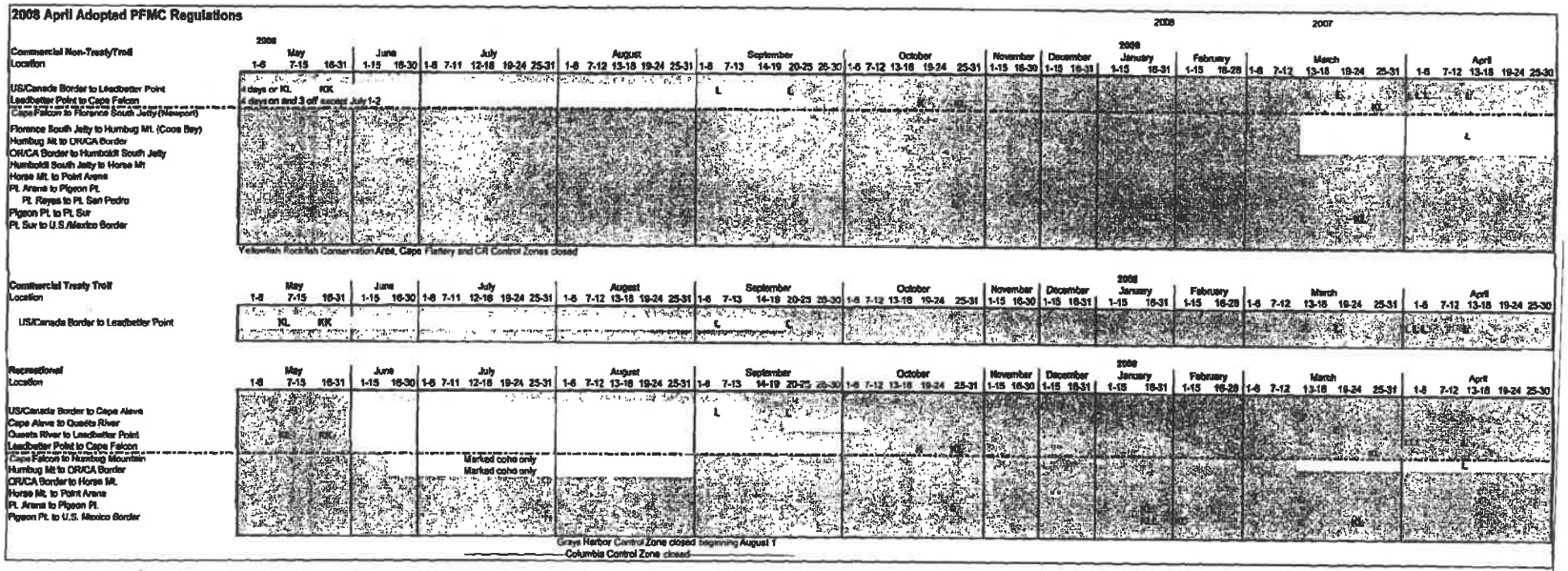
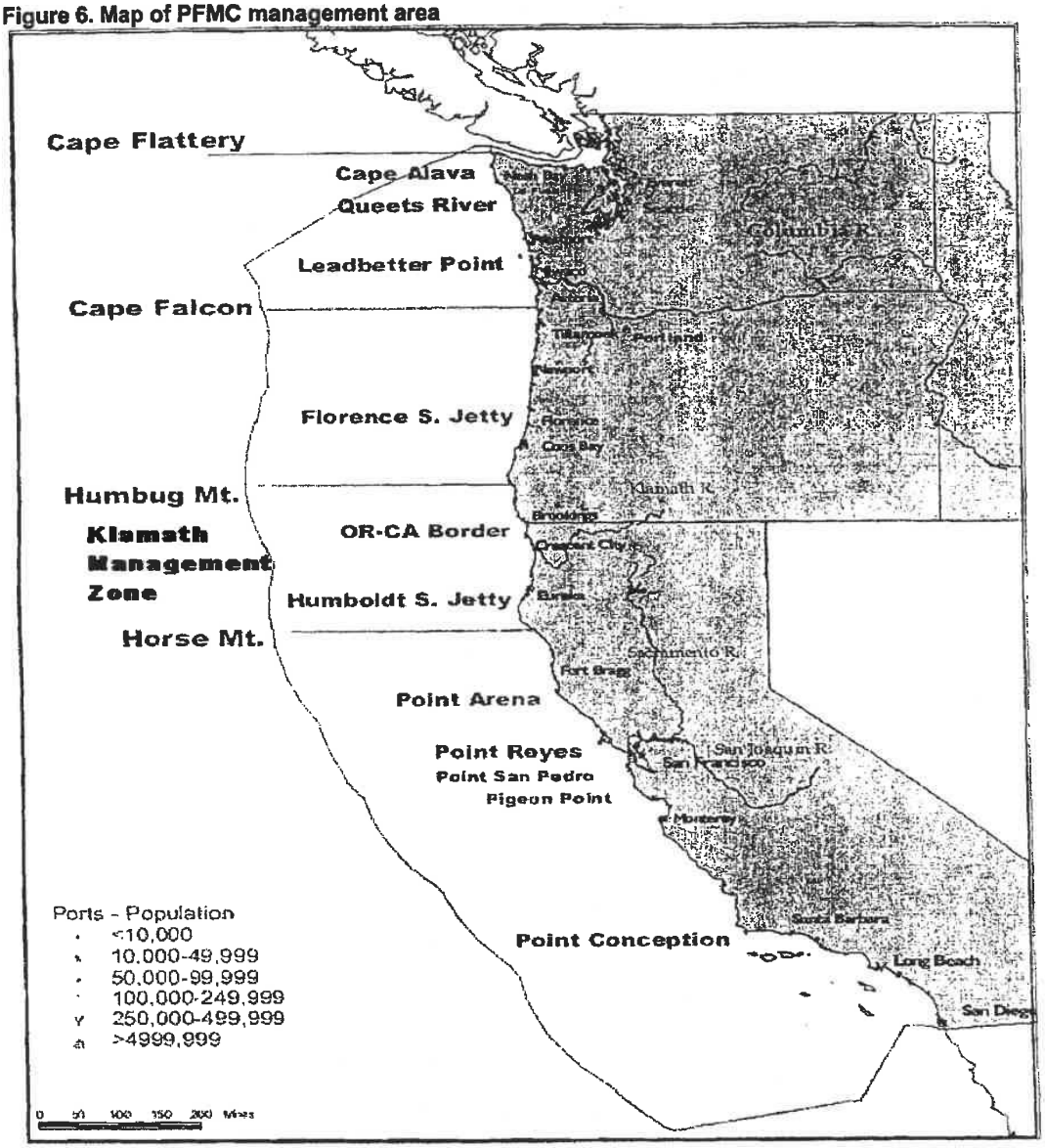


Figure 6. Map of PFMC management area



b. Effects of prey reduction

The proposed action has the potential to reduce prey availability, and this analysis considers whether effects of prey reduction may reduce the reproduction, numbers, or distribution of Southern Resident killer whales. We evaluated the potential effects of the proposed action on Southern Resident killer whales based on the best information currently available regarding metabolic needs of the whales, salmon abundance, and reductions in prey resulting from the proposed action. Effects during summer in inland waters were considered separately from the effects during winter/spring in coastal waters. Effects during fall months, when the occurrence of Southern Residents is less predictable, are discussed qualitatively.

This analysis focuses on effects to Chinook abundance, and to a lesser extent, on other salmon in coastal and inland waters during the seasons Southern Residents are most likely to occur in the respective portions of their range. As identified previously, the best available information indicates that Southern Residents prefer Chinook, at least from May to September, and considering this information they may also prefer Chinook when available in coastal waters during winter and spring (although at least a portion of the population may switch to chum salmon during the fall). An effects analysis on Chinook provides a conservative approach to evaluating reduction in prey availability. The total abundance of all salmon and other potential prey species within the range of Southern Residents is orders of magnitude larger than the total abundance of Chinook (tens of millions if considered all salmon species).

The short-term effects of the 2008 - 2009 PFMC fisheries on prey availability are evaluated by: 1) the percent of available Chinook removed by the PFMC fisheries; and 2) the remaining prey base of Chinook compared to the whales' needs. In addition we discuss the uncertainties involved in the prey estimates and where we have made conservative assumptions. The potential for long-term effects on prey availability are evaluated based on conclusions of the salmon analysis (NMFS 2008c) and review of conservation objectives for the primary contributing stocks (Table 4, discussed in detail in, NMFS 2008c).

Short-term or annual effects: In 2008, we expect approximately 93,900 Chinook and 66,150 coho to be killed in the PFMC recreational and commercial salmon troll fisheries (total = 160,050). Of the total fish killed, all of the coho and over 80 percent of the Chinook would be mature adult fish, which return to spawn in 2008 and move out of ocean waters to freshwater streams and rivers prior to early fall (i.e., October). Once these fish move out of ocean waters, they are no longer available to be caught by fisheries (or whales) in ocean waters. Except for salmon returning to inland waters, once salmon leave the ocean they are no longer available to Southern Residents as prey.

As discussed in H.1.a- Effects of vessel operation, there is little overlap expected between the 2008-2009 fisheries and Southern Resident killer whales. Based on the location and timing of harvest and the Southern Resident's movements, we expect 103 Chinook of the approximately 93,900 Chinook potentially caught in the 2008 PFMC fisheries would be harvested at a time (January through April) when they would have otherwise been available to the whales in their coastal range (160,050 – 121,850 NOF coho and Chinook

– 12,000 SOF Coho sport – 797 SOF Chinook sport; NMFS 2008a). The 103 Chinook removed from coastal waters when the whales are likely to be present reduces the prey available to the Southern Residents in coastal waters from January through April. Considering the ocean abundance of Chinook salmon estimated before fishing (1,265,788 Chinook, Table 2), the 2008 PFMC salmon fisheries may reduce the available Chinook prey resources by approximately 8×10^{-5} percent, a negligible difference from zero percent[2].

The PFMC fisheries also catch Chinook that would have returned to inland waters. The PFMC fisheries are expected to catch approximately 11,879 Chinook and 20,400 coho salmon (FRAM runs 2008 and 0824; NMFS 2008a) that may have otherwise returned to Puget Sound and been available as prey to the whales in inland waters (May to September). Considering the abundance of Chinook stocks that return to inland waters (Puget Sound and Canadian Stocks from Table 2) and other fisheries reductions from the environmental baseline (46,000 Chinook from WDFW/PSTIT harvest), the removal of 11,879 Chinook caught in the PFMC fisheries reduce the Chinook available to Southern Residents in inland waters by 2.2 percent[3].

Although the best available information indicates that Chinook are preferred prey of Southern Residents, preliminary study of Southern Resident diet suggests that at least members of J pod may switch to a mostly-chum diet when they intermittently occur in South Puget Sound during the fall months (Hanson et al. 2005, NWFSC unpubl data). If chum are included in the total prey available to the whales, any reduction in prey availability would be less than 2.2 percent in inland waters. For example, the total abundance of adult chum salmon returning to Puget Sound (greater than 1.8 million chum, based on summary of WDFW data for 1998-2002, T. Tynan pers. comm., March 13, 2008) combined with the total abundance of adult Chinook in their inland range would provide greater prey availability.

Remaining prey-base compared to whales' needs:
We then compared the amount of prey available to the whales after the action to the estimated number of fish needed by the whales. To be conservative we relied on scenarios that assume the whales' diet consists of mostly Chinook during both summer in inland waters and winter/spring in coastal waters. Considering the scenarios provided for inland and coastal waters respectively, Southern Residents could need as many as 125,765 Chinook from May to September and 121,485 Chinook from January to April (Table 3). Based on this scenario, the availability of Chinook in the inland waters range of Southern Residents would be 4 times the bioenergetic needs of the whales from May to September, and 10.4 times prey needs in coastal waters from January to April. Thus the result of the proposed action is that the Chinook prey available in inland waters would be reduced from 4.4 to 4.2 times prey needs, with no detectable change in the ratio for coastal waters.

Uncertainties and assumptions:

[2] (103 Chinook) / (1,265,788 expected 2008 Chinook ocean abundance before fishing).
[3] (11,879 Chinook) / (549,600 expected 2008 Chinook abundance of Puget Sound and Canadian Stocks + 11,879 Chinook – 10,205 Chinook from expected harvest in 2008 WDFW/PSTIT fisheries).

The ESA requires federal agencies to ensure their actions are not likely to jeopardize the continued existence of threatened and endangered species. Accordingly we used conservative assumptions to estimate effects on prey available to Southern Resident killer whales in coastal and inland waters. For example we used the maximum estimated energy for metabolic needs of Southern Residents in calculating the number of fish needed per day. We also used conservative scenarios for all salmon diets composed mainly of Chinook. In addition, the estimated ocean and inland abundances of Chinook salmon did not include all stocks, or all other sources of abundance, i.e., natural mortality.

Although these estimates do not quantitatively address the whales' needs during fall months (October to December), if we considered the whales' additional needs for this time period in either coastal or inland waters, or split between these areas the small reduction to prey resources or the ratios of prey availability to the whales' needs would not substantially change. Additionally, the likelihood that Southern Residents rely on a mostly-Chinook diet during fall months is diminished by the potential for at least members of J pod to switch to a mostly-chum diet during fall months when they intermittently occur in Puget Sound, and the fact that most Chinook adults returning to spawn in a given year have entered river systems by late-September to early-October.

Long-term effects: NMFS regulates PFMC fisheries to achieve management objectives for each of the Chinook and coho stock groups contributing to the fisheries to achieve sustainable fisheries in the long term. Managers constrain the fisheries to meet the objectives of individual stock groups (Table 4). The objectives consist of escapement goals, exploitation rates, escapement rates, or harvest reduction ratios depending on the salmon stock group. Where sufficient information is available, goals are set to maximize sustainable yield based on the natural productivity and capacity of the stock. For listed salmonids, the goals are consistent with ESA standards derived by NMFS and recovery plans, where those are available. While the harvest is managed to meet conservation objectives to promote recovery of salmon, we are not currently able to evaluate if the conservation objectives for salmon are consistent with the prey needs and recovery objectives for Southern Resident killer whales.

In the current year, all principal indicator stocks in the PFMC fisheries except one are expected to meet escapement goals. The exception is one of two bright populations in the Lower Columbia River Chinook ESU, the North Fork Lewis population. NMFS found that despite the fact that this indicator stock last met escapement goals in 2006, it is generally healthy because average escapement in recent years has exceeded escapement goals (average from 2000 to 2007 = 10,591 Chinook, compared to the escapement goal of 5,700 Chinook; NMFS 2008c). It was NMFS' biological opinion that the proposed 2008 PFMC fisheries are not likely to jeopardize the continued existence of Lower Columbia River Chinook. Thus although the 2008 proposed harvest will further reduce escapement of this stock below its escapement objective, NMFS has concluded that the lower Columbia Chinook ESU as a whole is likely to survive and recover. It is not possible to quantify the future reduced abundance of Chinook in the ocean as a result of this impact on 2008 escapement.

Since 1991, NMFS has conducted section 7 consultations on PFMC fisheries and concluded that the salmon fisheries north of Cape Falcon did not jeopardize the survival and recovery of listed salmonids, which is also true for the current year. The same has been true for salmon fisheries south of Cape Falcon, except in 2004, when NMFS determined that the PFMC salmon fisheries, as proposed in that area, would jeopardize listed Sacramento winter-run Chinook. As a result, regulations for those fisheries were subsequently adjusted to incorporate conservation measures that would not jeopardize listed salmonids (NMFS 2004b). The Sacramento fall-run Chinook stock is also expected to be below conservation objectives in 2008 (Table 4); however, this stock is not a part of a listed entity. The poor performance of Central Valley stocks were the impetus behind much of the fisheries closures south of Cape Falcon, and as a result of closure the proposed action will not affect escapements from these stocks (for more information, review the emergency declaration: http://www.nwr.noaa.gov/Salmon-Harvest-Hatcheries/Salmon-Fishery-Management/Salmon-Fishery-08.cfm).

Table 4. Harvest quotas and conservation objectives for primary contributing stocks with 2008 expectations. Stocks not meeting objectives are in BOLD (NMFS 2008a).

FISHERY		2001-2007 Avg Catch	2008 Quota/Catch	2008 Quota as % of 2001-2007 Average Catch
North of Falcon Non-treaty Commercial	Chinook	40,732	20,000	49%
	Coho	11,551	4,000	35%
North of Falcon Treaty Commercial	Chinook	23,038	37,500	163%
	Coho	39,996	20,000	50%
North of Falcon Recreational	Chinook	11,176	20,000	179%
	Coho	41,497	20,350	49%
South of Falcon Commercial	Chinook	582,072		0%
	Coho	0		
South of Falcon Recreational	Chinook	275,364		0%
	Coho	50,698	9,000	18%
Total PFMC	Chinook	932,382	77,500	8%
	Coho	143,742	53,350	37%

Only marked coho may be retained in non-treaty fisheries North of Cape Falcon and all fisheries south of Cape Falcon.

		2008 Abundance (Represents pre-fishing abundance)	2008 Expectation (Escapement or harvest rate)	Conservation Objective	2008 as % of Objective
CHINOOK STOCK					
Canadian stocks (Fraser, GS, WCVI)		305,000			
Puget Sound		244,600			
Columbia River					
Columbia Upriver Brights		162,500	165,900	57,300	190%
Mid-Columbia Brights		54,000	55,100	16,600	232%
Columbia Lower River HatcheryTules		59,000	55,900	31,100	80%
Columbia Lower River Natural Tules			35.8%	42%	-15%
Columbia Lower River Wild		3,800	3,800	5,700	-33%
Spring Creek Hatchery Tules		87,200	86,200	11,100	677%
Snake River Fall		6,388	46.60%	70%	-33%
California					
Klamath River Fall		188,200	40,700	35,000	16%
Sacramento River winter		157,100	ESA regulations in place		
Sacramento River fall			59,100	122,000-180,000	-52%

Table 4 Continued.

COHO STOCK		2008 Abundance	2008 Expectation	Conservation	2008
Fraser River (EXCL			8.30%	10%	-17%
Puget Sound					
Strait of Juan de Fuca	Natural	24,100	11%	40%	-73%
			22,000	12,800	72%
	Hatchery	9,500			
Nooksack-Samish	Natural	14,800			
	Hatchery	47,100			
Skagit	Natural	61,400	31%	35%	-12%
			51,300	30,000	71%
	Hatchery	18,300			
Stillaguamish	Natural	31,000	38%	50%	-25%
			25,500	17,000	50%
	Hatchery	100			
Snohomish	Natural	92,000	34%	40%	-14%
			79,700	70,000	14%
	Hatchery	53,500			
South Puget Sound	Natural	27,300			
	Hatchery	170,000			
Hood Canal	Natural	30,400	45%	65%	-31%
			21,400	21,500	0%
	Hatchery	35,000			
Coastal					
Willapa	Natural	35,100			
	Hatchery	25,500			
Grays Harbor	Natural	42,700	41,500	35,400	17%
	Hatchery	53,100			
Quinault	Natural	17,400			
	Hatchery	24,500			
Queets wild	Natural	10,200	8,900	5,800-14,500	53%
	Hatchery	10,300			
Hoh	Natural	4,300	3,900	2,000-5,000	95%
Quillayute fall	Natural	10,500	10,000	6,300-15,800	59%
	Hatchery	13,000			
Quillayute summer	Natural	1,100			
	Hatchery	4,200			
North Coast Independent Tributaries	Natural	3,200			
	Hatchery	5,000			
Columbia River					
OPI Public	Hatchery	216,100		20.00%	-100%
Columbia River Hatchery Early	Natural	110,300	92,400	38,700	139%
Columbia River Hatchery Late	Natural	86,400	68,100	15,200	348%
Upper Columbia River	Natural		>50%	50%	
Oregon Coastal, N. of Cape Blanco	Natural	1,700			
OR/CA Coastal , S. of Cape Blanco	Natural	17,700			
Lower Columbia River Natural	Natural	13,400	8.00%	8.00%	0%
Oregon Coastal Natural	Natural	60,000	6.90%	8.00%	-14%
Interior Columbia	Hatchery		1.00%	13.00%	-92%
2008 total expected Chinook/Coho ocean abundance		2,645,988	891,400		
2008 total expected Chinook ocean abundance		1,265,788	466,700		

2. Effects on critical habitat

In addition to the direct and indirect effects discussed above, the PFMC fisheries may have effects on critical habitat designated for Southern Resident killer whales. Based on the natural history of the Southern Residents and their habitat needs, we identified the following physical or biological features essential to conservation: (1) Water quality to support growth and development; (2) Prey species of sufficient quantity, quality and availability to support individual growth, reproduction and development, as well as overall population growth; and (3) Passage conditions to allow for migration, resting, and foraging. We evaluated effects to these features in our analysis.

We did not use the regulatory definition of "destruction or adverse modification" at 50 CFR 402.02 in this Opinion. Instead, this analysis relies on statutory provisions of the ESA, including those in section 3 that define "critical habitat" and "conservation", in section 4 that describe the designation process, and in section 7 that set forth the substantive protections and procedural aspects of consultations, and on agency guidance for application of the "destruction or adverse modification" standard (NMFS 2005).

The PFMC fisheries are not expected to have an impact on water quality or passage of the whales. Discharges from fishing vessels can affect water quality and vessels may affect the travel of the whales; however, the PFMC fishing fleet operates along the coast, outside of designated critical habitat.

Sufficient quantity, quality and availability of prey are an essential feature of the critical habitat designated for Southern Resident killer whales. The previous discussion of the PFMC fisheries effects on whales as a result of prey reduction is also relevant to effects on the prey feature of critical habitat. Effects of the fishery include a potential reduction in short- and long-term prey abundance in critical habitat resulting from the harvest of adult salmon. As described previously, the proposed PFMC fisheries are expected to result in the removal of 93,900 Chinook and 66,150 coho. An estimated 11,897 Chinook and 20,400 coho of the total catch would have otherwise been available to the whales within designated critical habitat. This represents a short-term (single year) reduction of Chinook in designated critical habitat of about 2.2 percent or less.

Additionally, the PFMC fisheries are managed to achieve the conservation objectives for the salmon stocks and harvest goals are set to maximize sustainable yield based on the natural productivity and capacity of the stock. Although a principle indicator stock for the Lower Columbia Chinook ESU is not expected to meet conservation goals in 2008, NMFS found that the proposed 2008 PFMC Fisheries are not likely to jeopardize the continued existence of Lower Columbia River Chinook, as described above. Very few Columbia River Chinook are found in inland waters, and thus any future consequences of the population's ability to meet conservation objectives in future years based on current year performance is not likely to affect designated critical habitat.

H. Cumulative Effects

Cumulative effects are those effects of future tribal, state, local or private activities, not involving Federal activities, reasonably certain to occur within the action area (50 CFR 402.02). For the purpose of this analysis, the action area is the EEZ under the jurisdiction of the PFMC and inland waters of Washington as described above. Future Federal actions will be reviewed through separate section 7 consultation processes. Non-Federal actions that require authorization under section 10 of the ESA, and that are not included within the scope of this conference, will also be evaluated in separate section 7 consultations.

Future tribal, state and local government actions will likely be in the form of legislation, administrative rules, or policy initiatives and fishing permits. Activities in the action area are primarily those conducted under state, tribal or federal government management. These actions may include changes in ocean policy and increases and decreases in the types of activities currently seen in the action area, including changes in the types of fishing activities, resource extraction, or designation of marine protected areas, any of which could impact listed species or their habitat. Government actions are subject to political, legislative and fiscal uncertainties. These realities, added to geographic scope of the action area which encompasses several government entities exercising various authorities, and the changing economies of the region, make any analysis of cumulative effects speculative. A Final Puget Sound Chinook Recovery Plan was adopted on January 19, 2007 (72 FR 2493) and a Final Recovery Plan for Southern Resident killer whales was published January 24, 2008 (NMFS 2008b). An Advanced Notice of Proposed Rulemaking regarding vessel effects on Southern Residents to gather information on the potential need for further regulations was published on March 22, 2007 (72 FR 13464). Although state, tribal and local governments have developed plans and initiatives to benefit marine fish species, ESA listed salmon, and the listed Southern Residents, they must be applied and sustained in a comprehensive way before NMFS can consider them "reasonably certain to occur" in its analysis of cumulative effects.

Private activities are primarily associated with other commercial and sport fisheries, construction, vessel traffic and sound, and marine pollution. These potential factors are ongoing, expected to continue in the future, and the level of their impact is uncertain. Therefore, it is difficult to assess the cumulative impacts and the relative importance of effects additional to those already identified.

I. Integration and Synthesis of Effects

This section discusses the effects of the action in the context of the status of the species, the status of critical habitat, the environmental baseline, and cumulative effects. Although the Southern Resident killer whale population has recently increased in size, it remains small. Because of the small population size, the loss of a single individual raises concerns about survival and recovery of the DPS. Similarly, even small effects on overall fitness of the population are a concern. The entire population is exposed to threats from vessel activities, high

levels of contamination, oil spills, and other human actions. It is unknown whether current prey availability year-round is adequate to maintain the fitness of the current population and provide for its recovery. While there is anecdotal evidence that some individual whales in some years may be undernourished, researchers have not established a correlation between salmon abundance in general – or Chinook abundance in particular – and population declines or increases. Ongoing research may in the future provide insights into whether lack of prey is affecting the fitness or recovery of Southern Residents.

The proposed action will reduce the amount of Chinook prey available to killer whales in coastal waters by a tiny percent and in inland waters by 2.2 percent. As a result, the number of Chinook available for killer whale consumption in inland waters will be 4.2 times the Southern Residents' metabolic needs versus 4.4 times needs. This small ratio raises concerns about the ability of killer whales to meet their nutritional needs when in inland waters. Nevertheless, there is currently no information indicating a correlation between Chinook abundance in inland waters and declines or increases in the Southern Resident population. In addition, these estimates are conservative.

The proposed action will also result in an increase in vessel activity in coastal waters. Any effects on killer whales are likely to be small, however, considering the limited potential for effects of vessel operations because of the unlikely time and space overlap of active PFMC fishing and Southern Resident killer whales.

J. Conclusions

After reviewing the current status of the endangered population of Southern Resident killer whales and their critical habitat, the environmental baseline for the action area, the effects of the proposed action, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of Southern Resident killer whales or adversely modify critical habitat. These conclusions were based on the following factors:

- The proposed action will reduce the amount of fish available to the whales when they occur in their coastal and inland waters within their range. According to our estimates, the 2008 PFMC fisheries may reduce the Chinook prey resources available to Southern Residents by a small percent (2.2) in inland waters, and a negligible reduction in coastal waters (8×10^{-5} percent reduction).

- Based on the best available information that Chinook are the killer whales' preferred prey in inland waters (and assuming this may be true in their coastal range), our conservative estimate is that the proposed action is likely to reduce the Chinook prey available in inland waters from 4.4 to 4.2 times prey needs, with no detectable change in the ratio for coastal waters.

- The proposed action sets harvest levels for only one year.

- Current information does not demonstrate a correlation between prey availability in inland waters and decreases or increases in the Southern Resident population. Ongoing research is expected to provide additional information as to whether a correlation exists. Because harvest is set on an annual basis, it will be possible to adjust the action if new information demonstrates a correlation that raises concerns.

- There are several factors that reduce the likely severity of effects from the proposed action, which we considered in making our conclusion:

    - The amount of spatial and temporal overlap between Southern Residents and the PFMC fisheries is small and direct interactions between the whales and vessels, gear or noise associated with the fishery are likely to be negligible. Additionally, there is no spatial or temporal overlap of fishing vessels and whales in designated critical habitat.

    - Our estimate of the number of Chinook required to sustain the Southern Resident killer whale population is likely an overestimate because we considered the maximum bioenergetic needs for all individuals of the population, and based decisions on the conservative assumption that the population relies on a mostly-Chinook diet.

    - Our estimate of the total number of Chinook available in inland and coastal waters during the time the killer whales are present is likely an underestimate, because our estimate does not include all stocks available in the action area, and does not include stocks outside the action area (i.e., Alaskan stocks and some Canadian stocks) that are likely consumed by Southern Residents. Additionally, our estimate does not account for all sources of natural mortality, such as predation (i.e., by killer whales).

We conclude that while the proposed action has the potential to adversely affect Southern Resident killer whales and their critical habitat by reducing prey in their range and critical habitat, the factors listed above reduce the severity of the impacts or mitigate our concerns, so that the proposed action is not likely to appreciably diminish the likelihood of the Southern Resident's survival and recovery nor significantly change the conservation value of essential features of its critical habitat. It is, therefore, NMFS' determination the 2008 PFMC fisheries are not likely to jeopardize the continued existence of the species or adversely modify critical habitat

K. Conservation Recommendations

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

The following conservation recommendations reduce the risks of the proposed action and provide information for future consultations involving the implementation of fisheries regulations that may affect Southern Resident killer whales, as well as reduce the adverse affects associated with fishing activities:

1. *Monitor and report Southern Resident killer whales in PFMC waters.* Although the Southern Residents are the subject of considerable scientific study, very little is known about their coastal habitat. In fact, the reference guide to the PFMC fishery regulations specifically requests information on killer whales when they are outside Puget Sound, including contact information, what should be documented, and the safe distance from which to observe killer whales. The available information suggests that there is some degree of overlap between the PFMC fisheries and the Southern Resident killer whales during certain times of the year. In addition to providing information in the reference guide, NMFS should work with the PFMC to teach fishermen how to identify, photograph, and report killer whale sightings in PFMC waters without causing harassment. With this information, we would better understand the level of overlap between the fisheries and the whales and improve our knowledge of the whales' coastal habitat.

2. *Support ongoing salmon recovery efforts to ensure an adequate food base for Southern Resident recovery.* In light of the inadequacy of information regarding the specific salmon stocks used by Southern Residents as prey, it is important to support salmon restoration efforts on a region-wide basis, with preliminary emphasis placed on river basins that are or have the potential to be significant producers of Chinook and other salmonids. NMFS will continue to play many roles in recovery planning and implementation. Successful salmon recovery programs must be broadly based and address the complex issues of land-use practices, commerce and energy demands, salmon harvest management, and hatchery management. Restoration measures for salmonids will require substantial actions across all categories of limiting factors and threats, as described in the Status of the Species and Environmental Baseline sections.

3. *Conduct research on the correlation between Southern Resident killer whale survival, birth rates, and various salmon species and stocks.* Assessing whether Southern Resident killer whales have adequate prey resources to support their survival and recovery is difficult because we lack a detailed knowledge of the food habits and seasonal ranges of killer whales, uncertainties in the historical and current abundance levels of many localized populations of prey, and the cyclic nature of large-scale changes in ocean conditions. Studies of resident killer whales indicate that fish, and particularly salmon, are the major dietary component of resident whales with a reported preference for Chinook salmon. To improve our understanding of the relationship between Southern Residents and their prey, NMFS continues to recommend and help facilitate further study dedicated to identifying the year-round food habits of Southern Residents in all parts of their range, including additional analysis of information regarding the correlation between Southern Resident survival and various salmon species and stocks within the range and distribution of this killer whale population.

4. *NMFS and the PFMC should cooperate with research partners to collect information on prey preference and biomass.* Although studies of resident killer whales indicate that fish, and particularly salmon, are the major dietary component of resident whales with a reported preference for Chinook salmon, more information is needed to determine the prey preference of Southern Residents in offshore waters. We recommend additional studies in cooperation with our research partners to confirm the relative importance of Chinook and to identify the contributions of other prey, including different salmon species, groundfish, herring, and squid. Information on prey size, annual variation in diet, and prey selection by age and sex class of whales in relation to species availability is also of interest.

5. *Minimize the ecosystem effects of the PFMC fisheries.* Fisheries that catch fish in particular areas during discrete times have greater potential to produce localized depletions of fish, which may interfere with predators that also take advantage of fish concentrations in overlapping places and times. Although NMFS has not identified this as an issue of concern for the PFMC fisheries, more information is needed to understand the effects of the fishery on an ecosystem level. Accordingly, NMFS should work with the PFMC to collect data and assess the potential for local depletion effects. Where a significant potential is identified, NMFS should work with the PFMC, the tribes, and states to develop means for reducing the impacts of fisheries that are concentrated in time and space.

L. Incidental Take Statement

The NMFS is not including an incidental take authorization for Southern Resident killer whales at this time because the incidental take of marine mammals has not been authorized under section 101(a)(5) of the Marine Mammal Protection Act and/or its 1994 Amendments. Following issuance of such regulations or authorizations, the NMFS may amend this biological opinion to include an incidental take statement for Southern Resident killer whales, as appropriate.

M. Reinitiation of Consultation

This concludes formal consultation on the effects of the proposed 2006 PFMC salmon fisheries on listed Southern Resident killer whales. Pursuant to the regulations found at 50 CFR 402.16, reinitiation of formal consultation is required and shall be requested by the Federal agency or by the Service, where discretionary Federal involvement or control over the action has been retained or is authorized by law and: (1) If new information reveals effects on the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (2) If the species or critical habitat is subsequently modified in a manner that has an effect to the listed species or critical habitat that was not considered in the biological opinion; or (3) If a new species is listed or critical habitat designated that may be affected by the identified action.

To reinitiate consultation, contact the Protected Resources Division of NMFS in the Northwest Regional Office and refer to the NMFS Tracking Number assigned to this consultation.

II. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

The consultation requirements of section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) directs Federal agencies to consult with NMFS on all actions, or proposed actions, that may adversely affect Essential Fish Habitat (EFH). EFH means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (MSA §3). Waters include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; substrate includes sediment, hard bottom, structures underlying the waters, and associated biological communities; necessary means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem (50 CFR 600.110). Adverse effects include the direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality of quantity of EFH. Adverse effects to EFH may result from actions occurring within EFH or outside EFH, and may include site-specific or habitat –wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CF 600.810). Section 305(b) also requires NMFS to recommend measures that may be taken by the action agency to conserve EFH.

The Pacific Fishery Management Council (PFMC) designated EFH for groundfish (PFMC 1998a), coastal pelagic species (PFMC 1998b), and Chinook, coho, and Puget Sound pink salmon. The proposed action and action area for this consultation are described in the Biological Opinion section of this document. The action area includes designated EFH for various life stages of Pacific coast groundfish, coastal pelagic species, and Pacific salmon. Activities shown to affect EFH include disturbance or destruction of habitat from stationary fishing gear, dredging and filling, agricultural and urban runoff, direct discharge, and the introduction of exotic species. The harvest-related activities of the proposed action involve boats using hook-and-line gear and gill nets. The use of these gear types affects the water column rather than the deeper water, offshore habitats. The PFMC assessed the effects of fishing on salmon EFH and provided recommended conservation measures in Appendix A to Amendment 14 of the Pacific Coast Salmon Plan (PFMC 1999). The PFMC also assessed the effects of ghost fishing by gillnets on EFH for groundfish and provided recommended conservation measures in the Final Environmental Assessment/Regulatory Impact Review for Amendment 11 to the Pacific Coast Groundfish Management Plan (PFMC 1998b) and the NMFS EFH for West Coast Groundfish Appendix (Casillas et al. 1998).

The PFMC concluded fishing activities of the type included in the proposed actions considered in this opinion are likely to adversely affect EFH and it provided recommended conservation measures (Casillas et al. 1998; PFMC 1998a; PFMC 1999). The PFMC adopted these

conservation measures for fishing activities under its jurisdiction at the June 2000 Council meeting, and they were approved by the Secretary of Commerce as part of the package on Amendment 14 on September 27, 2000. These conservation measures remain in effect for the PFMC fisheries. Therefore, NMFS concludes that EFH has been adequately addressed for the PFMC fisheries.

Essential Fish Habitat Conservation Recommendations

Pursuant to section 305(b)(4)(A) of the MSA, NMFS is required to provide EFH conservation recommendations to Federal agencies regarding actions which may adversely affect EFH. However, based on NMFS' conclusion, conservation recommendations were developed and adopted for the PFMC fisheries; therefore, no additional conservation recommendations beyond those identified and already adopted are required.

Supplemental Consultation

NMFS must reinitiate EFH consultation with itself if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH conservation recommendations (50 CFR 600.920(k)).

III. INFORMATION QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

Section 515 of the Treasury and General Government Appropriations Act of 2001 (Public Law 106-554: Information Quality Act) specifies three components contributing to the quality of a document: utility, integrity, and objectivity. This section of the Biological Opinion addresses these Information Quality Act (IQA) components, documents NMFS' compliance with the IQA, and certifies that this Opinion has undergone pre-dissemination review.

Utility: This document records the results of one intra-agency consultation, completed under the authority of the ESA. The information presented in this document is useful to federal agencies, including NMFS, state natural resource management agencies, local and tribal governments. This consultation helps to fulfill NMFS' legal obligations under multiple authorities. The information is also useful and of interest to the general public because it describes the manner by which public trust resources are being managed and conserved. The information presented in these documents and used in the underlying consultations represents the best available scientific and commercial information.

Integrity: This consultation was completed on a computer system managed by NMFS in accordance with the relevant technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

Objectivity:

Information Product Category: Natural Resource Plan

Standards: This consultation and the supporting documents are clear, concise, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards, including the NMFS ESA Consultation Handbook, and ESA Regulations (50 CFR 402.01 et seq.).

Best Available Information: This consultation and the supporting documents use the best available information, as referenced in the Literature Cited section. The analyses provided in this Opinion contain more background on information sources and quality.

Referencing: All supporting materials, information, data, and analyses are properly referenced, consistent with standard scientific referencing style.

Review Process: This consultation was drafted by NMFS staff with training in ESA implementation, and reviewed in accordance with the Northwest Region's ESA quality control and assurance processes.

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Appendix 1. NMFS ESA decisions regarding salmon ESUs affected by PFMC Fisheries and the duration of the 4(d) Limit determination or biological opinion (BO). Only those decisions currently in effect are included.

Date (Decision type)	Duration	Citation	ESU considered
March 8, 1996 (BO)	until reinitiated	NMFS 1996	Snake River spring/summer and fall Chinook, and sockeye
April 28, 1999 (BO)	until reinitiated	NMFS 1999	S. Oregon/N. California Coast coho Central California Coast coho Oregon Coast coho
April, 2000 (BO)	until reinitiated	NMFS 2000	Central valley Spring-run Chinook California Coastal Chinook
April, 2001 (4(d) Limit)	until withdrawn	NMFS 2001	Hood Canal summer-run chum
April, 2001 (BO)	until reinitiated	NMFS 2001b	Upper Willamette River Chinook Lower Columbia River Chinook Columbia River chum Ozette Lake sockeye Upper Columbia River spring-run Chinook Ten listed steelhead ESUs
April, 2004 (BO)	until 2010	NMFS 2004	Sacramento River winter-run Chinook
March 4, 2005 (4(d) Limit)	until May, 2010	NMFS 2005a	Puget Sound Chinook
June 13, 2005	until reinitiated	NMFS 2005b	California Coastal Chinook
April 27, 2006 (BO)	until April 30, 2007	NMFS 2006	Lower Columbia River Coho

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