Endangered Species Act Biological Opinion and Magnuson-Stevens Act Essential Fish Habitat Consultation on the Impacts of Programs Administered by the Bureau of Indian Affairs that Support Puget Sound Tribal Salmon Fisheries, Salmon Fishing Activities Authorized by the U.S. Fish and Wildlife Service, and Fisheries Authorized by the U.S. Fraser Panel in Puget Sound from August 1, 2010 through April 30, 2011

Action Agency: Bureau of Indian Affairs (BIA)
U.S. Fish and Wildlife Service (USFWS)
National Marine Fisheries Service (NMFS)

Species/Evolutionarily Significant Units That May Be Affected:

Species	Evolutionarily Significant Unit/Distinct Population Unit	Status	Federal Register Notice	
Chinook Salmon (*Oncorhynchus tshawytscha*)	Puget Sound	Threatened (reaffirmed)	64 FR 14308 70 FR 37160	3/24/1999 6/28/2005
Steelhead (*O. mykiss*)	Puget Sound	Threatened	72 FR 26722	5/11/2007
ESA-Listed Rockfish (Sebastes spp.)	Canary,Yelloweye Bocaccio	Threatened Endangered	75 FR 22276	4/28/2010
Killer whales (*Orcinus orca*)	Southern Resident	Endangered	70 FR 69903	11/18/2005
Steller sea lions (*Eumetopias jubatus*)	Eastern	Threatened (reaffirmed)	55 FR 49204 62 FR 24345	11/26/1990 5/5/1997
Green Sturgeon (*Acipenser medirostris*)	Southern	Threatened	71 FR 17757	4/7/2006
Pacific eulachon (*Thaleichthys pacificus*)	Southern	Threatened	75 FR 13012	3/18/2010

Activities considered: This is NMFS' Endangered Species Act (ESA) section 7 consultation and Essential Fish Habitat (EFH) consultation on three proposed Federal actions, which the action agencies have chosen to coordinate as a package for these consultations.

(1) Funding of Puget Sound tribes' management, enforcement, and monitoring projects associated with Puget Sound salmon fisheries implemented during August 1, 2010-April 30, 2011;

(2) Authorization of fisheries, as party to the Hood Canal Salmon Management Plan from August 1-April 30, 2011.

(3) Two related actions associated with the management of the U. S. Fraser Panel sockeye and pink fisheries under the Pacific Salmon Treaty (PST).

   (a) the U.S. government's relinquishment of regulatory control to the bilateral Fraser Panel within specified time periods and

   (b) the issuance of orders by the Secretary of Commerce that establish fishing times and areas consistent with the in-season implementing regulations of the U.S. Fraser River Panel. This regulatory authority has been delegated to the Regional Administrator of NMFS' Northwest Region.

Consultation conducted by: NMFS, Sustainable Fisheries Division, Northwest Region.
Consultation Number: F/NWR/2010/03521

This consultation consists of three primary federal actions. First, the BIA proposes to fund Puget Sound tribal management, enforcement, and monitoring projects in support of the Puget Sound Salmon Management Plan (PSSMP). The Puget Sound Salmon Management Plan (1985) is the implementation framework for the allocation, conservation and equitable sharing principles of U.S. v. Washington that governs management of salmon resources in the Puget Sound Action Area between the Puget Sound treaty tribes and State of Washington. Second, the USFWS proposes to authorize fisheries that are consistent with the implementation of the Hood Canal Salmon Management Plan, a regional plan and stipulated order related to the PSSMP. The relinquishment of regulatory control by the U.S. to the bilateral Fraser Panel and the subsequent issuance of regulations by NMFS for fisheries under the U.S Fraser Panel control constitute its third federal action.

This Opinion focuses on impacts to listed Puget Sound species under NMFS' jurisdiction that may occur in Puget Sound salmon and steelhead fisheries during the remainder of the fishing year from August 1, 2010 through April 30, 2011. Federal agencies proposing activities that may affect species listed under the ESA may request a formal consultation under Section 7(a)(2) of the ESA. In this biological opinion, NMFS reviews information regarding the impacts on listed Puget Sound Chinook and steelhead salmon, Southern Resident killer whales, southern green sturgeon, southern eulachon, eastern Steller sea lion and the Puget Sound/Georgia Basin rockfish associated with the proposed actions. The biological opinion has been prepared in accordance with section 7 of the ESA, as amended (16 U.S.C. 1531 et seq.). A complete administrative record of this consultation is on file with NMFS, Sustainable Fisheries Division in Seattle, Washington.

Approved by: ______________________
William W. Stelle, Jr., Regional Administrator

Date: July 28, 2010 **[Expires on:** May 1, 2011]

Endangered Species Act Section 7(a)(2) Consultation Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation

Impacts of Programs Administered by the Bureau of Indian Affairs that Support Puget Sound Tribal Salmon Fisheries, Salmon Fishing Activities Authorized by the U.S. Fish and Wildlife Service, and Fisheries Authorized by the U.S. Fraser Panel in Puget Sound from August 1, 2010 through April 30, 2011

Action Agencies: Bureau of Indian Affairs (BIA)
U.S. Fish and Wildlife Service (USFWS)
National Marine Fisheries Service (NMFS)

Consultation Conducted By: National Marine Fisheries Service, Northwest Region

NMFS Tracking Number: F/NWR/2010/03521

Date Issued: July 28, 2010

Issued By:

William W. Stelle, Jr.
Regional Administrator

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1 Introduction

1.1 Background

This document constitutes the National Marine Fisheries Service's (NMFS) biological opinion under section 7 of the ESA and Magnuson-Stevens Essential Fish Habitat consultation for the following three federal actions proposed by the NMFS, Bureau of Indian Affairs (BIA) and the U.S. Fish and Wildlife Service (USFWS):

(1) The proposed BIA funding of Puget Sound tribes' management, enforcement, and monitoring projects associated with Puget Sound salmon fisheries implemented during August 1, 2010-April 30, 2011;

(2) The proposed USFWS authorization of fisheries, as party to the Hood Canal Salmon Management Plan (U.S. v. Wash. Civil 9213, Ph. I (Proc. 83-8)), from August 1, 2010-April 30, 2011; and,

(3) Two actions associated with the management of the 2010 U. S. Fraser Panel sockeye and pink fisheries under the Pacific Salmon Treaty (PST).

   (a) the U.S. government's relinquishment of regulatory control to the bilateral Fraser Panel within specified time periods and,

   (b) the issuance of orders by the Secretary of Commerce that establish fishing times and areas consistent with the in-season implementing regulations of the U.S. Fraser River Panel. This regulatory authority has been delegated to the Regional Administrator of NMFS' Northwest Region.

NMFS is grouping these three proposed Federal actions in this consultation pursuant to 50 CFR 402.14 (c) because they are similar actions occurring within the same geographical area. Puget Sound non-treaty salmon fisheries and related enforcement, research and monitoring projects associated with fisheries other than those governed by the U.S. Fraser Panel, are included as interrelated and interdependent actions because the state of Washington and the Puget Sound tribes are required under the Puget Sound Salmon Management Plan, implementation plan for *U.S. v Washington*, to jointly manage Puget Sound salmon fisheries (see 384 F. Supp. 312 (W.D. Wash. 1974)).

This Biological Opinion considers impacts of the proposed actions on the Puget Sound Chinook salmon Evolutionarily Significant Unit (ESU), the Puget Sound Steelhead Distinct Population Segment (DPS), the Southern Resident killer whale DPS, the Southern Green Sturgeon DPS, the Southern Eulachon DPS, the Eastern Steller sea lion DPS, and three listed Puget Sound rockfish DPS' under the ESA. Other listed species occurring in the Action Area are either covered under existing, long-term ESA opinions or 4(d) determinations, or NMFS anticipates the proposed actions would have no affect to the species.

On July 10, 2000, NMFS issued the ESA 4(d) Rule establishing take prohibitions for 14 salmon and steelhead ESUs, including the Puget Sound Chinook Salmon ESU (65 Fed. Reg. 42422, July 10, 2000). The ESA 4(d) Rule provided limits on the application of the take prohibitions, i.e., take prohibitions would not apply to the plans and activities set out in the rule if those plans and activities met the rule's criteria. One of those limits (Limit 6, 50 CFR 223.203(b)(6)) applies to joint tribal and state resource management plans. In 2005, as part of the final listing determinations for sixteen Evolutionarily

Significant Units of West Coast salmon, NMFS amended and streamlined the previously promulgated 4(d) protective regulations for threatened salmon and steelhead (70 Fed. Reg. 37160, June 28, 2005). Under these regulations, the same set of fourteen limits was applied to all threatened Pacific salmon and steelhead ESU's or DPS's. As a result of the Federal listing of the Puget Sound Steelhead DPS in 2007 (72 Fed. Reg.26722, May 11, 2007), NMFS applied the 4(d) protective regulations adopted for the other Pacific salmonids (70 Fed. Reg. 37160, June 28, 2005) to Puget Sound steelhead (73 Fed. Reg. 55451, September 25, 2008).

Since 2001, NMFS has received, evaluated and approved a series of jointly developed resource management plans (RMP) from the Puget Sound Treaty Indian Tribes (PSIT) and the Washington Department of Fish and Wildlife (WDFW)(collectively the co-managers) under Limit 6 of the 4(d) Rule. These RMPs provided the framework within which the tribal and state jurisdictions jointly managed all recreational and commercial salmon fisheries, and steelhead gillnet fisheries impacting listed Chinook salmon within the greater Puget Sound area. The most recent RMP approved in 2005 expired April 30, 2010 (NMFS 2005a). The federal actions consulted on in the associated biological opinions included NMFS' 4(d) determinations and similar BIA program funding and USFWS Hood Canal Salmon Plan related actions.

For the past two years, the co-managers have been negotiating a successor to the 2004-2009 Puget Sound Chinook Harvest RMP (May1, 2004-April 30, 2010) and have concluded a new RMP that would extend for five years, through April 30, 2015 (PSIT and WDFW 2010a). Finalizing the 2010 Puget Sound RMP requires a determination that the RMP is consistent with the criteria in Limit 6 of the 4(d) Rule and an ESA section 7 consultation by NMFS on its determination. Because of the timing of events NMFS anticipated a gap between the time the 2004 RMP expired at the end of April and when NMFS makes its determination and completes a biological opinion on the 2010 RMP. In May, NMFS issued a biological opinion for impacts of Puget Sound salmon fisheries on listed species for the May 1-July 31 time period, expecting to complete it's analysis of the RMP under the 4(d) Rule by August 1, 2010. The scope and complexity of the analysis involved and delays in obtaining key information extended the anticipated schedule to complete the RMP evaluation until after the bulk of the 2010 fishing season was complete. With that information, NMFS determined that the most efficient course of action was to complete a biological opinion on the impacts to listed species for the remainder of the fishing year (through April 30, 2011).

As a consequence, this Opinion evaluates the effects of the fishery actions authorized or funded by the BIA and USFWS on the listed species between the expiration of the current biological opinion on August 1, 2010 and the remainder of the fishing year. NMFS expects to complete the 4(d) determination on the proposed 2010 RMP by May 1, 2011. The BIA formally requested consultation on its administration of programs that support tribal management of salmon fisheries in Puget Sound during this interim period in a letter to NMFS dated July 21, 2010 (Ball 2010). A detailed description of the fisheries is included in the 2010-2011 Co-managers List of Agreed Fisheries subsequently provided to NMFS on May 4, 2010 (WDFW and NWIFC 2010). The fisheries that are the subject of this Opinion (August 1, 2010 through April 30, 2011) are a subset of the fisheries negotiated for the full 2010 Puget Sound salmon fishing season during the North of Falcon preseason planning process. This planning process implements certain requirements of joint management between the Puget Sound treaty tribes and WDFW under *U.S. v. Washington.* Although this biological opinion focuses on fisheries occurring in the August-April period, the evaluation of the 2010 RMP under the 4(d) Rule will consider the effects of all salmon fisheries anticipated to occur under the 5-year RMP including the full set of fisheries negotiated in the 2010 North of Falcon process (May 1, 2010–April 30, 2011).

1.2 Consultation History

The effects of Puget Sound salmon fisheries on listed species under NMFS' jurisdiction have been considered for ESA compliance through completion of long-term biological opinions or the ESA 4(d) Rule evaluation and determination processes. Opinions and 4d determinations for salmon, steelhead and other NMFS listed species still in effect are summarized in Table 1. As discussed above, the 4(d) determination for the Puget Sound Chinook RMP expired April 30, 2010. In each case, NMFS concluded that the proposed actions were not likely to jeopardize the continued existence of any of the listed species. NMFS also concluded that the actions were not likely to destroy or adversely modify designated critical habitat for any of the listed species. Therefore, with the exception of Puget Sound Chinook and steelhead, the other ESUs and DPS's of salmonids will not be discussed further in this Opinion.

Table 1. NMFS ESA decisions regarding listed species affected by Puget Sound salmon fisheries and duration of the decision (4(d) Limit or biological opinion (BO)). Only the decisions currently in effect and the listed species represented by those decisions are included.

Date (Coverage)	Duration	Citation	ESU considered
March 1996 (BO)*	until reinitiated	NMFS 1996	Snake River spring/summer and fall Chinook and sockeye
April 1999 (BO) *	until reinitiated	NMFS 1999a	S. Oregon/N. California Coast coho Central California Coast coho Oregon Coast coho
April, 2000 (BO) *	until reinitiated	NMFS 2000a	California Central Valley spring-run Chinook
April 2001 (4(d) Limit)	until withdrawn	NMFS 2001a	Hood Canal summer-run Chum
April 2001 (BO) *	until withdrawn	NMFS 2001b	Upper Willamette River Chinook Columbia River chum Ozette Lake sockeye Upper Columbia River spring-run Chinook Ten listed steelhead ESUs
April 2004 (BO) *	until withdrawn	NMFS 2004a	Puget Sound Chinook
June 13, 2005*	Until reinitiated	NMFS 2005b	California Coastal Chinook
April 2008 (BO) *	until reinitiated	NMFS 2008a	Lower Columbia River coho Puget Sound steelhead
December 2008 (BO)	through December 2018	NMFS 2008b	Southern Resident killer whales Steller sea lions North American Green sturgeon
April 2010 (BO)*	through April 30, 2012	NMFS 2010a	Lower Columbia River Chinook Three ESA listed Puget Sound rockfish DPS's

* Focus is fisheries under PFMC and US Fraser Panel jurisdiction. For ESU's and DPS's from outside the Puget Sound area, the effects assessment includes impacts in Puget Sound, and fisheries are managed for management objectives that include impacts that may occur in Puget Sound salmon fisheries.

This is the second consultation on the effects of Puget Sound salmon fisheries on the three Puget Sound rockfish and Puget Sound steelhead DPS'. Three DPS's of Puget Sound rockfish were listed on April 28, 2010 (75 Fed. Reg. 22276). Bocaccio (*S. paucispinis*) are listed as endangered. Yelloweye rockfish (*S. ruberrimus*) and canary rockfish (*S. pinniger*) are listed as threatened. The listings became effective on July 27, 2010. The Puget Sound steelhead DPS was listed as threatened on May 11, 2007 (72 Fed. Reg. 26722). Critical habitat for the steelhead and rockfish DPS' has not been designated. NMFS and the co-managers are currently discussing revisions to a joint RMP for Puget Sound steelhead provided to NMFS by the co-managers in November, 2008. In the first consultation, NMFS assessed the effect of Puget Sound salmon fisheries occurring during May 1-July 31, 2010 and concluded they would not jeopardize the Puget Sound Chinook ESU, the Puget Sound steelhead DPS, the Southern Resident killer whale DPS or the three Puget Sound rockfish DPS's.

1.3 Description of the Proposed Action

BIA Funding of Tribal Management, Enforcement, and Monitoring Projects:
The BIA proposes to fund Puget Sound tribal management, enforcement, and monitoring projects in support of the Puget Sound Salmon Management Plan (PSSMP) during the remainder of the 2010 fishing year from August 1, 2010 through April 30, 2011 (see WDFW and NWIFC 2010 for fisheries proposed to occur during this period). This Opinion focuses on project funding that may impact listed Puget Sound species under NMFS' jurisdiction. The co-managers manage Puget Sound fisheries pursuant to the PSSMP, which establishes guidelines for management of all marine and freshwater salmon fisheries from the Strait of Juan de Fuca eastward. The PSSMP was adopted by court order as a sub-proceeding related to *U.S. v. Washington* Civ. No. C70-9213 (W.D. Wash.)(see 384 F. Supp. 312 (W.D. Wash. 1974)).

USFWS Authorization of Fisheries Consistent with the Hood Canal Salmon Management Plan:
The USFWS proposes to authorize fisheries that are consistent with the implementation of the Hood Canal Salmon Management Plan (HCSMP)(1985) from August 1, 2010 through April 30, 2011. The USFWS, along with the State of Washington and the treaty tribes within the Hood Canal, is party to the HCSMP which is a regional plan and stipulated order related to the PSSMP. The state, tribal, and federal parties to the Hood Canal Plan establish management objectives for stocks originating in Hood Canal including listed Chinook and summer-run chum stocks. Any change in management objectives under the HCSMP requires authorization by the USFWS, as a party to the plan. Management under the HCSMP affects those fisheries where Hood Canal salmon stocks are caught. This Opinion focuses on Puget Sound salmon and steelhead fisheries that may impact listed Puget Sound species under NMFS' jurisdiction from August 1, 2010 through April 30, 2011 (see WDFW and NWIFC 2010 for fisheries proposed to occur during this period).

These actions require consultation with NMFS because the Federal agency (BIA, or USFWS) is funding or authorizing actions that may adversely affect listed species (section 7(a)(2) of the ESA). Puget Sound non-treaty salmon fisheries and related enforcement, research and monitoring projects are included as interrelated and interdependent actions because the state of Washington and the Puget Sound tribes are required under the PSSMP to jointly manage Puget Sound salmon fisheries (see 384 F. Supp. 312 (W.D. Wash. 1974)).

Fisheries Managed under the U.S. Fraser Panel

The Fraser Panel controls sockeye and pink fisheries conducted in the Strait of Juan de Fuca and San Juan Island regions in the U.S., the southern Georgia Strait in the U.S. and Canada, and the Fraser River in Canada, and certain high seas and territorial waters westward from the western coasts of Canada and the U.S. between 48 and 49 degrees latitude. The Fraser Panel assumes control from July 1 through September, although the exact date depends on the fishing schedule in each year. The fisheries in recent years have occurred in late July and August. These fisheries are commercial and subsistence net fisheries using gillnet, reef net and purse seine gear to conduct fisheries targeted on Fraser River-origin sockeye and, in odd-numbered years (e.g., 2005, 2007, 2009), pink salmon. Other salmon species are caught incidentally in these fisheries. The U.S. Fraser Panel fisheries are managed in-season to meet the objectives described in Chapter 4 of the PST (the Fraser Annex). The season structure and catches are modified in-season in response to changes in projected salmon abundance, fishing effort or environmental conditions in order to assure achievement of the management objectives and in consideration of safety concerns. U.S. Fraser Panel fisheries are also managed together with the suite of other Puget Sound and Pacific Fisheries Management Council fisheries to meet conservation and harvest management objectives for Chinook, coho and chum salmon.

Two Federal actions are taken to allow the Fraser Panel to manage Fraser River sockeye and pink fisheries in Fraser Panel Waters. One action grants regulatory control of the Fraser Panel Area Waters by the U.S. and Canadian governments to the Panel for in-season management. The other action is the issuance of in-season orders by NMFS that give effect to Fraser Panel actions in the U.S. portion of the Fraser Panel Area. The Pacific Salmon Treaty Act of 1985 (16 U.S.C. 3631 et seq.) grants to the Secretary of Commerce authority to issue regulations implementing the Pacific Salmon Treaty. Implementing regulations at 50 CFR 300.97 authorize the Secretary to issue orders that establish fishing times and areas consistent with the annual Pacific Salmon Commission regime and in-season orders of the Fraser River Panel. This authority has been delegated to the Regional Administrator of NMFS' Northwest Region.

1.4 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. For the purposes of this Opinion, the action area (Figure 1) includes all marine and freshwater fishing areas in Puget Sound and the western Strait of Juan de Fuca to Cape Flattery within the United States; and certain high seas and territorial waters westward from the U.S. coast between 48 and 49 degrees latitude during the period of Fraser Panel control (a detailed description of U.S. Panel Area waters can be found at 50 CFR 300.91, Definitions). Within this area, U.S. Fraser Panel fisheries occur in the Strait of Juan de Fuca region (treaty Indian drift net fisheries) Catch Reporting Areas 4B, 5, and 6C, and in the San Juan Islands Area (treaty Indian drift net, set net, and purse seine fisheries; and non-treaty drift net, reef net, and purse seine fisheries) Catch Reporting Areas 6, 6A (treaty only), 7, and 7A.

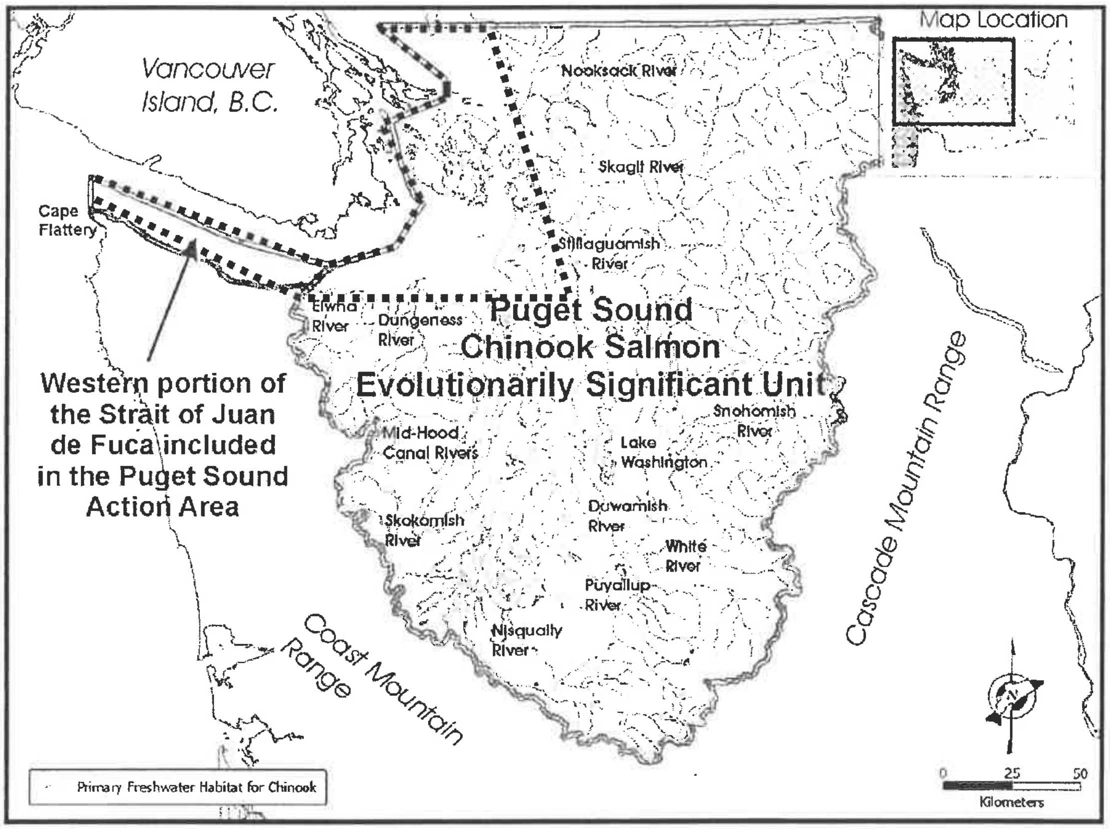


Figure 1. Puget Sound Action Area, which includes the Puget Sound Chinook ESU and the western portion of the Strait of Juan de Fuca in the United States. Dashed area denotes waters in U.S. Fraser Panel jurisdiction.

1.5 Associated Informal Consultations

Much of this Opinion addresses the effects of the proposed actions on listed Puget Sound Chinook, Puget Sound steelhead, Southern Resident killer whales, and the three Puget Sound rockfish DPS'. This section addresses three additional species (southern green sturgeon, southern eulachon and eastern Steller sea lions) and any associated critical habitat. Aside from those considered in existing opinions noted above, other listed species are found in the Action Area but migration timing, habitat use or other life history characteristics make their encounter in Puget Sound salmon fisheries highly unlikely.

Green Sturgeon

Individuals of the southern DPS of green sturgeon are unlikely to be caught in Puget Sound salmon fisheries. Most marine area fisheries use hook-and-line gear to target pelagic feeding salmon near the surface and in mid-water areas. Net gear that is used in terminal and nearshore areas throughout the action area is fished at the surface. Green sturgeon are bottom oriented, benthic feeders. NMFS is not aware of any records or reports of green sturgeon being caught in Puget Sound salmon fisheries. Any contact of the gear with the bottom would be rare and inadvertent. Given their separation in space and differences in feeding habitats, and the nature and location of the salmon fisheries, NMFS would not expect green sturgeon to be caught in or otherwise affected by the proposed fisheries or there to be any effect on the primary constituent elements (PCEs) of the critical habitat, making any such effects discountable. The proposed salmon fisheries therefore are not likely to adversely affect green sturgeon or its designated critical habitat.

Eulachon

Eulachon in the listed southern DPS are primarily a marine, pelagic species that spawn in the lower reaches of coastal rivers and whose primary prey is zooplankton (Drake et al. 2010a). They are typically found "in near-benthic habitats in open marine waters" of the continental shelf between 20 and 150 m depth (Hay and McCarter 2000). In Puget Sound the species is found almost exclusively in the Strait of Juan de Fuca and San Juan Islands (W. Palsson, WDFW, unpubl. data). Eulachon are caught in targeted commercial fisheries in the Columbia River basin using small-mesh gillnets (i.e., ≤2 inches) and small mesh dipnets (although small trawl gear is legal, it is rarely used). Eulachon have been taken as bycatch in pink shrimp trawl gear off of the coast of Oregon, Washington and California (Hannah and Jones 2007) and in Puget Sound (W. Palsson, pers. comm., WDFW, Fish Biologist). Salmon fisheries in the northern Puget Sound areas use nets with large mesh sizes (i.e., >4 inches) and hook and line gear designed to catch the much larger salmon species. The gear is deployed to target pelagic feeding salmon near the surface and in mid-water areas. Encounters of eulachon in salmon fisheries would be extremely unlikely given the general differences in spatial distribution and gear characteristics. NMFS is not aware of any record of eulachon caught in either commercial or recreational Puget Sound salmon fisheries. Given all of the above, NMFS would not expect eulachon to be caught or otherwise affected by the proposed fisheries, making any such effects discountable. The proposed salmon fisheries therefore are not likely to adversely affect eulachon or its designated critical habitat.

Steller sea lions

Steller sea lions in Washington are from the species' eastern DPS. For the past 25 to 30 years, the eastern DPS has grown steadily at about 3 percent per year. The final revised recovery plan for Steller sea lions (73 FR 11872) identified no threats to their continued recovery. Steller sea lions can occur in Washington waters throughout the year, however there are no breeding rookeries in Washington. Occurrence in the action area is limited to primarily male and sub-adult Steller sea lions in fall, winter, and spring months. Given these data and other information, the biological opinion on the 2008-2018 Pacific Salmon Treaty Agreement found that the fishery actions contemplated there were not likely to adversely affect Steller sea lions or its critical habitat. NMFS incorporates by reference the findings in that document because the proposed fisheries would have even less effect than those considered therein (NMFS 2008b).

1.6 Southern Resident Killer Whale Consultation

Earlier this year, we consulted on the effects Puget Sound salmon and steelhead fisheries would have on killer whales from May-July of 2010 (NMFS 2010). That biological opinion incorporated by reference NMFS' previous Southern Resident killer whale and critical habitat analysis and findings of the Pacific Salmon Treaty biological opinion that the harvest was likely to adversely affect, but not likely to jeopardize the continued existence of Southern Resident killer whales (NMFS 2008b). This was because the fishery would only have a limited effect on Puget Sound Chinook stocks (from May- July, 2010), and the effects during this limited timeframe were not likely to be more than the effects previously considered under the Pacific Salmon Treaty opinion. Therefore, NMFS determined that Puget Sound fisheries from May-July of 2010 were likely to adversely affect, but not likely to jeopardize the continued existence of Southern Resident killer whales or adversely modify their critical habitat.

In this opinion we consider the effects these fishery actions will have on killer whales from August, 2010 through April, 2011—after which time we will have completed consultation on the 5-year RMP. In considering those effects, we will continue to incorporate by reference (and rely upon) the previous Southern Resident killer whale and critical habitat analysis and findings (and therefore the status, environmental baseline, effects and conclusions) contained in the Pacific Salmon Treaty biological opinion (NMFS 2008b) and the 2009 U.S. Fraser Panel fisheries biological opinion (NMFS 2009). These opinions remain current and incorporate best available information for the relevant sections.

Given the short time period under consideration (through April 2011), the smaller geographical extent of the Puget Sound fishery, and that the exploitation and anticipated escapement rates for Chinook affected by Puget Sound fisheries during this time are within the scope of effects previously contemplated (Bishop 2010), it is our opinion that the new effects it may generate would be no greater than those already contemplated in the Pacific Salmon Treaty opinion. Similarly, harvest levels for the proposed 2010 U.S. Fraser Panel fisheries will be lower than harvest levels planned for in 2009 (Tynan 2010), and correspondingly impacts to Southern Resident killer whale prey base are also anticipated to be lower. Therefore, NMFS finds that the 2010 U.S. Fraser Panel fisheries are within the scope of effects considered in the 2009 U.S. Fraser Panel fisheries biological opinion. Therefore, NMFS finds that the proposed Puget Sound fisheries from August 1, 2010 – April 30, 2011 are likely to adversely affect, but not likely to jeopardize the continued existence of Southern Resident killer whales or adversely modify their critical habitat.

2 Endangered Species Act: Biological Opinion

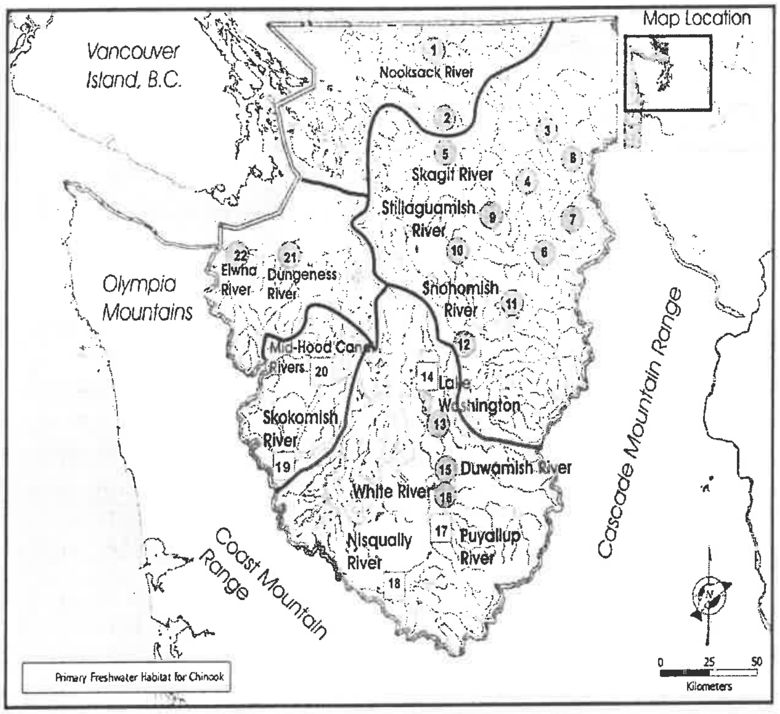
2.1 Range-wide Status of the Species and Critical Habitat

2.1.1 Puget Sound Chinook

Current Rangewide Status of the Species

On March 24, 1999, NMFS listed Puget Sound Chinook salmon as a threatened species (64 Fed. Reg. 14308, March 24, 1999; 70 Fed. Reg. 37160, June 28, 2005). The ESU encompasses all runs of Chinook salmon from rivers and streams flowing into Puget Sound, including the Straits of Juan de Fuca from the Elwha River eastward, and rivers and streams flowing into Hood Canal, South Sound, North Sound, and the Strait of Georgia in Washington. Also included in the ESU are 26 artificial propagation programs. The majority of Chinook salmon in this area are fall run (also called late) fish that exhibit an ocean-type life history. Although some spring-run (also called early) Chinook salmon populations in the Puget Sound Chinook ESU have a high proportion of yearling smolt emigrants, the proportion varies substantially from year to year, and appears to be environmentally mediated rather than genetically determined (Myers et al. 1998). Puget Sound populations all tend to mature at ages 3 and 4 and exhibit similar, coastally-oriented, ocean migration patterns. A recovery plan for the ESU was adopted in 2007 (72 Fed. Reg. 2493, January 27, 2007; NMFS 2006a). It describes the population structure, identifies populations essential to recovery of the ESU, establishes recovery goals for each of the populations based largely on the recommendations of the Puget Sound Technical Recovery Team (Ruckelshaus et al. 2002 and 2006), and recommends habitat, hatchery and harvest actions designed to contribute to the recovery of the ESU.

The Puget Sound TRT identified 22 demographically independent populations within five geographic regions across the ESU, representing the primary historical spawning areas of Chinook salmon (Ruckelshaus et al. 2006). Populations were further classified into two broad categories according to the population's life history and production characteristics (NMFS 2005a)(Figure 2). Category 1 watersheds are areas where populations are genetically unique and indigenous to Puget Sound. These areas are managed primarily for natural-origin production. Category 2 watersheds are areas where indigenous populations are believed to no longer exist, but where sustainable wild populations existed historically. Until recently, these areas were managed for hatchery production used extensively to mitigate for natural production lost to habitat degradation. Consequently, in many of these systems, hatchery and natural fish are currently genetically indistinguishable on the spawning grounds.



Key: Chinook salmon populations (Ruckelshaus et al. 2006). Categories as defined by Sustainable Fisheries Division, NOAA Fisheries, NW Region.

1 - North Fork Nooksack River
2 - South Fork Nooksack River
3 - Upper Skagit River
4 - Lower Sauk River
5 - Lower Skagit River
6 - Upper Sauk River
7 - Siuattle River
8 - Upper Cascade River
9 - North Fork Stillaguamish River
10 - South Fork Stillaguamish River
11 - Skykomish River
12 - Snoqualmie River
13 - Cedar River
14 - Lake Washington Northern Tributaries
15 - Green River
16 - White River
17 - Puyallup River
18 - Nisqually River
19 - Skokomish River
20 - Mid-Hood Canal Rivers
21 - Dungeness River
22 - Elwha River

Category 1
Category 2

Figure 2. Populations of the Puget Sound Chinook salmon ESU.

NMFS considers these distinctions in genetic legacy and watershed condition in assessing the risks to survival and recovery of proposed actions across populations within the Puget Sound Chinook ESU. It is important to take into account whether the genetic legacy of the population is intact or if it is no longer distinct. Populations are defined by their relative isolation from each other, and by the unique genetic characteristics that evolve as a result of that isolation to adapt to their specific habitats. If these are populations that still retain their historic genetic legacy, then the appropriate course to insure their survival and recovery is to preserve that genetic legacy and rebuild those populations. Preserving that legacy requires both a sense of urgency and the actions necessary and appropriate to preserve the legacy that remains. However, if the genetic legacy is gone, then the appropriate course is to recover the populations using the individuals that best approximate the genetic legacy of the original population, reduce the effects of the factors that have limited their production and provide the opportunity for them to readapt to the existing conditions. NMFS has incorporated this approach in its previous 4d determination on the 2004-2009 Puget Sound Chinook RMP (NMFS 2005) and in several other recent opinions (NMFS 2010a, NMFS 2008b, NMFS 2008h).

The Puget Sound TRT determined that all 22 populations are currently at high risk (NMFS 2006a). Three of the five regions (Strait of Juan de Fuca, Georgia Basin, and Hood Canal) contain only two populations, both of which must be recovered to viability to recover the ESU (NMFS 2006a). Under the Puget Sound Salmon Recovery Plan, the Suiattle and one each of the early, moderately early, and late run-timing populations in the Whidbey Basin Region, as well as the White and Nisqually[1] (or other late-timed) populations in the Central/South Sound Region must also achieve viability (NMFS 2006a). Consistent with these population structure criteria, the Nisqually, Skokomish and Mid-Hood Canal populations, currently classified as Category 2 watersheds, will therefore need to transition to Category 1 status over time as the populations adapt to the watersheds and habitat conditions improve to support natural production. The timing and magnitude of changes in harvest that occur in these watersheds must be coordinated with corresponding habitat and hatchery actions. The relevance of these distinctions for specific populations is discussed in more detail in the Effects section of this document (Section 2.3.1).

Limiting factors for the Puget Sound Chinook populations include a range of adverse affects associated with land use activities including urbanization, forestry, agriculture, and development. Populations are also limited by the adverse effects of hatchery operations and harvest. The severity and relative contribution of these factors varies by population. Declines in fish populations in Puget Sound in the 1980s and into the 1990s may reflect broad-scale shifts in natural limiting conditions, such as increased predator abundances and decreased food resources in ocean rearing areas. These factors are discussed in more detail in the Environmental Baseline (Section 2.2).

Abundance, Productivity and Trends

Overall abundance of Chinook salmon in this ESU has declined substantially from historical levels, and several populations are small enough that genetic and demographic risks are high. In its 1998 status review, NMFS noted that the average run size (hatchery + natural) at that time was approximately 240,000 fish with natural spawning escapement averaging 25,000 fish (Myers et al. 1998). Since 1998, natural spawning escapement has increased to an annual average of approximately 45,000 with increases observed in all life history types (spring, summer, fall).

[1] The TRT noted that the Nisqually watershed is in comparatively good condition, and thus the certainty that the population could be recovered is among the highest in the Central/South Region. NMFS concluded in its supplement to the Puget Sound Salmon Recovery Plan that protecting the existing habitat and working toward a viable population in the Nisqually watershed would help to buffer the entire region against further risk (NMFS 2006a).

Table 2 summarizes the available information on current abundance and productivity and their trends for the Puget Sound Chinook populations including recovery plan targets for abundance and productivity. The information is summarized from the most recent status review of West Coast salmon ESUs (Good et al. 2005), NMFS' final supplement to the Puget Sound Salmon Recovery Plan (NMFS 2006a) and recent escapement and fisheries data provided by the co-managers.

Escapement trends for natural Chinook salmon runs in North Puget Sound (Georgia Strait and Whidbey Basin Regions) were predominately negative through the mid-1990s. Escapement trends are now predominantly positive (1990-2007). In South Puget Sound and Hood Canal, escapement trends have been predominantly stable. However, the contribution of hatchery fish to natural escapements in many of the populations, particularly in the latter regions, may be substantial. Because data on the proportion of hatchery fish in spawning escapements is limited to recent years for these regions, escapement estimates for most years in the trend analysis includes hatchery fish; potentially masking the trends in natural-origin production.

Since listing, the geometric mean (1999–2009) of natural spawners in populations of Puget Sound Chinook salmon ranges from 150 (Mid-Hood Canal population) to just over 10,000 fish (Upper Skagit River population)(Table 2). Just over half of the 22 populations contain natural spawners numbering over 1,000 fish (median recent natural escapement = 1,254 fish); however, only two of those are thought to have a consistently low fraction of hatchery fish (Table 2). Estimates of the fraction of natural spawners that are of hatchery origin are currently limited. Data are available for 19 of the 22 populations in the ESU, and such information is available for only the most recent 5-10 years and varies greatly in quality (Table 2). Based on the available information, the six Skagit populations have very little hatchery contribution to natural spawning. The Cedar, Duwamish-Green, White, Puyallup, Stillaguamish and Snohomish populations have moderate proportions of naturally spawning hatchery fish. The remainder of the populations have substantial numbers of naturally spawning hatchery fish. Better, more broad-scale information will become available over the next several years because management agencies have increased marking and monitoring programs to more comprehensively track hatchery fish.

Twenty -one of the 22 Puget Sound Chinook populations exhibit stable or increasing trends in abundance (Table 3). In particular, the North Fork Nooksack, White and Dungeness River populations show substantial increasing trends; but associated supplementation programs contribute substantially to natural escapement for all three populations. Estimates of median population growth rate have not been updated for the most recent period, but the current information is probably still reflective of the general trends since escapements have remained at or above those seen in the early 2000s. Trends in growth rate of return (i.e., recruits/spawers) and escapement (i.e., spawners/spawners) are generally similar to or lower than those for trends in escapement. Since the growth rate reflects the performance of the naturally produced fish, the differences likely reflect the influence of degraded habitat and potential negative effects of the intermingled hatchery fish. The data series for the two sets of information also differ by a few years.

Table 2. Estimates of abundance and productivity for Puget Sound Chinook populations. Natural origin escapement information is provided where available. As noted, for several populations, data on hatchery contribution to natural spawning are limited or unavailable. Populations in critical status are bolded.

Region	Population	1999 to 2009 Geometric mean Escapement (Spawners)		Escapement Thresholds		Recovery Planning Abundance Target (productivity)	Average % hatchery fish in escapement 1999-2008 (min-max)[5]
		Natural[1]	Natural-Origin (Productivity[2])	Critical[3]	Rebuilding[4]		
Georgia Basin		2,107	296	400	500		
	NF Nooksack (early)	1,701	227 (0.7)	*200[6]*	-	3,800 (3.4)	85 (76-94)
	SF Nooksack (early)	376	**56 (1.0)**	*200[6]*	-	2,000 (3.6)	82 (62-92)
Whidbey/ Main Basin	Upper Skagit River (moderately early)	10,092	10,561 (2.4)	967	7,454	5,380 (3.8)	4 (0-7)
	Lower Sauk River (moderately early)	618	690[8] (1.7)	*200[6]*	681	1,400 (3.0)	2 (0-7)
	Lower Skagit River (late)	2,245	2,248[8] (1.9)	251	2,182	3,900 (3.0)	3 (0-7)
	Upper Sauk River (early)	423	425[9] (1.8)	130	330	750 (3.0)	1 (0-8)
	Suiattle River (very early)	312	317[9] (1.9)	170	400	160 (3.2)	0
	Upper Cascade River (moderately early)	308	298[9] (1.6)	170	*1,250[6]*	290 (3.0)	2 (0-15)
	NF Stillaguamish R. (early)	1,031	565[9] (1.2)	300	552	4,000 (3.4)	45 (37-56)
	SF Stillaguamish R. (moderately early)	**152**	**152 (0.9)**	*200[6]*	300	3,600 (3.3)	NA
	Skykomish River (late)	3,918	2,578[9] (1.4)	1,650	3,500	8,700 (3.4)	32 (17-47)
	Snoqualmie River (late)	1,906	1,731[9] (1.9)	400	*1,250[6]*	5,500 (3.6)	14 (7-23)
Central/South Sound	Cedar River (late)	555	591[9] (1.7)	*200[6]*	*1,250[6]*	2,000 (3.1)	23 (10-36)
	Sammamish River (late)	1,122	210[9] (0.3)	*200[6]*	*1,250[6]*	1,000 (3.0)	79 (66-88)
	Duwamish-Green R. (late)	6,754	3,615 (1.9)	835	5,523	-	44 (16-66)
	White River[10] (early)	1,013	987 (1.8)	*200[6]*	1,100[7]	-	37 (27-49)
	Puyallup River (late)	1,809	969 (0.6)	*200[6]*	1,200[7]	5,300 (2.3)	43 (18-59)
	Nisqually River (late)	1,549		*200[6]*	1,200[7]	3,400 (3.0)	68 (53-79)
Hood Canal	Skokomish River (late)	1,311	437[9] (1.1)	452	1,160	-	55 (7-77)
	Mid-Hood Canal Rivers[11] (late)	**150**		*200[6]*	*1,250[6]*	1,300 (3.0)	NA
Strait of Juan de Fuca	Dungeness River (early)	395	**124[8] (0.6)**	*200[6]*	925[7]	1,200 (3.0)	72 (39-96)
	Elwha River[12] (late)	1,748		*200[6]*	*1,250[6]*	6,900 (4.6)	NA

[1] Includes naturally spawning hatchery fish
[2] Source is Abundance and Productivity Tables from Puget Sound TRT database. Sammamish productivity estimate has not been revised to include Issaquah Creek

[3] Critical threshold under current habitat and environmental conditions. (McElhaney et al. 2000, NMFS 2000b)
[4] Rebuilding thresholds under current habitat and environmental conditions (McElhaney et al. 2000, NMFS 2000b)
[5] Estimates of the fraction of hatchery fish in natural spawning escapements are from the Puget Sound TRT database and co-manager postseason reports on the Puget Sound Chinook Harvest Management Plan (WDFW and PSTIT 2005, 2006, 2007, 2008, 2009) and the proposed 2010-2014 Puget Sound Chinook Harvest Management Plan (PSIT and WDFW 2010)
[6] Based on generic VSP guidance (McElhaney et al. 2000, NMFS 2000b)
[7] Based on alternative habitat assessment
[8] Estimates of natural-origin escapement for Skagit springs available only for 1999-2007; for Snohomish available only for 1999-2001, 2004, and 2006-2007; and for Lake Washington populations for 2003-2008.
[9] Estimates of natural-origin escapement available only for 1999-2008.
[10] Captive broodstock program for early run Chinook salmon ended in 2000; estimates of natural spawning escapement include an unknown fraction of naturally spawning hatchery-origin fish from late- and early run hatchery programs in the White and Puyallup River basins.
[11] The Puget Sound TRT considers Chinook salmon spawning in the Dosewallips, Duckabush, and Hamma Hamma rivers to be subpopulations of the same historically independent population; annual counts in those three streams are variable due to inconsistent visibility during spawning ground surveys.
[12] Estimates of natural escapement do not include volitional returns to the hatchery or those fish gaffed or seined from spawning grounds for broodstock collection.

Table 3. Trends in abundance and productivity for Puget Sound Chinook populations. Long-term, reliable data series for natural-origin contribution to escapement are limited in many areas.

Region	Population	Escapement Trend[a] (1990-2009)		Median Growth Rate[b] (1990-2005)	
		Trend	Direction	Return	Escapement
Georgia Basin	NF Nooksack (early)	1.21	increasing	1.02	1.02
	SF Nooksack (early)	1.06	increasing	0.92	1.00
Whidbey/ Main Basin	Upper Skagit River (moderately early)	1.04	increasing	0.98	1.06
	Lower Sauk River (moderately early)	1.02	stable	0.97	1.00
	Lower Skagit River (late)	1.03	stable	0.97	1.02
	Upper Sauk River (early)	1.02	stable	0.95	1.00
	Suiattle River (very early)	0.98	stable	0.99	0.99
	Upper Cascade River (moderately early)	1.04	increasing	1.05	1.05
	NF Stillaguamish R. (early)	1.02	stable	0.95	0.99
	SF Stillaguamish R.[c] (moderately early)	0.93	**declining**	0.89	0.94
	Skykomish River (late)	1.03	stable	0.99	1.05
	Snoqualmie River (late)	1.05	increasing	0.99	1.03
Central/South Sound	Cedar River (late)	1.05	increasing	0.95	1.06
	Sammamish River[d] (late)	1.07	stable	0.94	0.96
	Duwamish-Green R. (late)	0.99	stable	1.01	1.04
	White River[e] (early)	1.09	increasing	1.13	1.12
	Puyallup River (late)	0.99	stable	0.88	0.91
	Nisqually River (late)	1.07	increasing	0.92	1.01
Hood Canal	Skokomish River (late)	1.01	stable	0.92	1.01
	Mid-Hood Canal Rivers (late)	1.00	stable	0.88	0.99
Strait of Juan de Fuca	Dungeness River (early)	1.09	increasing	1.05	1.13
	Elwha River[cf] (late)	0.99	stable	0.96	1.00

[a] Escapement Trend is calculated based on all spawners (i.e., including both natural origin spawners and hatchery-origin fish spawning naturally).
[b] Median growth rate (λ)is calculated assuming the reproductive success of naturally spawning hatchery fish is equivalent to that of natural-origin fish (for those populations where information on the fraction of hatchery fish in natural spawning abundance is available). Source: Abundance and Productivity Tables from Puget Sound TRT database.
[c] Estimate of the fraction of hatchery fish in time series is not available for use in λ calculation, so trend represents that in hatchery-origin + natural-origin spawners.
[d] Median growth rate estimates are not updated for revised Sammamish escapement estimate methodology.
[e] Natural spawning escapement includes an unknown fraction of naturally spawning hatchery-origin fish from late- and early run hatchery programs in the White and Puyallup River basins.
[f] Estimates of natural escapement do not include volitional returns to the hatchery or those fish gaffed or seined from spawning grounds for broodstock collection.

Eleven populations exhibit a stable or increasing growth rate in return and 19 populations exhibit a stable or increasing growth rate in escapement (Table 3). Growth rates in return show substantial declining trends for the South Fork Nooksack, South Fork Stillaguamish, Puyallup, Nisqually, and Skokomish populations. The White River population shows a significant increasing trend in growth rates for both return and escapement (Table 3). Growth rates for both return and escapement are declining for the South Fork Stillaguamish, Sammamish, and Puyallup populations. No clear patterns in trends in abundance or growth rate are evident among the five major regions of Puget Sound.

NMFS has derived critical and rebuilding escapement thresholds for some of the Puget Sound Chinook salmon populations based on an assessment of current habitat and environmental conditions. After taking into account uncertainty, the critical threshold is defined as a point below which: (1) depensatory processes are likely to reduce the population below replacement; (2) the population is at risk from inbreeding depression or fixation of deleterious mutations; or (3) productivity variation due to demographic stochasticity becomes a substantial source of risk (NMFS 2000b). The rebuilding threshold is defined as the escapement that will achieve Maximum Sustained Yield (MSY)[2] under current environmental and habitat conditions (NMFS 2000b). Thresholds were based on population-specific data where available. For populations lacking such data, generic guidance from the Viable Salmonid Paper (McElhaney et al. 2000) or alternative analyses based on habitat capacity have been used (NMFS 2005c). These VSP-derived thresholds offer only general guidance as to what generally represents points of population stability or instability. Some populations may be fairly robust at very low abundances, while other populations in large river systems may become unstable at higher abundances depending on resource location and spawner density. However, without population-specific information, NMFS believes these generic guidelines used to derive thresholds for some populations offer the best available information. Table 2 compares the recent years' average escapements for each population with their respective critical or upper thresholds. Comparisons are made on the basis of natural-origin escapement where data are available.

It is important to note that the rebuilding thresholds represent a level of spawning escapement, consistent with current environmental conditions, that is associated with rebuilding to recovery. For most populations, these thresholds are well below the escapement levels associated with recovery (Table 2), but achieving these threshold levels is a necessary step to eventual recovery when habitat and other conditions are more favorable than they currently are. Survival and recovery of the Puget Sound Chinook Salmon ESU will depend, over the long term, on

[2] MSY is the point on the spawner-recruit curve that represents the maximum number of progeny produced per spawner. It is the curve itself that describes the overall status of the population. The curve represents both the abundance and the productivity of the population. In this context, NMFS uses the MSY point to represent that curve. As conditions change over time, the curve will change and the MSY point will change with it. For example, the high productivity recovery planning targets for Puget Sound Chinook populations represents the MSY point on a curve associated with greatly improved habitat condition, i.e., productivity (NMFS 2006a). As conditions improve, the natural habitat will support more salmon and the rebuilding thresholds will increase, eventually approaching the recovery planning targets.

improvements in habitat conditions, and reductions in the effects of hatcheries, in addition to the harvest reforms that have been and are being implemented.

Average natural-origin escapements are above critical thresholds for all populations except for the South Fork Nooksack, South Fork Stillaguamish, Skokomish, Mid-Hood Canal Rivers and Dungeness populations (Table 2). Average natural-origin escapements for the North Fork Nooksack and Sammamish populations are near their critical thresholds. Average natural-origin escapements for eight of the 22 populations are above their rebuilding thresholds, although hatchery fish contribute substantially to natural escapement for the Elwha and Nisqually populations (Table 2). Adult production originating from associated conservation programs contribute extensively to the annual return abundance of the North Fork Nooksack River, South Fork Nooksack, and Dungeness Chinook population. If escapement of the hatchery-origin fish to the natural spawning grounds from the Kendall Creek Hatchery is considered, the average spawning escapement is 1,699 fish for the North Fork Nooksack River. Total natural escapement to the South Fork Nooksack River has averaged 371 fish over the same period due to strays from the Kendall Creek and fall Chinook hatchery programs, and North Fork Nooksack early and localized natural-origin South Fork fall Chinook. Contribution from the Dungeness supplementation program has also contributed to spawning escapement for that population. Average total natural escapement is 395 for the Dungeness; well above the critical threshold when the supplementation program contribution is taken into account. Hatchery-origin adults from the associated fishery augmentation programs contribute extensively to the Sammamish and Skokomish spawning ground escapement. Total natural escapement when hatchery contribution is included is 1,122 and 1,311 for the Sammamish and Skokomish populations, respectively.

Spatial Structure, Diversity and Extinction Risk

As described earlier, the Puget Sound TRT identified five biogeographical regions within the Puget Sound Chinook ESU and associated each of the 22 populations with one of the regions. This structure is illustrated in Figure 1. It also recommended six delisting criteria that would describe a viable ESU (NMFS 2006a): 1) The viability status of all populations is improved from current condition; 2) Two to four populations in each of the regions achieve viability, depending on the historical biological characteristics and acceptable risk levels for populations within each region; 3) At least one population from each major genetic and life history group historically present within each of the five biogeographical regions is viable; 4) Tributaries not identified as primary habitat are functioning sufficient to support an ESU-wide recovery scenario; 5) Production from tributaries not identified as primary freshwater habitat occurs in a manner consistent with ESU recovery; and, 6) populations that do not meet the viability criteria for all VSP parameters are sustained to provide ecological functions and preserve options for ESU recovery.

Three of the five biogeographical regions (Strait of Juan de Fuca, Georgia Basin, and Hood Canal) contain only two populations, both of which, according to NMFS' delisting criteria, must be recovered to viability. The Suiattle and one each of the early, moderately early, and late run-timing populations in the Whidbey Basin Region, as well as the White and Nisqually[3] (or other late-timed) populations in the Central/South Sound Region must also achieve viability (NMFS 2006a).

The previous section described the trends and status of populations within the various regions. In general, the Strait of Juan de Fuca, Georgia Basin and Hood Canal regions are at greater risk than the other regions due to critically low abundance and declining growth rates of at least one of the two populations in the region. In addition, spatial structure, or geographic distribution, of the White, Skagit, Elwha and Skokomish populations has been substantially reduced or impeded by the loss of access to the upper portions of those tributary basins due to flood control activities and hydropower development. It is likely that genetic diversity has also been reduced by this habitat loss. The habitat conditions conducive to salmon survival in most other watersheds have been reduced significantly by the effects of land use, including urbanization, forestry, agriculture, and development (NMFS 2005d; NMFS 2006b; NMFS 2008d; Shared Strategy for Puget Sound 2007).

The diversity of some populations has been eroded further by hatchery and harvest influences and degraded habitat conditions, all of which have contributed to low population sizes and loss of life history types in some areas (NMFS 2008d, 2005d; WDF et al. 1993). Rearing habitat in the region has been significantly reduced particularly at lower elevations due to loss of wetland, nearshore and estuary habitat, removal or degradation of riparian vegetation, channelization and bank hardening. In particular, the distribution of early-type Chinook salmon life histories (also called spring-type) was historically much wider in the ESU (WDF et al. 1993; Nehlssen et al. 1991). Early Chinook no longer exist in the Hood Canal Region or in most rivers in the Central/South Sound Region where they occurred historically. Of the seven extant early populations, only those in the Whidbey Basin Region are not supported by conservation hatchery programs.[4] Fall Chinook populations in the Central/South Sound, Hood Canal and Strait of Juan de Fuca Regions are sustained predominately by hatchery production. Indigenous fall Chinook in the Sammamish, Puyallup, Nisqually, Skokomish, and Mid-Hood Canal watersheds have been extirpated due to habitat degradation, hatchery introgression and historical over-fishing. Genetically, most of the present spawning aggregations in the Central/South Sound and Hood Canal Regions are similar, likely reflecting the extensive influence of transplanted hatchery releases, primarily from the Green River population (Ruckelshaus et al. 2006).

The March 24, 1999 (64 Fed. Reg. 14308) listing determination and supporting species status reviews (Myers et al. 1998; NMFS 1998b), along with subsequent status reviews (Good et al.

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[3] The TRT noted that the Nisqually watershed is in comparatively good condition, and thus the certainty that the population could be recovered is among the highest in the Central/South Region. NOAA Fisheries concluded in its supplement to the Puget Sound Salmon Recovery Plan that protecting the existing habitat and working toward a viable population in the Nisqually watershed would help to buffer the entire region against further risk (NMFS 2006d).

[4] A captive brood program began in 2007 for the South Fork Nooksack population.

2005), biological opinions (NMFS 2008b), and Puget Sound Salmon Recovery Plan (Shared Strategy 2007) provide more detailed information regarding the ESU's distribution, trend, limiting factors and status.

Current Rangewide Status of Critical Habitat

Designated critical habitat for the Puget Sound Chinook ESU includes estuarine areas and specific river reaches associated with the following subbasins: Strait of Georgia, Nooksack, Upper Skagit, Sauk, Lower Skagit, Stillaguamish, Skykomish, Snoqualmie, Snohomish, Lake Washington, Duwamish, Puyallup, Nisqually, Deschutes, Skokomish, Hood Canal, Kitsap, and Dungeness/Elwha (NMFS 2005e). The designation also includes some nearshore areas extending from extreme high water out to a depth of 30 meters and adjacent to watersheds occupied by the 22 populations because of their importance to rearing and migration for Chinook salmon and their prey, but does not otherwise include offshore marine areas. There are 61 watersheds within the range of this ESU. Twelve watersheds received a low rating, 9 received a medium rating, and 40 received a high rating of conservation value to the ESU (NMFS 2005d). Nineteen nearshore marine areas also received a rating of high conservation value. Of the 4,597 miles of stream and nearshore habitat eligible for designation, 3,852 miles are designated critical habitat (NMFS 2005e).

In the Puget Sound areas designated as critical habitat, major management activities affecting PCEs are forestry, grazing, agriculture, channel/bank modifications, road building/maintenance, urbanization, sand and gravel mining, dams, irrigation impoundments and withdrawals, river, estuary, and ocean traffic, wetland loss, and forage fish/species harvest. Over the last several years, NMFS has completed several section 7 consultations on large scale habitat projects affecting listed species in Puget Sound. Among these are the Washington State Forest Practices Habitat Conservation Plan (NMFS 2006b), and consultations on Washington State Water Quality Standards (NMFS 2008c) and the National Flood Plain Insurance Program (NMFS 2008d). These documents provide a current and more detailed overview of the status of critical habitat in Puget Sound.2.1.2 Puget Sound Steelhead

Current Rangewide Status of the Species

The Puget Sound steelhead DPS was listed as threatened on May 11, 2007 (72 Fed. Reg. 26722). The DPS includes all naturally spawned anadromous winter-run and summer-run steelhead populations, in streams in the river basins of Puget Sound, as well as the Green River natural and Hamma Hamma winter-run steelhead hatchery stocks. The majority of hatchery stocks are not considered part of this DPS because they are more than moderately diverged from the local native populations (Hard et al. 2007). Resident steelhead occur within the range of Puget Sound steelhead but are not part of the DPS due to marked differences in physical, physiological, ecological, and behavioral characteristics (71 Fed. Reg. 15666; March 29, 2006). Puget Sound steelhead typically mature at age 2, with smaller numbers of fish emigrating to the ocean between 1 to 3 years of age. Seaward emigration commonly occurs from April to mid-May, with fish spending 1 to 3 years in the ocean, but inshore migration of steelhead is not well documented. Steelhead are capable of repeat spawning, unlike other species of Pacific salmon.

Female repeat spawners that return to the sea are referred to as kelts. Averaging across all West Coast steelhead populations, 8% of spawning adults have spawned previously, with coastal populations containing a higher incidence of repeat spawning compared to inland populations (Busby et al. 1996).

The Puget Sound steelhead DPS includes more than 50 stocks of summer- and winter-run fish, comprised mainly of winter-run populations. WDFW identifies 53 populations in this DPS (SaSI 2002) where 37 (69.81%) are winter-run steelhead (Hard et al. 2007). Summer-run populations are generally small and exist primarily in northern Puget Sound. The Puget Sound Steelhead Technical Review Team (PSSHTRT) is in the process of identifying putative populations for the Puget Sound Steelhead DPS. Once delineation and viability assessment of the populations are completed, a recovery plan will be developed for the DPS describing population structure, identifying populations essential to recovery, and establishing recovery goals based on the recommendations of the PSSHTRT.

Abundance, Productivity and Trends

No estimates of historical (pre-1960s) abundance specific to the DPS are available. Of the 21 independent stocks for which adequate escapement information exists to determine trends, 17 stocks have been declining and four increasing over the available data series, with a range from 18 percent annual decline (Lake Washington winter steelhead) to seven percent annual increase (Skykomish River winter steelhead). Eleven of these trends (nine negative, two positive) were significantly different from zero. The two basins producing the largest numbers of steelhead (Skagit and Snohomish Rivers) both had overall upward trends (Busby et al. 1996).

The Biological Review Team (BRT) for Puget Sound steelhead evaluated trends in abundance of natural steelhead over the most recent decade. Table 4 summarizes geometric mean escapement for Puget Sound steelhead populations over the most recent 5 years available to the BRT at the time of its status review to the geometric mean over the full range of available data in terms of both aggregate and natural escapement. All steelhead populations within the DPS demonstrate current declines with most populations exhibiting significantly declining trends in natural escapement, particularly in southern Puget Sound (Cedar, Lake Washington, Puyallup, and Nisqually winter-run populations), in northern Puget Sound (Stillaguamish winter-run), in Hood Canal (Skokomish winter-run), and along the Strait of Juan de Fuca (Dungeness winter-run). Positive trends were detected in two populations in northern Puget Sound (Samish winter-run) and Hood Canal (Hamma Hamma winter-run). Increasing trends in the Hamma Hamma River appear to be due to the captive rearing program rather than natural escapement (Hard et al. 2007). Since the mid-1990s, natural steelhead production has shown little or weak response to reduced harvest throughout the DPS. There is concern regarding the lack of data available for the majority of steelhead populations in the Puget Sound DPS. Detailed information on population abundance and productivity and their trends can be found in the 2007 Status Review on Puget Sound Steelhead (Hard et al. 2007).

Table 4. Geometric mean estimates of escapements for Puget Sound steelhead populations. Geometric mean estimates are based on hatchery and natural-origin spawners (H+N) or on natural spawners only (N). Natural-origin escapement information is provided where available. Estimates are provided for 1980 – 2004 (historical) or 2000 – 2004 (current).

Region	Population	1980 to 2004 Geometric mean Escapement (Spawners)		2000 to 2004 Geometric mean Escapement (Spawners)	
		H+N	N	H+N	N
Northern Puget Sound	Canyon summer-run	N/A	N/A	N/A	N/A
	Skagit summer-run	N/A	N/A	N/A	N/A
	Snohomish summer-run	N/A	N/A	N/A	N/A
	Stillaguamish summer-run	N/A	N/A	N/A	N/A
	Canyon winter-run	N/A	N/A	N/A	N/A
	Dakota winter-run	N/A	N/A	N/A	N/A
	Nooksack winter-run	N/A	N/A	N/A	N/A
	Samish winter-run	684.2	852.2	500.8	852.2
	Skagit winter-run	7,720.4	5,608.5	6,993.9	5,418.8
	Snohomish winter-run	5,283.0	3,230.1	5,283.0	3,230.1
	Stillaguamish winter-run	1,027.7	550.2	1,027.7	550.2
	Tolt summer-run	129.2	119.0	129.2	119.0
Southern Puget Sound	Green summer-run	N/A	N/A	N/A	N/A
	Cedar winter-run	137.9	36.8	137.9	36.8
	Green winter-run	2,050.6	1,625.5	1,802.1	1,619.7
	Lake Washington winter-run	247.1	36.8	308.0	36.8
	Nisqually winter-run	1,136.7	392.4	1,115.9	392.4
	Puyallup winter-run	1,881.5	1,001.0	1,714.4	907.3
Hood Canal	Dewatto winter-run	27.0	24.7	24.0	24.7
	Dosewallips winter-run	70.6	76.7	70.6	76.7
	Duckabush winter-run	16.6	17.7	16.6	17.7
	Hamma Hamma winter-run	29.6	51.9	29.6	51.9
	Quilcene winter-run	16.8	15.1	16.8	15.1
	Skokomish winter-run	439.3	202.8	439.3	202.8
	Tahuya winter-run	131.8	117.0	113.9	117.0
	Union winter-run	57.1	55.3	55.0	55.3
Strait of Juan de Fuca	Elwha summer-run	N/A	N/A	N/A	N/A
	Dungeness winter-run	311.2	173.8	311.2	173.8
	Elwha winter-run	459.5	210.0	N/A	N/A
	McDonald winter-run	N/A	N/A	149.8	96.1
	Morse winter-run	132.6	103.0	105.8	103.0

Source: Hard et al. 2007

Spatial Structure, Diversity and Extinction Risk

Summer steelhead stocks within this DPS are all small, occupy limited habitat, and most are subject to introgression by hatchery fish. Summer-run steelhead programs utilizing Skamania hatchery-origin stock, which are found to be genetically distinct from Puget Sound populations, are conducted in the Stillaguamish, Snohomish, and Green river basins (Busby et al. 1996, Phelps et al. 1997). For the one summer-run steelhead population (Tolt River) with available natural escapement and run size data, the trend in abundance was predominately negative (Hard et al. 2007). Historically higher harvest rates prior to the mid-1990s may have eliminated a significant proportion of natural summer-run and early-returning natural winter-run fish in many Puget Sound watersheds. Little or no data is available on summer-run populations to evaluate extinction risk.

Hatchery fish associated with winter-run steelhead in this DPS are widespread, spawn naturally throughout Puget Sound, and are largely derived from a single stock (Chambers Creek). The proportion of spawning escapement comprised of hatchery fish ranged from less than one percent (Nisqually River) to 51 percent (Morse Creek). With the exception of the Cedar River and a few smaller tributaries to Puget Sound and Hood Canal, hatchery-origin winter-run steelhead have been released in nearly every basin in the Puget Sound Steelhead DPS (Hard et al. 2007). In general, hatchery proportions are higher in Hood Canal and the Strait of Juan de Fuca than in other regions of Puget Sound. Most of the hatchery steelhead in Puget Sound originated from stocks indigenous to the DPS, but are generally not native to local river basins. Interbreeding of natural populations with hatchery steelhead may contribute to reduced productivity of natural fish. Hatchery fish pose an ecological threat to natural fish through increased competition in estuaries and marine environments which are demonstrated as declines in density-dependent growth and survival at critical life history stages.

NMFS identified the principal factor for decline for Puget Sound steelhead as the present or threatened destruction, modification, or curtailment of its habitat or range (72 Fed. Reg. 26722, May 11, 2007). Barriers to fish passage and adverse effects on water quality and quantity resulting from dams, the loss of wetland and riparian habitats, and agricultural and urban development activities have contributed and continue to contribute to the loss and degradation of steelhead habitats in Puget Sound. Previous harvest management practices likely contributed to the historical decline of Puget Sound steelhead, but NMFS concluded that the elimination of the direct harvest of wild steelhead in the mid 1990s largely addressed this threat. Predation by marine mammals (principally seals and sea lions) and birds as well as the extensive propagation of the Chambers Creek and Skamania hatchery steelhead stocks are also potential sources of concern.

The May 11, 2007 (72 Fed. Reg. 26722) listing determination and supporting species status reviews (Busby et al. 1996; Hard et al. 2007) provide more detailed information regarding the ESU's distribution, trend, limiting factors and status. The PSSHTRT is currently determining the population structure and viability criteria for recovery of the DPS but has not yet completed its work. As that information becomes available, it will be incorporated into future biological opinions and evaluations of fishery management actions.

Current Rangewide Status of Critical Habitat

Critical habitat has not yet been designated for Puget Sound steelhead.

2.1.3 Puget Sound/Georgia Basin Rockfish

Current Rangewide Status of the Species

On April 28, 2010, NMFS listed the Puget Sound/Georgia Basin DPS's of yelloweye rockfish (*Sebastes ruberrimus*) and canary rockfish (*Sebastes pinniger*) as threatened, and listed the Puget Sound/Georgia Basin DPS of bocaccio (*Sebastes paucispinis*) as endangered under the ESA (75 Fed. Reg. 22276). These DPSs include all yelloweye rockfish, canary rockfish and bocaccio found in waters of the Puget Sound, the Strait of Georgia, and the Strait of Juan de Fuca east of Victoria Sill (Figure 3). Puget Sound is the second-largest estuary in the United States, located in northwest Washington State, covering an area of about 2,600 square km (1,004 square miles), including 4,000 km (2,500 miles) of shoreline and is home to a rapidly-expanding human population. Puget Sound is part of a larger inland waterway, the Georgia Basin, situated between southern Vancouver Island, British Columbia, Canada and the mainland coasts of Washington State. Puget Sound can be subdivided into five interconnected basins separated by shallow sills: (1) The San Juan/Strait of Juan de Fuca region (also referred to as "North Sound"), (2) Main Basin, (3) Whidbey Basin, (4) South Puget Sound, and (5) Hood Canal. We use the term ''Puget Sound Proper'' to refer to all of these basins except the San Juan/Strait of Juan de Fuca region. All five basins have unique temperature regimes, water residence times and circulation patterns, biological condition, depth profiles and contours, species compositions, and nearshore and benthic habitats (Burns 1985, Ebbesmeyer 1984, Rice 2007).

Figure 3. Puget Sound/Georgia Basin DPS for ESA-listed rockfish.

The life-histories of the yelloweye rockfish, canary rockfish and bocaccio include a larval and pelagic juvenile stage followed by a nearshore juvenile stage and sub-adult and adult stage. Much of the life-history for these three species is similar, with differences noted below.

Larval and Pelagic Juvenile Stage. Rockfish fertilize their eggs internally and the young are extruded as larvae. As larvae, rockfish generally occupy the upper 100 meters of the water column and are often near the surface (Love et al. 2002). Larvae can make small local movements to pursue food immediately after birth (Tagal et al. 2002), but are nonetheless passively distributed with prevailing currents. Larvae are observed under free-floating algae, seagrass and detached kelp (Love et al. 2002, Shaffer et al. 1995). As a result of the unique bathymetry of the Puget Sound proper, most larval rockfish likely remain and grow to maturity within the basin in which they are born (Drake et al. 2010b). However, the larvae do broadly disperse across that birth region (NMFS 2003a)

Nearshore Juvenile Stage. When bocaccio and canary rockfish reach sizes of 3 to 9 cm (approximately 3 to 6 months old), they settle onto shallow nearshore waters in rocky or cobble substrates with or without kelp (Love et al. 1991, Love et al. 2002). These habitat features offer a beneficial mix of warmer temperatures, food and refuge from predators (Love et al. 1991). Areas with floating and submerged kelp species support the highest densities of most juvenile rockfish (Carr 1983, Halderson and Richards 1987, Hayden-Spear 2006, Matthews, 1989). Unlike bocaccio and canary rockfish, juvenile yelloweye rockfish do not typically occupy intertidal waters (Love et al. 1991; Studebaker et al. 2009), but settle in 30 to 40 meters of water near the upper depth range of adults (Yamanaka and Lacko 2001).

Sub-Adult and Adult. Subadult and adult yelloweye rockfish, canary rockfish and bocaccio typically utilize habitats with moderate to extreme steepness, complex bathymetry and rock and boulder-cobble complexes (Love et al. 2002). Within Puget Sound Proper, each species has been documented in areas of high relief rocky and non-rocky substrates such as sand, mud and other unconsolidated sediments (Washington 1977, Miller and Borton, 1980). Yelloweye rockfish remain near the bottom and have small home-ranges, while some canary rockfish and bocaccio have larger home ranges, move long distances, and spend time suspended in the water column (Love et al. 2002). Adults of each species are most commonly found between 40 to 250 m (Love et al. 2002, Orr et al. 2000). In southeast Alaska, adult yelloweye and canary rockfish were observed at mean depths of 46 and 53 meters and minimum depths of 21 and 37 meters, respectively (Johnson et al. 2003).

Yelloweye rockfish are one of the longest lived of the rockfishes, potentially reaching more than 100 years of age, and reach 50 percent maturity at sizes around 40 to 50 cm and ages of 15 to 20 (Rosenthal et al. 1982, Yamanaka and Kronlund 1997). Maximum age of canary rockfish is at least 84 years (Love et al. 2002), although 60 to 75 years is more common (Caillet et al. 2000). They reach 50 percent maturity at sizes around 40 cm and ages of 7 to 9. The maximum age of bocaccio is unknown, but may exceed 50 years, and they are first reproductively mature near age 6 (Love et al. 2002). The timing of larval birth for each species varies throughout the geographic range. In Puget Sound, there is some evidence that larvae are extruded in early spring to late summer for yelloweye rockfish (Washington et al. 1978). In British Columbia, birth peaks in February for canary rockfish (Hart 1973, Westrheim and Harling 1975). Along the coast of Washington state, female bocaccio release larvae between January and April (Love et al. 2002). Each species produces from several thousand to over a million eggs (Love et al. 2002).

Previous Section 7(a)(2) Consultations

The status of the species is influenced by the actions contemplated in previously completed section 7(a)(2) consultations. Thus far, three Biological Opinions have addressed adverse affects on ESA-listed rockfish within the Puget Sound/Georgia Basin DPS as listed in Table 5.

Table 5. Consultations completed regarding adverse affects on listed Puget Sound Georgia Basin rockfish species

Consultation Number	Action Area	Duration	Maximum Authorized Take (fish or habitat area)		
			Yelloweye	Canary	Bocaccio
F/NWR/2010/01850 (see footnote 5) (Conference Opinion for ESA-listed rockfish)	U.S. portion of the Puget Sound/Georgia Basin	May 1 through July 31, 2010.	76 fish	172 fish	7 fish
F/NWR/2010/00314	U.S. portion of the Puget Sound/Georgia Basin	April 24, 2010 to December 31, 2012.	6 fish	6 fish	1 fish
F/NWR/2010/01714	San Juan Region of the Puget Sound/Georgia Basin	April 30, 2010 to December 31, 2011	Up to 45,000 square feet of benthic habitat of the San Juan region.		

Viability Criteria

In the following section, the condition of the yelloweye rockfish, canary rockfish and bocaccio DPSs are summarized at the DPS level according to the following demographic risk criteria: abundance and productivity, spatial structure/connectivity, and diversity. These viability criteria are outlined in McElhaney et al. (2000), and reflect concepts that are well founded in conservation biology and are generally applicable to a wide variety of species. These criteria describe demographic risks that individually and collectively provide strong indicators of extinction risk (Drake et al. 2010b).

Abundance & Productivity

There is no single reliable historic or contemporary population estimate for yelloweye rockfish, canary rockfish or bocaccio within the Puget Sound/Georgia Basin DPS (Drake et al. 2010b). Despite this limitation, there is clear evidence each species' abundance has declined dramatically (Drake et al. 2010b). The total rockfish population in the Puget Sound region is estimated to have declined around three percent per year for the past several decades, which corresponds to an approximate 70 percent decline from the 1965 to 2007 time period (Drake et al. 2010b). Catches of each species have declined as a proportion of the overall rockfish catch (Drake et al. 2010b, Palsson et al. 2009). Yelloweye rockfish were 2.4 percent of the harvest in North Sound during the 1960s, occurred in 2.1 percent of the harvest during the 1980s, but then decreased to an average of one percent from 1996 to 2002 (Palsson et al. 2009). In Puget Sound Proper, yelloweye rockfish comprised 4.4 percent of the harvest during the 1960's, only 0.4 percent during the 1980's, and 1.4 percent from 1996 to 2002. Canary rockfish occurred in 6.5 percent

[5] This document is also referred to in Table 1.

of the North Sound recreational harvests during the 1960's and then declined to 1.4 percent and to 0.6 percent during the subsequent two periods. During the 1960's, canary rockfish comprised 3.1 percent of the Puget Sound Proper rockfish harvest and then declined to one percent in the 1980's and 1.4 percent from 1996 to 2002.

Bocaccio were reported to consist of eight to nine percent of the overall rockfish catch in the late-1970's (Drake et al. 2010b), and declined in frequency, relative to other species of rockfish, from the 1970's to the 1980's to the 1990's. From 1975-1979, bocaccio were reported as an average of 4.63 percent of the catch. In 1980-1989, they were 0.24 percent of the 8,430 rockfish identified (Palsson et al. 2009). From 1996 to 2007, bocaccio were not observed out of the 2,238 rockfish identified in the dockside surveys of the recreational catches. In 2008, several bocaccio were reported by recreational anglers in the Central Sound (WDFW unpublished data).

Fishery-independent estimates of population abundance come from spatially and temporally limited research trawls, drop camera surveys and underwater remotely operated vehicle (ROV) surveys conducted by WDFW. These population estimates should be interpreted in the context of the sampling design and gear. The trawl surveys were conducted on the bottom to assess marine fish abundance for a variety of species. These trawls generally sample over non-rocky substrates where yelloweye rockfish, canary rockfish and bocaccio are less likely to occur compared to steep-sloped, rocky habitat (Drake et al. 2010b). The drop camera surveys sampled habitats less than 120 feet, which is potential habitat for juveniles, but less likely habitat for adults of the three listed species. Similarly, because juvenile yelloweye rockfish are less dependent on rearing in shallow nearshore environments, the likelihood of documenting them with drop camera surveys less than 120 feet is less than for canary rockfish and bocaccio.

The ROV surveys were conducted exclusively within the rocky habitats of the San Juan Island region in 2008, and represent the best available abundance data for one region of the DPS for each species to date. Rocky habitats have been mapped within the San Juan Island region, which allows a randomized survey of these habitats to assess species assemblages and collect data for abundance estimates. In 200 transects the WDFW surveyed a subset of rocky habitats stratified as "shallower than" and "deeper than" 120 feet. The total area surveyed within each stratum was calculated using the average transect width multiplied by the transect length. The mean density of yelloweye rockfish, canary rockfish, and bocaccio were calculated by dividing the species counts within each stratum by the area surveyed. Population estimates for each species were calculated by multiplying the species density estimates by the total survey area within each stratum (WDFW unpublished data). Since the WDFW did not survey non-rocky habitats of the San Juan Island region with the ROV, these estimates do not account for ESA-listed rockfish in non-rocky habitat in 2008. The WDFW expanded the survey data to estimate total abundance in the San Juan Island region (Table 6). From the mid-water trawl and drop camera surveys, the WDFW has reported population estimates in the North Sound and the Puget Sound Proper (Table 6).

Table 6. WDFW Population Estimates for Yelloweye Rockfish, Canary Rockfish and Bocaccio.

WDFW Survey Method	Yelloweye Population Estimate		Percent Standard Error (or Variance)	
	North Sound	Puget Sound Proper		
Bottom Trawl	Not detected	600	NA	400 (variance)
Drop Camera	Not detected	Not detected	NA	NA
Remotely Operated Vehicle	50,656 (San Juan Region)		29	
WDFW Survey Method	Canary Population Estimate		Percent Standard Error	
	North Sound	Puget Sound Proper		
Bottom Trawl	16,100	Not detected	260.6 (variance)	NA
Drop Camera	2,751	Not detected	89.3	NA
Remotely Operated Vehicle	1,648 (San Juan Region)		100	
WDFW Survey Method	Bocaccio Population Estimate		Percent Standard Error	
	North Sound	Puget Sound Proper		
Bottom Trawl	Not detected	Not detected	NA	NA
Drop Camera	Not detected	Not detected	NA	NA
Remotely Operated Vehicle	4,487 (San Juan Region)		100	

Though the bottom-trawl and drop camera surveys did not detect canary rockfish or bocaccio in Puget Sound Proper, each species has been historically present there and each has been caught in recreational fisheries from 2004 to 2008 (WDFW unpublished data). The lack of detected canary rockfish and bocaccio in Puget Sound Proper is likely due to the following factors: (1) populations of each species are depleted, (2) the general lack of rocky benthic areas in Puget Sound Proper may lead to densities of each species that are naturally less than the San Juan region, and (3) the study design or effort may have not been sufficiently powerful to detect each species. Though yelloweye rockfish were detected in Puget Sound Proper within bottom-trawl surveys, we do not consider the WDFW estimate of 600 fish to be a complete estimate, for the reasons given above. Thus, there are no abundance estimates of yelloweye rockfish, canary rockfish or bocaccio within Puget Sound Proper sufficient to assist in the analysis of effects of the proposed action.

Productivity is the measurement of a population's growth rate through all or a portion of its life-cycle. Life-history traits of yelloweye rockfish, canary rockfish and bocaccio suggest generally low levels of inherent productivity because they are long-lived and mature slowly, with sporadic episodes of successful reproduction (Drake et al. 2010b, Tolimieri and Levin 2005). Historic over fishing can have dramatic impacts on the size or age structure of the population, with effects that can influence ongoing productivity. When the size and age of females decline, there are negative impacts to reproductive success. These impacts, termed maternal effects, are evident in a number of traits. Larger and older females of various rockfish species have a higher weight-specific fecundity (number of larvae per unit of female weight) (Bobko and Berkeley 2004, Boehlert et al. 1982, Sogard et al. 2008). A consistent maternal effect in rockfishes relates to the timing of parturition (larval birth). The timing of larval release can be crucial in terms of matching favorable oceanographic conditions for larvae because most are released on only one day each year, with a few exceptions in southern coastal populations and yelloweye in Puget Sound (Washington et al. 1978). Larger or older females release larvae earlier in the season compared to smaller or younger females in several studies of rockfish species (Nichol and Pikitch 1994, Sogard et al. 2008). Larger or older females provide more nutrients to larvae by developing a larger oil globule released at parturition, which provides energy to the developing larvae (Berkeley et al. 2004, Fisher et al. 2007), and in black rockfish enhances early growth rates (Berkeley et al. 2004). An additional maternal effect in black rockfish indicates that older females are more successful in completing recruitment of progeny from primary oocyte to fully developed larva (Bobko and Berkeley 2004) and would likely also occur for ESA-listed rockfish.

Contaminants such as PCBs, chlorinated pesticides, and PBDEs appear in rockfish collected in urban areas (Palsson et al. 2009). While the highest levels of contamination occur in urban areas, toxins can be found in the tissues of fish in all regions of the sound (Puget Sound Action Team, 2007). Although few studies have investigated the effects of toxins on rockfish ecology or physiology, other fish in the Puget Sound region that have been studied do show a substantial impact, including reproductive dysfunction of some sole species (Landahl et al. 1997). Reproductive function of rockfish is also likely affected by contaminants (Palsson et al. 2009), and other life history stages may be as well (Drake et al. 2010b).

Yelloweye Rockfish Abundance and Productivity

Yelloweye rockfish within the Puget Sound/Georgia Basin (in U.S. waters) are very likely the most abundant within the San Juan Islands region of the DPS. Though there is a lack of a reliable population-census (ROV or otherwise) within the regions of Puget Sound Proper, the San Juan region has the most suitable rocky benthic habitat (Palsson et al. 2009) and historically was the area of greatest angler catches (Moulton and Miller 1987, Olander 1991). Productivity for yelloweye rockfish is influenced by long generation times that reflect intrinsically low annual reproductive success. Natural mortality rates have been estimated from two to 4.6 percent (Wallace 2007, Yamanaka and Kronlund 1997). Productivity may also be particularly impacted by Allee effects. As adults have been removed by fishing, the density and proximity of mature fish is decreased. Adult yelloweye typically occupy relatively small ranges (Love et al. 2002), and may not move to find suitable mates. Maternal effects on yelloweye rockfish productivity within the DPS are similar to those previously described for rockfish generally.

Canary Rockfish Abundance and Productivity

Historically the South Puget Sound was thought to be a population stronghold within the DPS, but it appears to be greatly depleted (Drake et al. 2010b). Natural annual mortality ranges from six to nine percent (Methot and Stewart 2005, Stewart 2007). Life history traits suggest intrinsically slow growth rate and low rates of productivity for this species, specifically its age at maturity, long generation time and its maximum age (84 years) (Love et al. 2002). Past commercial and recreational fishing removals may have depressed the DPS to a threshold beyond which optimal productivity is unattainable (Drake et al. 2010b). Maternal effects on canary rockfish productivity within the DPS are similar to those previously described for rockfish.

Bocaccio Abundance and Productivity

Bocaccio within the Puget Sound/Georgia Basin were historically most common within the South Sound and Central Sound regions (Drake et al. 2010b), with just several documented occurrences within Hood Canal and none within the San Juan region. Though bocaccio were never a predominant segment of the multi-species rockfish population within the Puget Sound/Georgia Basin (Drake et al. 2010b), their present-day abundance is likely a fraction of their pre-contemporary fishery abundance. Bocaccio may be absent in significant segments of their formerly-occupied habitat; from 1998 to 2008 fish were reported by anglers in only one region of the DPS. Productivity is driven by high fecundity and episodic recruitment events, largely correlated with environmental conditions, thus bocaccio populations do not follow consistent growth trajectories and sporadic recruitment drives population structure (Drake et al. 2010b). Natural annual mortality is approximately 15 percent (Tolimeri and Levin 2005). Tolimeri and Levin (2005) found that bocaccio population growth rate is around 1.01, indicating a very low intrinsic growth rate for this species. Demographically, this species demonstrates some of the highest recruitment variability among rockfish species, with many years of failed recruitment being the norm (Tolimieri and Levin 2005). Given their severely reduced abundance, Allee effects may be particularly acute for bocaccio, even considering the propensity of some individuals to move long distances and potentially find mates.

Spatial Structure and Connectivity

Spatial structure consists of a population's geographical distribution and the processes that generate that distribution (McElhaney et al. 2000). A population's spatial structure depends on habitat quality, spatial configuration, and dynamics as well as dispersal characteristics of individuals within the population (McElhaney et al. 2000). Recreational fisheries data from 1977 and 1987 and from 2004 to 2008 provide a coarse glimpse of the spatial structure of yelloweye rockfish, canary rockfish and bocaccio (Table 7) (Moulton and Miller 1987, WDFW unpublished data). These data are influenced by a number of factors that include differing angler effort levels, fishing regulations and survey methods within each of the regions and time periods, and the probability that some fish were miss-identified (particularly in the earlier time periods).

Table 7. Presence of yelloweye rockfish, canary rockfish and bocaccio, 1975 and 1985 compared with WDFW fishery data from 2004 to 2008. Recreational angler catch.

Species/ Region	Year	Gulf-Bellingham	San Juan	Juan de Fuca^	Hood Canal	Central Sound	South Sound
Yelloweye	1975	x	x	x	x	x	x
	1985	x	x	x	x	x	x
	2004 to 2008	NA	x*	x	x	x**	0***
Canary	1975	x	x	x	0	x	x
	1985	x	x	x	x	x	x
	2004 to 2008	NA	x*	x ~	x	x**	x***
Bocaccio	1975	0	0	x	x ****	x	x
	1985	0	0	x	0	x	x
	2004 to 2008	NA	0*~	0	0	x	0***

X:Present, 0:Absent.
*(includes gulf-Bellingham region as reported by Moulton and Miller (1987).
** (WDFW recreational fishing Marine Catch Areas 8-1, 8-2,9,10 & 11).

*** (WDFW recreational fishing Marine Catch Area 13).
^Moulton and Miller did not report where the "Juan de Fuca" region border with the "West Juan de Fuca" region (not reported here), thus some of the reported fish from 1975 and 1985 may have been caught outside the Puget Sound/Georgia Basin DPS.
****from Washington (1977).
~Note that WDFW documented bocaccio in ROV surveys in 2008.

Yelloweye Rockfish Spatial Structure & Connectivity

Yelloweye rockfish spatial structure and connectivity is likely threatened by the apparent reduction (or absence) of fish within all or portions of Hood Canal and the South Sound. The severe reduction in these regions may eventually result in a contraction of the DPS's range (Drake et al. 2010b). The likelihood of juvenile recruitment from the San Juan region may be diminished due to the generally retentive circulation patterns of Puget Sound Proper. Combined with limited adult movement, yelloweye rockfish population viability may be highly influenced by the probable localized loss of populations within the DPS, which decreases spatial structure and connectivity.

Canary Rockfish Spatial Structure and Connectivity

Canary rockfish were present in each of the catch regions through the time-periods listed in Table 6, yet were not detected in any WDFW trawl or drop camera survey in Puget Sound Proper. Several historically large populations in the canary rockfish DPS may have been depleted, including an area of past distribution in South Puget Sound which has declined due to harvest and perhaps because of low dissolved oxygen events (Drake et al. 2010b). The apparent steep reduction of fish in Puget Sound Proper leads to concerns about the viability of these populations (Drake et al. 2010b). The ability of adults to migrate hundreds of kilometers could allow the DPS to re-establish spatial structure and connectivity in the future under favorable conditions (Drake et al. 2010b).

Bocaccio Spatial Structure & Connectivity

Bocaccio may have been historically spatially limited to several regions within the DPS. They were apparently historically most abundant in the Central and South Puget Sound (Drake et al. 2010b), with no documented occurrences in the San Juan region until 2008 (WDFW unpublished data). Positive signs for spatial structure and connectivity come from the propensity of some adults and pelagic juveniles to migrate long distances, which could reestablish aggregations of fish in formerly occupied habitat (Drake et al. 2010b). The apparent reduction of populations of bocaccio in large portions of the DPS's range represents a further reduction in the historically limited distribution of bocaccio, and adds significant risk to the viability of the DPS.

Diversity

Characteristics of diversity for rockfish include fecundity, timing of the release of larva and their condition, morphology, age at reproductive maturity and physiology and molecular genetic characteristics. In spatially and temporally varying environments, there are three general reasons why diversity is important for species and population viability: (1) diversity allows a species to use a wider array of environments, (2) it protects a species against short-term spatial and temporal changes in the environment, and(3) genetic diversity provides the raw material for surviving long-term environmental changes. Though there are no genetic data within the DPSs of ESA-listed rockfish, the unique oceanographic features and relative isolation of some of its regions may have led to unique adaptations, such as timing of larval release (Drake et al. 2010b).

Yelloweye Rockfish Diversity

Yelloweye rockfish size (and age) distribution have been truncated. Recreationally caught yelloweye rockfish in the 1970's spanned a broad range of sizes. By the 2000's, there was some evidence of fewer older fish in the population (Drake et al. 2010b). However, overall numbers of fish in the database were also much lower, making it difficult to determine if clear size truncation occurred. Within the WDFW ROV surveys, no adult yelloweye were observed. As a result, the reproductive burden may be shifted to younger and smaller fish. This shift could alter the timing and condition of larval release, which may be miss-matched with habitat conditions within the DPS, potentially reducing the viability of offspring (Drake et al. 2010b).

Canary Rockfish Diversity

Canary rockfish size (and age) distribution have been truncated (Drake et al. 2010b). As a result, the reproductive burden may be shifted to younger and smaller fish. Canary rockfish exhibited a broad spread of sizes in the 1970's. However, by the 2000's, there were far fewer size classes represented and no fish greater than 55 cm were recorded in the recreational data (Drake et al. 2010b). This shift could alter the timing and condition of larval release which may be miss-matched with habitat conditions within the DPS, potentially reducing the viability of offspring (Drake et al. 2010b).

Bocaccio Diversity

Size-frequency distributions for bocaccio in the 1970's indicate a wide range of sizes, with recreationally caught individuals from 25 to 85 cm. This broad size distribution suggests a spread of ages, with some successful recruitment over many years. A similar range of sizes is also evident in the 1980's catch data. The temporal trend in size distributions for bocaccio also suggests size truncation of the population, with larger fish becoming less common over time. By the decade of the 2000's, no bocaccio data were available. Bocaccio in the Puget Sound/Georgia Basin may have physiological or behavioral adaptations due to the unique habitat conditions of the DPS. The potential loss of diversity in the bocaccio DPS, in combination with their relatively low productivity, may result in a mismatch with habitat conditions and further reduce population viability (Drake et al. 2010b).

Current Rangewide Status of Critical Habitat

Critical habitat has not yet been designated for the listed yelloweye rockfish, canary rockfish or bocaccio DPS'.

2.2 Environmental Baseline

Environmental baselines for biological opinions are defined by regulation at 50 CFR 402.02, which states that an environmental baseline is the physical result of all past and present state, Federal, and private activities in the action area along with the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early consultation under section 7 of the ESA. The environmental baseline for the species affected by the proposed actions includes the effects of many activities that occur across the broad expanse of the action area considered in this opinion. The status of the species described in this section of the biological opinion is a consequence of those effects.

NMFS has convened recovery planning efforts across the Pacific Northwest to identify what actions are needed to recover listed salmon. A recovery plan for the Puget Sound Chinook ESU was completed in 2007. This plan is made up of two documents: a locally developed recovery plan and a NMFS-developed supplement (Puget Sound Salmon Recovery Plan (Shared Strategy for Puget Sound 2007) http://www.nwr.noaa.gov/Salmon-Recovery-Planning/Recovery-Domains/Puget-Sound/PS-Recovery-Plan.cfm and Final Supplement to the Shared Strategy's Puget Sound Salmon Recovery Plan (NMFS 2006a) http://www.nwr.noaa.gov/Salmon-Recovery-Planning/Recovery-Domains/Puget-Sound/upload/PS-Supplement.pdf). Recovery Plan for Puget Sound steelhead is just getting underway. Future consultations will incorporate information from the recovery planning process as it becomes available.

NMFS recognizes the unique status of treaty Indian fisheries and their relation to the environmental baseline. Implementation of treaty Indian fishing rights involves, among other things, application of the sharing principles of *United States v. Washington*, annual calculation of allowable harvest levels and exploitation rates, the application of the "conservation necessity principle" articulated in *United States v. Washington* to the regulation of treaty Indian fisheries, and an understanding of the interaction between treaty rights and the ESA on non-treaty allocations. Exploitation rate calculations and harvest levels to which the sharing principles apply, in turn, are dependent upon various biological parameters, including the estimated run sizes for the particular year, the mix of stocks present, the allowable fisheries and the anticipated fishing effort. The treaty fishing right itself exists and must be accounted for in the environmental baseline, although the precise quantification of treaty Indian fishing rights during a particular fishing season cannot be established by a rigid formula.

If, after completing this ESA consultation, circumstances change or unexpected consequences arise that necessitate additional Federal action to avoid jeopardy determinations for ESA listed species, such action will be taken in accordance with standards, principles, and guidelines established under *United States v. Washington*, Secretarial Order 3206, and other applicable laws and policies. The conservation principles of *United States v. Washington* will guide the determination of appropriate fishery responses if additional harvest constraints become necessary. Consistent with the September 23, 2004 Memorandum for the Heads of Executive Departments and Agencies pertaining to Government-to-Government Relationship with Tribal Governments and Executive Order 13175, Departmental and agency consultation policies guiding their implementation, and administrative guidelines developed to implement Secretarial Order 3206, these responses are to be developed through government-to-government discourse involving both technical and policy representatives of the Northwest Region and affected Indian tribes prior to finalizing a proposed course of action.

2.2.1 Puget Sound Chinook and Steelhead

Harvest: In the past, fisheries in Puget Sound were generally not managed in a manner appropriate for the conservation of naturally spawning Chinook salmon populations. Fisheries exploitation rates were in most cases too high in light of the declining productivity of natural Chinook salmon stocks. The co-managers implemented several strategies to manage fisheries to reduce harvest impacts in recent years and to implement harvest objectives that are consistent with the underlying production of the natural population. Time and area closures are implemented to reduce catches of weak stocks and to reduce Chinook by-catch in other fisheries. Other regulations, such as size limits, bag limits, and requirements for the use of barbless hooks in all recreational fisheries are also used. Since 2004, the state and tribal fishery co-managers managed Chinook mortality in Puget Sound salmon and tribal steelhead net fisheries to meet the conservation and allocation objectives described in the jointly-developed Puget Sound Chinook Harvest RMP, which expired April 30, 2010 (PSIT and WDFW 2004). NMFS evaluated the RMP and found that it met the requirements of Limit 6 of the ESA 4(d) Rule and that fisheries managed consistent with the terms of the plan would not jeopardize the survival and recovery of the ESU (Information related to the RMP and its approval can be found at NMFS' web site at: http://www.nwr.noaa.gov/Salmon-Harvest-Hatcheries/State-Tribal-Management/PS-Chinook-RMPs.cfm). The RMP was adopted as the harvest component of the Puget Sound Salmon Recovery Plan which includes the Puget Sound Chinook ESU. NMFS is currently evaluating a new 2010-2014 Puget Sound Chinook RMP for consistency with Limit 6 of the 4(d) Rule.

Forty percent or more of the harvest of most Puget Sound Chinook stocks occurs in salmon fisheries outside the Action Area; primarily in Canadian waters. These fisheries are managed under the terms of the Pacific Salmon Treaty Agreement and the Pacific Fisheries Management Council. The effects of these fisheries were assessed in previous biological opinions (NMFS 2004a, NMFS 2008b).

Fisheries on steelhead and trout occur in rivers and lakes throughout Puget Sound. The non-treaty harvest of steelhead in Puget Sound occurs primarily in recreational hook-and-line fisheries targeting adipose fin clipped hatchery winter-run and summer-run steelhead. Limited retention of wild fish (bag limit of 1 wild fish/year) was allowed in some areas, particularly in earlier years. Washington now prohibits the retention of natural-origin steelhead (those without a clipped adipose fin) in recreational fisheries. The retention of steelhead in non-treaty commercial fisheries is prohibited. In a study by WDFW to estimate the incidental catch rate of steelhead in non-Treaty commercial fisheries, 17 steelhead were encountered in 4,675 net sets; indicating that the encounter rate of steelhead in these fisheries was low. The treaty fishery for winter steelhead targets primarily hatchery steelhead by fishing during the early winter months when hatchery steelhead are returning to spawn and wild steelhead are at low abundance. Wild summer-run steelhead is captured incidentally in fisheries targeting other salmon species, but overall impacts are low. Available data on escapement of both winter and summer steelhead stocks in Puget Sound is extremely limited. Long-term time series of escapement and catch are available for two of the 16 Puget Sound summer-run stocks and five of the 37 winter-run stocks. Data are currently insufficient to assess harvest rates on summer-run steelhead stocks.

Using the limited information available, NMFS calculated that the harvest rate on a subset of natural-origin winter-run stocks averaged 4% in Puget Sound fisheries during 2001/2002-2006/2007 (NMFS unpubl. data). This estimate includes sources of non-landed mortality such as hooking mortality and net drop-out. The 2001/2002-2006/2007 average was chosen as the most recent six year period to the listing determination and for which rates across the five winter stocks in the average generally did not include directed fisheries, consistent with the language in the listing determination. However, it is important to note that the resulting harvest rates are highly variable among years and across the five stocks for which information is available (Table 8). NMFS determined that the recent harvest management strategy that has eliminated direct harvest of wild steelhead in Puget Sound has largely addressed the threat of decline to the listed DPS posed by harvest (72 Fed. Reg. 26777, May 11, 2007).

Table 8. Terminal harvest rates for a subset of Puget Sound winter steelhead stocks for which catch and run size information are available (NMFS unpubl. data)

	Skagit	Snohomish	Green	Puyallup	Nisqually
2001-02	4.2%	8.0%	18.9%	15.5%	
2002-03	0.6%	0.0%	3.5%	5.0%	
2003-04	2.7%	0.5%	0.7%	2.0%	1.0%
2004-05	3.6%	0.5%	5.7%	0.0%	3.4%
2005-06	3.9%	1.8%	3.7%	0.6%	2.7%
2006-07	9.6%		5.4%	1.5%	5.8%

In November 2008, the co-managers provided a Puget Sound steelhead RMP to NMFS for consideration under Limit 6 of the 4(d) Rule. The plan is undergoing revision based on discussions with NMFS (PSIT and WDFW 2010b). The plan encompasses take of listed Puget Sound steelhead in marine and freshwater salmon and steelhead fisheries. NMFS is currently evaluating the plan against the Limit 6 criteria. Harvest effects outside of the action area are discussed in previous biological opinions (NMFS 2004a, NMFS 2008a, NMFS 2008b).

Hatcheries: Hatcheries can provide benefits by reducing demographic risks and preserving genetic legacies for populations at low abundance in degraded habitats; providing harvest opportunity and contributing to meeting obligations under the Pacific Salmon Treaty. Hatchery-origin fish also potentially pose risks to naturally-produced salmon and steelhead in four primary ways: (1) ecological effects, (2) genetic effects, (3) harvest effects, and (4) masking effects (Good et al. 2005, Hard et al. 2007, Myers et al. 1998). Beginning in the 1990s, state and tribal co-managers took steps to reduce risks identified for Puget Sound hatchery programs as better information became available (PSTT and WDFW 2004), in response to reviews of hatchery programs (e.g., Busack and Currens 1995, HSRG 2000, HSRG 2002), and as part of the region-wide Puget Sound salmon recovery planning effort (Shared Strategy for Puget Sound 2007). The intent of hatchery reform is to strive to reduce negative effects of artificial propagation on natural populations while retaining proven production and potential conservation benefits. The goals of conservation programs are to restore and maintain natural populations. In addition, hatchery programs in the Pacific Northwest are in the process of phasing out use of dissimilar broodstocks, such as out-of-basin or out-of-ESU stocks, replacing them with fish derived from, or more compatible with, locally adapted populations. Producing fish that are better suited for survival in the wild is now an explicit objective of many salmon hatchery programs. Hatchery programs are also incorporating improved production techniques, such as NATURES-type rearing protocols[6] and limits on the duration of conservation hatchery programs. The changes proposed are to ensure that existing natural salmonid populations are preserved, and that hatchery-induced genetic and ecological effects on natural populations are minimized.

Chinook salmon stocks are artificially propagated through 42 programs in Puget Sound. Currently, the majority of Chinook salmon hatchery programs produce fall-run (also called summer/fall) stocks for fisheries harvest augmentation purposes. Supplementation programs implemented as conservation measures to recover early returning Chinook salmon operate in the White (Appleby and Keown 1994), Dungeness (Smith and Sele 1995) and North Fork Nooksack rivers, and for summer Chinook salmon on the North Fork Stillaguamish and Elwha Rivers (Fuss and Ashbrook 1995; Myers et al. 1998). Two new programs are under development for early Chinook in the South Fork Nooksack River and fall Chinook in the South Fork Stillaguamish River (Tynan, pers. comm., NMFS NWR, Fishery Biologist, April 13, 2010).

Steelhead stocks are artificially propagated through 30 programs in Puget Sound. Twenty-seven of these programs utilize fish from Chambers Creek winter-run stock or Skamania Creek summer-run stock which are both considered outside the Puget Sound steelhead DPS[7]. These twenty-seven programs account for approximately 95% of the hatchery production in the Puget Sound Steelhead ESU (Hard et al. 2007). Almost all programs using Chambers Creek stock in Puget Sound have been artificially selected to return as adults several months in advance of natural winter-run steelhead for harvest augmentation purposes (Hard et al. 2007). Currently there are two on-going steelhead supplementation programs for conservation in Puget Sound, the Green and Hamma Hamma winter-run hatchery programs.

Habitat: Human activities have degraded extensive areas of salmon spawning and rearing habitat in Puget Sound. Most devastating to the long term viability of salmon has been the modification of the fundamental natural processes which allowed habitat to form, and recover from disturbances such as floods, landslides, and droughts. Among the physical and chemical processes basic to habitat formation and salmon persistence are floods and droughts, sediment

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[6] A fundamental assumption is that improved rearing technology will reduce environmentally induced physiological and behavioral deficiencies presently associated with cultured salmonids. NATURES-type rearing protocols includes a combination of underwater feed-delivery systems, submerged structure, overhead shade cover, and gravel substrates, which have been demonstrated in most studies to improve instream survival of Chinook salmon (*O. tshawytscha*) smolts during seaward migrations.

[7] The Chambers Creek winter-run stock is considered more than moderately diverged from stocks in the Puget Sound steelhead DPS. The Skamania stock originated from the Washougal River, Lower Columbia River Steelhead ESU.

transport, heat and light, nutrient cycling, water chemistry, woody debris recruitment and floodplain structure (Shared Strategy for Puget Sound 2007).

Development activities have limited access to historical spawning grounds and altered downstream flow and thermal conditions. Watershed development and associated urbanization throughout the Puget Sound, Hood Canal, and Strait of Juan de Fuca regions have resulted in direct loss of riparian vegetation and soils, significantly altered hydrologic and erosion rates and processes by creating impermeable surfaces (roads, buildings, parking lots, sidewalks etc.), and polluting waterways, raised water temperatures, decreased large woody debris recruitment, decreased gravel recruitment, reduced river pools and spawning areas, and dredged and filled estuarine rearing areas (Bishop and Morgan 1996). Hardening of nearshore bank areas with riprap or other material has altered marine shorelines; changing sediment transport patterns and reducing important juvenile habitat. The development of land for agricultural purposes has resulted in reductions in river braiding, sinuosity, and side channels through the construction of dikes, hardening of banks with riprap, and channelization of the river mainstems. Poor forest practices in upper watersheds have resulted in bank destabilization, excessive sedimentation and removal of riparian and other shade vegetation important for water quality, temperature regulation and other aspects of salmon rearing and spawning habitat. There are substantial habitat blockages by dams in the Skagit and Elwha River basins, and minor blockages, including impassable culverts, throughout the region. In general, habitat has been degraded from its pristine condition, and this trend is likely to continue with further population growth and resultant urbanization in the Puget Sound region.

Over the last several years, NMFS has completed several section 7 consultations on large scale habitat projects affecting listed species in Puget Sound. Among these are the Washington State Forest Practices Habitat Conservation Plan (NMFS 2006b), and consultations on Washington State Water Quality Standards (NMFS 2008c) and the National Flood Plain Insurance Program (NMFS 2008d). These documents considered the effects of the proposed actions that would occur up to the next 50 years on the ESA listed salmon and steelhead species in the Puget Sound basin, listed Southern Resident killer whales and the listed southern distinct population segment of green sturgeon. Information on the status of these species, the environmental baseline, and the effects of the proposed actions are reviewed in detail. The environmental baselines in these documents consider the effects from timber, agriculture and irrigation practices, urbanization, hatcheries and tributary habitat, estuary, and large scale environmental variation. These biological opinions and HCPs, in addition to the watershed specific information in the Puget Sound Salmon Recovery Plan mentioned above, provide a current and comprehensive overview of baseline habitat conditions in Puget Sound.

2.2.2 Puget Sound/Georgia Basin Rockfish

Harvest: Anglers targeting salmon, halibut and bottomfish such as lingcod, cabezon, or flounder also incidentally catch rockfish. NMFS authorized the take of ESA-listed rockfish from incidental catches of anglers targeting salmon from May 1 through July 31 (see table in status of the species section-Previous Section 7(a)(2) Consultations). The WDFW estimates the number of incidentally caught yelloweye rockfish, canary rockfish and bocaccio of anglers targeting salmon, bottomfish and other marine species through dock-side and phone surveys, and effort-expansion calculations. The most recent estimates of bycatch of ESA-listed rockfish are from 2004 to 2008 (WDFW unpublished data), and additional data is provided in Palsson et al. (2009). These estimates show how frequently recent fisheries incidentally caught ESA-listed rockfish. Anglers targeting bottomfish and other marine species within the Puget Sound/Georgia Basin catch some ESA-listed rockfish. From 2004 to 2008, anglers targeting fish other than salmon caught an average of 177 yelloweye rockfish and 202 canary rockfish within the DPS. No bocaccio were reported as caught. The WDFW changed fishery regulations for the 2010 season to prohibit keeping any rockfish species, and anglers targeting bottomfish and other marine species (aside from salmon and halibut) from fishing deeper than 120 feet (36.6 meters). These new restrictions eliminated the directed fisheries for rockfish, and will likely reduce bycatch. Most of the bycatch in the bottomfish category is likely from anglers targeting lingcod, mainly because of the large amount of participants in this fishery and the co-occurrence of yelloweye rockfish, canary rockfish and bocaccio and lingcod on rocky habitats. The lingcod fishery was open from May 1 through June 15 in 2010. Fishing for some other bottomfish species is allowed throughout the year within most of the Puget Sound/Georgia Basin. Most subadult and adult yelloweye rockfish, canary rockfish and bocaccio occupy waters deeper than 120 feet (Love et al. 2002), and thus the new regulations likely prevent these fish from exposure to lures and bait of bottomfishing anglers.

In the San Juan region in 2008 the WDFW surveyed rocky habitats above and below 120 feet, and observed no canary rockfish or bocaccio shallower than 120 feet (WDFW unpublished data). Yelloweye rockfish were observed at mean densities of 0.00001 (fish/meters squared) in waters 120 feet or less, compared to 0.00093 (fish/meters squared) in waters deeper than 120 feet (WDFW unpublished data). The 2004 to 2008 averages of bycatch of ESA-listed rockfish from anglers targeting bottomfish and other marine species inform bycatch estimates, but are somewhat obscured because the WDFW rule changes will reduce bycatch of ESA-listed rockfish. We are unable to predict the extent of this reduction at this time.

Habitat: Habitats used by ESA-listed rockfish have been altered by a number of factors. The degradation of some rocky habitat, loss of eelgrass and kelp, introduction of non-native species that modify habitat, and degradation of water quality are threats to rockfish habitat in the Puget Sound region (Drake et al. 2010b, Palsson et al. 2009). Adult yelloweye rockfish, canary rockfish and bocaccio have been documented along areas of high relief and non-rocky substrates such as sand, mud and other unconsolidated sediments (Washington 1977, Miller and Borton 1980), but it is very likely that densities of ESA-listed rockfish are highest near rocky habitats. Such habitat is extremely limited in Puget Sound, with only 10 km^2 (3.8 sq miles) of such habitat in Hood Canal and waters east of Admiralty Inlet, and 207 km^2 (80 sq miles) in the eastern Strait of Juan de Fuca and the San Juan region (Palsson et al. 2009). Rocky habitat is threatened by, or has been impacted by, derelict fishing gear, construction of bridges, sewer lines and other structures, deployment of cables and pipelines, and burying from dredge spoils (Palsson et al. 2009). Derelict fishing gear can continue "ghost" fishing and is known to kill rockfish as well as degrade rocky habitat by altering bottom composition (Palsson et al. 2009). There is an ongoing program run by the Northwest Straits Initiative to remove derelict gear throughout the Puget Sound region, mostly concentrated in waters less than 100 feet (33 meters) deep. Because habitats deeper than 100 feet are most readily used by adult yelloweye rockfish, canary rockfish and bocaccio, there is an unknown but potentially significant impact from deepwater derelict gear on each population within the DPS.

Juvenile bocaccio and canary rockfish utilize nearshore waters with substrates of rock or cobble compositions, and/or kelp species (Love et al. 1991, Love et al. 2002). Kelp cover is highly variable and has shown long-term declines in some regions, while kelp beds have increased in areas where artificial substrate provides additional kelp habitat (Palsson et al. 2009). Threats to kelp communities include toxins such as petroleum products which lower photosynthesis and respiration, activities associated with oyster culture and boat operations, and harvest (Mumford 2007). Indirect stressors to kelp include low dissolved oxygen, eutrophication, and changes in trophic structure resulting from harvest of organisms that feed upon kelp (Mumford, 2007). Development has occurred along approximately 30 percent of the Puget Sound shoreline (Broadhurst 1998), and has increased in recent years (Cornwall and Mayo 2008). Development along the shoreline has been linked to reduced invertebrate abundance and species taxa diversity (Dugan et al. 2003), and reduced forage fish egg viability (Rice 2006). These are examples of food web changes that may alter forage fish prey composition or abundance for these rockfish.

Over the last century, human activities have introduced a variety of toxins into the Georgia Basin at levels that may affect adult and juvenile rockfish habitat, and/or the prey that support them. The Washington State Department of Ecology (Ecology) estimates that Puget Sound receives between 14 and 94 million pounds of toxic pollutants per year, which include oil and grease, polychlorinated biphenyls (PCBs), phthalates, polybrominated diphenyl ethers (PBDEs), and heavy metals that include zinc, copper and lead (Washington Department of Ecology 2010). Several urban embayments in the Sound have high levels of heavy metals and organic compounds (Palsson et al. 2009). About 32 percent of the sediments in the Puget Sound region are considered to be moderately or highly contaminated (Puget Sound Action Team, 2007), though some areas are undergoing clean-up operations that have improved benthic habitats (Puget Sound Partnership, 2010).

In addition to chemical contamination, water quality in the Puget Sound region is also influenced by sewage, animal waste, and nutrient inputs. The Washington Department of Ecology has been monitoring water quality in the Puget Sound region for several decades. Monitoring includes fecal coliform, nitrogen, ammonium, and dissolved oxygen. In 2005, of the 39 sites sampled, eight were classified as highest concern, and 10 were classified as high concern for some of these parameters. Hood Canal has seen persistent and increasing areas of low dissolved oxygen since the mid 1990's. Typically, rockfish move out of areas with dissolved oxygen less than 2 mg/l; however, when low dissolved oxygen waters were quickly upwelled to the surface in 2003, about 26 percent of the rockfish population was killed (Palsson et al. 2009). In addition to Hood Canal, periods of low dissolved oxygen are becoming more widespread in waters south of Tacoma Narrows (Palsson et al. 2009).

Degraded habitat and its consequences to rockfish can only be described qualitatively because the precise spatial and temporal impacts to populations of yelloweye rockfish, canary rockfish and bocaccio are poorly understood. However, there is sufficient evidence to indicate that rockfish productivity may be impacted from the habitat structure and water quality stressors discussed above (Drake et al. 2010b).

Incidental take that is expected to occur in already-permitted research activities is also part of the environmental baseline. The activities include work done by the Washington State Department of Ecology for research, monitoring, and evaluation purposes. Mortality associated with these activities will be kept to a minimum, but are subject collectively to incidental take limits for yelloweye rockfish, canary rockfish and bocaccio (Table 5, Consultation Number 2010/00314). Similarly, NMFS incidental take from anglers targeting salmon from May 1 through July 31, 2010 (Table 5, Consultation Number 2010/01850) is part of the environmental baseline. Finally, incidental take from derelict gear associated with commercial fisheries in 2010 and 2011 authorized by the U.S Fraser Panel pursuant to the Pacific Salmon Treaty is part of the environmental baseline (Table 5, Consultation Number 2010/01714).

2.2.3 Other Activities Affecting Listed Species in This Opinion

Natural Conditions: The declines in fish populations in Puget Sound in the 1980s and into the 1990s may reflect broad-scale shifts in natural limiting conditions, such as increased predator abundances and decreased food resources in ocean rearing areas compared with previous decades. NMFS has noted that predation by marine mammals has increased as marine mammal numbers, especially harbor seals (*Phoca vitulina*) and California sea lions (*Zalophus californianus*) increase on the Pacific Coast (Myers et al. 1998). In addition to predation by marine mammals, Fresh (1997) reported that 33 fish species and 13 bird species are predators of juvenile and adult salmon, particularly during freshwater rearing and migration stages.

Changes in climate and ocean conditions happen on several different time scales and have had a profound influence on distributions and abundances of marine and anadromous fishes. Recent evidence suggests that marine survival among salmonids fluctuates in response to 20- to 30-year cycles of climatic conditions and ocean productivity. Although recent climatic conditions appear to be within the range of historical conditions, the risks associated with climatic changes are probably exacerbated by human activities (Lawson 1993). The fluctuations in salmon survival that occur with these changes in climate conditions can also affect species that depend on salmon for prey such as Southern Resident killer whales. A more detailed discussion about the likely effects of large-scale environmental variation on salmonids is found in Section 6 of the biological opinion on the 2008 Pacific Salmon Treaty Agreement (NMFS 2008b).

Scientific Research: The listed species in this Opinion are the subject of scientific research and monitoring activities. Most biological opinions issued by NMFS have conditions requiring specific monitoring, evaluation, and research projects to gather information to aid the preservation and recovery of listed species. The impacts of these research activities pose both benefits and risks. In the short-term, take may occur in the course of scientific research; however, these activities have a great potential to benefit to ESA-listed species in the long-term. Most importantly, the information gained during research and monitoring activities will assist in planning for the recovery of listed species. Research on the listed species in the Action Area is currently provided coverage under Section 7 of the ESA or the 4(d) research Limit 7, or included in the estimates of fishery mortality discussed in the Effects of the Proposed Action in this Opinion.

2.3 Effects of the Proposed Action

In its biological opinions, NMFS analyzes the effects of proposed Federal actions, as defined in 50 CFR 402.02, to determine whether the actions are likely to jeopardize the continued existence of the affected listed ESUs or result in the destruction or adverse modification of designated critical habitat. To complete the jeopardy analysis presented in this Opinion, NMFS reviews the status of each listed species considered in this consultation, the environmental baseline in the action area, the effects of the action, and cumulative effects (50 CFR 402.14(g)). From this analysis, NMFS determines whether effects of the action are likely, in view of existing risks, to appreciably reduce the likelihood of survival and recovery of the affected listed species.

For the critical habitat adverse modification analysis, NMFS considers the status of the designated area of the critical habitat considered in this consultation, the environmental baseline in the action area, the likely effects of the action on the function and conservation role of the affected critical habitat, and cumulative effects. NMFS used this assessment to determine whether, with implementation of the proposed action, critical habitat would remain functional, or retain the current ability for the PCEs to become functionally established, to serve the intended conservation role for the species (Hogarth 2005). With respect to critical habitat, the following analysis relied only on the statutory provisions of the ESA, and not on the regulatory definition of "destruction or adverse modification" at 50 CFR 402.02.

2.3.1 Puget Sound Chinook

Assessment Approach

NMFS analyzes the effects of harvest actions on salmon populations using quantitative analyses where possible (i.e., where a sufficiently reliable time series of data is available) and more qualitative considerations where necessary. The Viable Risk Assessment Procedure (VRAP) provides estimates of the maximum population-specific exploitation rates (called Rebuilding Exploitation Rates or RERs) that are thought to be consistent with survival and recovery of that population based on the assumptions made in deriving the rates for individual populations. In deriving the RERs, NMFS accounts for and makes conservative assumptions regarding management error, environmental uncertainty and parameter variability. NMFS has established RERs for 10 individual populations within the ESU and for the Nooksack Management Unit. The RERs are converted to FRAM-based (Fishery Regulation and Assessment Model) equivalents (Table 9) for the purposes of assessing proposed harvest actions since FRAM is the analytical tool used to assess proposed fishery actions. Surrogate standards are identified for those populations where data are currently insufficient or NMFS has not completed population-specific analysis to establish RERs. Surrogates are based on similarities in population size, life history, productivity, watershed size and hatchery contribution with other populations in the ESU for which RERs have been derived.

Table 9. Rebuilding Exploitation Rates by Puget Sound Chinook population. Surrogate RERs are italicized.

Region	Management Unit	Population	Rebuilding Exploitation Rate	FRAM-based Rebuilding Exploitation Rate
Strait of Georgia	Nooksack Early	N.F. Nooksack S.F. Nooksack	21%	23%
Whidbey/Main Basin	Skagit Spring	Upper Skagit River Lower Skagit River Lower Sauk River	54% 36% 33%	60% 51% 49%
	Skagit Summer/Fall	Upper Sauk River Suiattle River Upper Cascade	46% 50%	38% 41% 38-41%
	Stillaguamish	N.F. Stillaguamish River S.F. Stillaguamish River	45% 28%	30% 18%
	Snohomish	Skykomish River Snoqualmie	24%	18% 18%
South Sound	Lake Washington Green-Duwamish White Puyallup Nisqually	Sammamish[a] Cedar[a] Duwamish-Green White[b] Puyallup[c] Nisqually[c]	62%	*30%* *30%* 46% *23%* *33-46%* *33-46%*
Hood Canal	Mid-Hood Canal Skokomish	Mid-Hood Canal[d] Skokomish	36%	*18-23%* 33%
Strait of Juan de Fuca	Dungeness Elwha	Dungeness[b] Elwha[b]		*23%* *23%*

[a]Uses North Fork Stillaguamish RER as a surrogate for the Cedar (30%) and the Sammamish given similarity of current abundance and escapement trends.

[b] Uses Nooksack early Chinook as surrogate

[c] Uses range encompassing Skokomish (33%) and Green River (46%) as surrogates

[d] Uses range including Nooksack early Chinook (23%) and South Fork Stillaguamish (18%) as surrogates

Although component populations contribute fundamentally to the structure and diversity of the ESU, it is the ESU, not an individual population, which is the listed species under the ESA. The Supplement to the Puget Sound Recovery Plan and the Puget Sound TRT provided general guidelines for assessing recovery efforts across individual populations within Puget Sound and determining whether they are sufficient for delisting and recovery of the listed ESU (NMFS 2006a, Ruckelshaus 2002). An ESU-wide recovery scenario should include at least two viable Chinook salmon populations in each of the five geographic regions identified within Puget Sound, depending on the historical biological characteristics and acceptable risk levels for populations within each region (NMFS 2006a, Ruckelshaus 2002). An ESU-wide recovery scenario should also include within each of these geographic regions one or more viable populations from each major genetic and life history group historically present within that geographic region (NMFS 2006a). While changes in harvest alone cannot recover the Puget Sound Chinook Salmon ESU, NMFS can use the recovery plan guidance to assist it in evaluating whether the proposed actions would impede recovery and survival of the ESU.

NMFS uses the FRAM-equivalent RERs, and the critical and rebuilding escapement thresholds[8] (described in more detail in Section 2.1.1) in addition to other relevant information and the recovery plan guidance described in the above paragraph to assist it in evaluating the effects of the proposed actions on survival and recovery of the ESU[9]. The rates that would result from the proposed fisheries are compared to the relevant RERs. Generally speaking, where estimated impacts of the proposed fisheries are less than or equal to the RERs, NMFS considers the fisheries to present a low risk to that population (NMFS 2004c). However, RERs are not jeopardy standards. The risk to the ESU associated with an individual population not meeting its RER also must be considered within the broader context of other information such as the Recovery Plan guidance on the number, distribution and life-history representation within the regions and across the ESU; the role of associated hatchery programs; observed population status, and trend; and the practical effect of further constraints on the proposed action. Derivation of an RER is based on conservative assumptions regarding environmental conditions, and uncertainty in management performance and population dynamics based on observed patterns. The objectives of the RER are to achieve escapement levels consistent with the rebuilding threshold and minimize escapements below the critical threshold over a given time frame. The model identifies the RER that meets specific probabilities based on these assumptions when compared with the same conditions and no harvest. The RER analyses are updated on a regular basis to incorporate the most recent information and assumptions are made conservatively (e.g., assuming low marine survival) to protect against overly optimistic future projections of population performance. However, the observed data may indicate that the population status or environmental conditions are actually better than the conservative assumptions anticipated in the RER derivation. For example, the observed information may indicate that marine survival is better than assumed or that a population's escapement has achieved its rebuilding threshold under exploitation rates higher than the RER. Therefore, it is important to consider the anticipated exploitation rates and escapements relative to the RERs and thresholds, and the observed information on population status, environmental conditions and exploitation rate patterns. A population will be identified in this Opinion as having a potential

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[8] After taking into account uncertainty, the critical threshold is defined as a point below which: (1) depensatory processes are likely to reduce the population below replacement; (2) the population is at risk from inbreeding depression or fixation of deleterious mutations; or (3) productivity variation due to demographic stochasticity becomes a substantial source of risk (NMFS 2000b). The rebuilding threshold is defined as the escapement that will achieve Maximum Sustained Yield (MSY)[8] under current environmental and habitat conditions (NMFS 2000b). Thresholds were based on population-specific data where available.

[9] For most populations, the rebuilding thresholds are well below the escapement levels associated with recovery, but achieving these goals under current conditions is a necessary step to eventual recovery when habitat and other conditions are more favorable. Therefore, NMFS has evaluated the future performance of populations in the ESU under recent productivity conditions; i.e., assuming that the impact of hatchery and habitat management actions remain as they are now.

increased level of risk[10] when the expected escapement of that population does not meet its critical threshold. The distribution of risk across populations based on the weight of information available is then used in making the jeopardy determination for the ESU as a whole[11]. For a more detailed explanation of the technical approach see NMFS (2000b) and NMFS (2004b and 2005c). The discussion in the following section summarizes the results of the impact analysis of the proposed actions across populations within each of the five major bio-geographical regions in the ESU.

Effects on the Species

Escapements and exploitation rates expected to result from Puget Sound (including U.S. Fraser Panel fisheries) during August 1, 2010 through April 30, 2011 are summarized in Table 10. Exploitation rates are reported by management units and escapements by populations based on the information that the FRAM model provides. Impacts in PFMC and PST (ocean) and May 1-July 31, 2010 Puget Sound salmon fisheries are included in actions previously consulted on by NMFS (2004a and 2008b) and are therefore part of the environmental baseline. Thus, Table 10 represents the sum of fishing-related mortality anticipated under the proposed actions together with those approved under existing consultations. Also included in Table 10 are the harvest standards discussed above that NMFS uses to evaluate the effects of the proposed actions on survival and recovery of populations within the ESU. For management units comprised of multiple populations, Table 10 provides the range of RERs associated with the populations within that management unit. For example, the range of RERs summarized for the Skagit Spring Management Unit represents the Suiattle (38%) and the Upper Sauk (41%)[12].

The critical and rebuilding escapement thresholds represent natural-origin spawners. However, long-term time series of data on the contribution of natural-origin fish to escapement are limited for all Puget Sound populations; particularly those historically dominated by hatchery

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[10] When compared to a population otherwise at or above its critical threshold.

[11] NMFS has used RERs as part of its assessment of proposed harvest actions on the Puget Sound Chinook ESU in biological opinions and application of take limits under the ESA 4(d) Rule since 1999 (NMFS 1999b, NMFS 2000d, NMFS 2001c; NMFS 2003b; NMFS 2005c; NMFS 2008b), NMFS 2010b).

[12] Data were insufficient to develop a RER for the Upper Cascade population; the third population in the Skagit Spring Management Unit.

Table 10. 2010 FRAM adult equivalent exploitation rates in ocean (full year) and Puget Sound (August 2010-April 2011) and escapements expected after these fisheries occur for Puget Sound management units compared with their RERs and escapement thresholds (surrogates in *italics*). Outcomes expected to exceed RERs or fall below critical escapement thresholds are bolded.

Region	Management Unit	Total Ocean	Puget Sound May-July	Ocean + Puget Sound May-July	Puget Sound Aug-April	Ocean + Puget Sound	RER or RER surrogate
Georgia Basin	Nooksack early	14%	4%	18%	2%	20%	23%
Whidbey/ Main Basin	Skagit spring	11%	12%	23%	4%	27%	38-41%
	Skagit summer/fall	32%	6%	38%	6%	44%	49-60%
	Stillaguamish	8%	2%	10%	6%	16%	18-30%
	Snohomish	11%	5%	16%	4%	**20%**	18%
Central/South Sound	Lake Washington	23%	4%	27%	9%	**36%**	*30%*
	Duwamish-Green R	22%	4%	26%	21%	**47%**	46%
	White River	2%	14%	16%	3%	19%	*23%*
	Puyallup River	22%	3%	25%	25%	**50%**	*33-46%*
	Nisqually River	23%	6%	29%	35%	**65%**	*33-46%*
Hood Canal	Mid-Hood Canal R.	21%	3%	**24%**	5%	**29%**	*18-23%*
	Skokomish River	21%	3%	24%	26%	**50%**	33%
Strait of Juan de Fuca	Dungeness River	38%	1%	**39%**	2%	**41%**	*23%*
	Elwha River	38%	1%	**39%**	2%	**41%**	*23%*

Region	Management Unit	Escapement	Critical	Rebuilding
Georgia Basin		439		500
	NF Nooksack (early)	297	200	-
	SF Nooksack (early)	**142**	200	-
Whidbey/ Main Basin	Upper Skagit River (moderately early)	9,558	967	7,454
	Lower Sauk River (moderately early)	537	200	681
	Lower Skagit River (late)	1,759	251	2,182
	Upper Sauk River (early)	304	130	330
	Suiattle River (very early)	**159**	170	400
	Upper Cascade River (moderately early)	197	170	1,250
	NF Stillaguamish R. (early)	528	300	552
	SF Stillaguamish R. (moderately early)	**163**	200	300
	Skykomish River (late)	4,653	1,650	3,500
	Snoqualmie River (late)	3,182	400	1,250
Central/South Sound	Cedar River (late)	1,349	200	1,250
	Sammamish River (late)	1,480[13]	200	1,250
	Duwamish-Green R. (late)	5,802	835	5,523
	White River (early)	1,453	200	1,100
	Puyallup River (late)	1,428	200	1,200
	Nisqually River (late)	2,983	200	1,200
Hood Canal	Mid-Hood Canal Rivers (late)	**138**	200[3]	1,250
	Skokomish River (late)	1,592	452	1,160
Strait of Juan de Fuca	Dungeness River	535	200	925
	Elwha River	1,261	200	1,250

Source: FRAM model runs: Chin1010final2010.xls and Chin1010final2010MayJulyPSonlyatzero.xls (L. Lavoy, pers. comm., June 17, 2010)

[13] Extrapolated relationship to Cedar River abundance

production. The co-managers are refining abundance forecasts and modeling tools like the FRAM as better information becomes available. Several historically hatchery-dominated populations are transitioning to natural-origin management and, for others, hatchery production will continue to contribute significantly to escapement depending on their role in ESU recovery.

Consequently, the preseason expectations of escapements compared to the escapement thresholds represent a variety of different levels of hatchery contribution depending on the available information. In general, FRAM-estimated escapement for Category 1 populations represents primarily natural-origin escapement while hatchery-origin spawners may contribute significantly to estimates of Category 2 population escapements (Figure 1, Table 2). NMFS expects the treatment of escapements to become more refined over time as information improves, as decisions are made regarding the treatment of hatchery- and natural-origin fish in an individual watershed, and as the role of individual populations in ESU recovery becomes better defined.

Test, research, update and evaluation fisheries that inform fishery management decisions are included as part of the fishery-related mortality in FRAM model run Chin1010 and included in the estimates of exploitation rates discussed in the following paragraphs. These activities are therefore part of the actions addressed in this Opinion. Other research activities informing Puget Sound salmon fishery management during August 2010 through April 2011 are permitted under Section 7 of the ESA or Limit 7 of the 4(d) Rule.

Georgia Basin: There are two populations within the Strait of Georgia Basin: the North Fork Nooksack River and the South Fork Nooksack River early Chinook salmon populations (Figure 2). Both are classified as Category 1 populations and both are essential to recovery of the Puget Sound Chinook ESU (NMFS 2006a). The two populations form the Nooksack Early Management Unit.

Natural-origin average escapement is near the critical threshold for the North Fork Nooksack and well below the critical threshold for the South Fork Nooksack (Table 2) indicating additional concern for this stock. Hatchery contribution to escapement from the conservation program at the Kendall Creek Hatchery is significant as intended in order to assist in recovery of the North Fork Nooksack population (e.g., North Fork NOR=227, North Fork NOR+HOR=1,701). Productivity analyses have demonstrated a relative lack of response in terms of natural-origin production (NF=1.02 growth rate of return, SF=0.92 growth rate of return, Table 2). The trend for aggregate escapement is positive for the South Fork population and the growth rate for natural-origin escapements is higher than the growth rate for natural-origin return (Table 2). This indicates that sufficient fish are escaping the fisheries to maintain or increase the number of spawners from the parent generation; providing some stabilizing influence for abundance and reducing demographic risks. The combination of these factors suggests that natural-origin recruitment will not increase much beyond existing levels unless constraints limiting marine, freshwater, and estuary survival for the Nooksack early populations are alleviated (NMFS 2005c and 2008b, PSIT and WDFW 2010a)

The anticipated total exploitation rate in 2010 is below the RER for the management unit, and the exploitation rates in the August 2010-April 2011 Puget Sound salmon fisheries and cumulatively in

Puget Sound are expected to be very low, 2% and 4%, respectively (Table 10). Therefore, because the total anticipated exploitation rate, including the effects of the proposed action, are below the RER NMFS considers the proposed fisheries to present a low risk to these populations. Under the proposed actions, the North Fork Nooksack escapement is anticipated to be above its critical threshold (Table 10). The South Fork Nooksack population is expected to be below its critical escapement threshold; a chronic circumstance for this population. Complete closure of the Puget Sound salmon fisheries during August 1, 2010-April 30, 2011 would result in only an additional 3 natural-origin fish to the South Fork escapement. Therefore, further constraints on the remaining 2010 Puget Sound fisheries would not provide a substantive benefit to the South Fork Nooksack population.

Given that the anticipated exploitation rate on the Nooksack Management Unit for the 2010 fishing season is below its RER and the lack of demonstrated or anticipated benefit that further harvest reductions would have for the South Fork Nooksack population, the fisheries associated with the proposed actions present a low risk to the survival and recovery of the Georgia Basin Region.

Whidbey/Main Basin: The ten Chinook salmon populations in Whidbey/Main Basin region are all Category 1 populations (Figure 2). NMFS has determined that the Suiattle and one each of the early (Upper Sauk, North Fork Stillaguamish), moderately early (Upper Skagit, Lower Sauk, Upper Cascade, South Fork Stillaguamish), and late (Lower Skagit, Skykomish, Snoqualmie) life history types will need to be viable for the Puget Sound Chinook ESU to recover. The ten populations comprise four management units: Skagit Spring (Suiattle, Upper Cascade and Upper Sauk), Skagit Summer/Fall (Upper Skagit, Lower Skagit and Lower Sauk), Snohomish (Skykomish and Snoqualmie) and Stillaguamish (North Fork Stillaguamish and South Fork Stillaguamish). Hatchery contribution to natural escapement is extremely low in the Skagit system and moderate in the Snohomish and Stillaguamish systems.

Under the proposed actions, eight of the 10 populations in the region are expected to exceed their critical thresholds and three to exceed their rebuilding thresholds (Table 10). Both the Suiattle and South Fork Stillaguamish populations are expected to be below their critical thresholds. Low escapement has been a chronic condition for the South Fork Stillaguamish population, but the average escapement for the Suiattle is well above its critical threshold (avg = 312 spawners) given the historically small size of the population (Table 2). Progeny from parent year escapements in 2006 and 2007 are the primary contributors to adults returning in 2010. Severe flooding occurred in 2006 significantly reducing the survival of that brood. Parent year escapement in 2007 for the Suiattle was also very low (108 spawners) primarily as a result of severe floods in 2003. Because of the poor survival of the 2006 brood and the low escapement in 2007, the low 2010 anticipated return is not unexpected. Subsequent parent brood escapements for the Suiattle population have been stronger. Current average natural-origin escapement is well above the critical threshold for the Skykomish population (2,578) and above the generic rebuilding threshold for the Snoqualmie population (1,731). The expected 2010 escapements in the Snohomish management unit are anticipated to exceed the current average natural escapements[14] for each population by approximately 1,000 adults; nearing or exceeding the rebuilding thresholds for both populations.

[14] Includes hatchery fish contributing to spawning ground escapement.

Including the effects of the proposed action, exploitation rates for three of the four management units are below the RERs for the populations in those units (Skagit spring, Skagit summer/fall, Stillaguamish). Therefore, NMFS considers the proposed fisheries to present a low risk to those populations. The Snohomish Management Unit is 2% points above its RER. The exploitation rates in the August 2010-April 2011 Puget Sound fisheries are expected to be low across the four management units (4-6%)(Table 10). The escapement trends and growth rates for return and escapement are stable or increasing for both populations in the Snohomish Management Unit. The trends in growth rate for natural-origin escapements are higher than the growth rate for natural-origin return (Table 2). This indicates that sufficient fish are escaping the fisheries to maintain or increase the number of spawners from the parent generation; providing some stabilizing influence for abundance and reducing demographic risks. The stable or positive direction of the growth trends and, in particular, the relatively robust status of the populations compared with their thresholds should mitigate the increased risk possible as a result of exceeding the RER in one year for the Snohomish Management Unit. In addition, the late life history type exhibited by the Snohomish populations is also represented by the Lower Skagit River which is expected to meet its RER.

Considering all the information, the effects of the August 2010-April 2011 fisheries will meet the recovery plan guidance of two to four populations representing the range of life histories displayed by the populations in that region at low risk including those specifically identified as needed for recovery of the Puget Sound Chinook ESU. Therefore, the effects of the fisheries associated with the proposed actions when compared to no action, will adequately protect the survival and potential for recovery of the Whidbey/Main Basin region.

Central/South Sound: There are six populations within the Central/South Sound Region (Figure 2). Most are genetically similar, likely reflecting the extensive influence of transplanted hatchery releases, primarily from the Green River population. The Cedar and Duwamish-Green River fall Chinook salmon populations and White River spring Chinook salmon population are Category 1 populations. The Sammamish, Puyallup and Nisqually River Chinook are Category 2 populations. The six populations comprise five management units: Lake Washington (Cedar and Sammamish), Green-Duwamish, White, Puyallup, and Nisqually. Hatchery contribution to spawning escapement is moderate to significant for the populations within this region (Table 2).

NMFS determined the Nisqually and White River populations must be at low extinction risk to recover the ESU (NMFS 2006a). Therefore, the Nisqually population will need to transition to Category 1 management over time as it is considered essential to recovery of the ESU. Significant work is occurring to improve and restore estuarine habitat through land acquisition, , estuary improvement and similar projects. The timing and magnitude of changes in harvest that occur in the Nisqually watershed as part of a longer-term transitional strategy must be coordinated with corresponding habitat and hatchery actions and take into account the current Category 2 status of the population. That is, the indigenous population is extirpated and the objective is to recover the populations using the individuals that best approximate the genetic legacy of the original population, reduce the effects of the factors that have limited their production and provide the opportunity for them to readapt to the existing conditions.

The transition will occur over years and perhaps decades as the habitat improves to support better production and the current population becomes locally adapted and less reliant on hatchery production to sustain it. The co-managers took the first step in the harvest component of the strategy in the 2004 Puget Sound Chinook Harvest RMP when they established and managed fisheries to achieve an escapement goal for naturally spawning adult Chinook rather than a hatchery escapement goal as was the case in the past. In their proposed 2010 Puget Sound Chinook Harvest RMP, the co-managers have defined the next step in the transitional strategy as a stepped exploitation rate ceiling approach for the Nisqually population. In 2010, the exploitation rate ceiling is 65%; a 17% decrease in total exploitation rate compared to the recent year average of 78%. The RMP requires further reductions over the five years of the harvest plan, culminating in a 47% exploitation rate for the 2014 fishing season. Concurrently, the co-managers will install a floating weir in order to control the contribution of hatchery fish in the natural escapement as the population rebuilds.

The basins in the Central/South Sound region are the most urbanized and some of the most degraded in the ESU. The lower reaches of all these system flow through lowland areas that have been developed for agricultural, residential, urban or industrial use. Much of the watersheds or migration corridors for five of the six populations in the region are within the cities of Tacoma or Seattle or their environments (Sammamish, Cedar, Duwamish/Green, Puyallup and White). Natural production is limited by stream flows, physical barriers, poor water quality and limited spawning and rearing habitat related to timber harvest and residential, industrial and commercial development.

Except for the Sammamish population, current average natural-origin escapements are well above their critical thresholds and escapements in the White and Puyallup Rivers are approaching their rebuilding thresholds (Table 2). When hatchery-origin spawners are taken into account, current average escapements of three of the six populations exceed their rebuilding threshold. Spawning escapements in 2010 (including hatchery contribution) are expected to be above their rebuilding thresholds for all six populations in the Central/South Sound region (Table 10). Escapement trends are stable or increasing for all populations within the region.

Growth rates for escapement are declining for the Sammamish and Puyallup populations and stable or increasing for the remaining four populations (Table 2). Growth rates for returns are declining for four of the six populations (Cedar, Sammamish, Puyallup, Nisqually). Average productivity is also less than 1.0 for the Sammamish and Puyallup populations indicating that the populations are not replacing themselves. The White River population has the strongest escapement trend and growth rates within the ESU (Table 2). As with populations in other Puget Sound regions, the growth rates for escapement are generally higher than growth rates for return. In particular, fisheries management seems to have had a stabilizing influence on the Cedar River and Nisqually populations which have declining growth rates of return and stable to increasing growth rates of escapement. The combination of declining growth rates, low productivity, and, for the Sammamish, low natural-origin escapement suggest that the Puyallup and Sammamish populations are at higher risk for survival and recovery than other populations in the region. However, total spawning escapement remains strong when compared to their rebuilding thresholds (Table 10).

Exploitation rates for four of the five management units are expected to exceed their RERs or RER surrogates for the populations in those units; three by moderate to substantial amounts (Lake Washington, Puyallup and Nisqually)(Table 10). Under the proposed fisheries, escapements for all six populations in the region are expected to exceed both their critical thresholds and rebuilding thresholds (Table 10); although hatchery fish are expected to contribute moderately to significantly to most escapements in the region. The observed stable growth trends and, in particular, the relatively robust current and anticipated status of the Green River population compared with its thresholds should mitigate the slightly increased risk possible as a result of exceeding the RER in one year by 1%. Similar logic applies to any additional risk to the Cedar River which would exceed its surrogate RER by six percentage points. Given the current status and trends of the natural-origin production, exceeding the surrogate RERs for the Sammamish and Puyallup populations may result in some increased risk for the pace of adaptation of the local population. However, it is important to remember when assessing the risks for Category 2 populations like these that there is no increased risk to the indigenous populations in these watersheds because they are extirpated. Given the low productivity of the watersheds (Sammamish = 0.3, Puyallup = 0.6, Table 2) natural-origin recruitment will not increase much beyond existing levels unless constraints limiting marine, freshwater, and estuary survival for these populations are alleviated.

For the Nisqually population, the anticipated exploitation rate during the August 2010-April 2011 Puget Sound salmon fisheries is 35% for a total exploitation rate of 65% for the 2010 fishing season (Table 10). This rate also represents a 17% decrease in the rate of change in total exploitation rate compared to the recent year (2004-2008) average of 78%. Although NMFS has not yet made an ESA determination on the proposed 2010 RMP including the Nisqually management objectives[15], the 2010 total exploitation rate does represent the first step in a longer term commitment to reduced exploitation rates as part of a transitional strategy designed to reduce rates over time in concert with improvements in habitat and adjustments in hatchery operations (i.e., weir). Escapement trends and growth rates for natural-origin escapement under the recent year higher exploitation rates have been stable even under a declining growth rate in overall natural-origin return. This indicates that fisheries are providing some stabilizing influence to abundance and productivity; reducing demographic risks. Given that the proposed actions will be consistent with the longer term transitional strategy for recovery of the population, the stability in escapements, the Category 2 status of the population and the strong escapement anticipated in 2010, additional risks associated with exceeding the RER in the 2010 fishing year should not significantly effect the long-term persistence of the Nisqually Chinook population.

Given the information and context presented above, the fishing regime represented by the proposed actions should adequately protect four (White, Cedar, Duwamish/Green and Nisqually) of the six populations in the Region. The Sammamish River and Puyallup populations may experience some increased risks to the pace of adaptation of the existing local stock given the current status of the natural-origin populations. However, both are Category 2 populations for which the native population has been extirpated and potential improvement in natural-origin production is limited by the existing habitat. The aggregate natural escapements in 2010 are anticipated to exceed their rebuilding thresholds;

[15] A determination that the 65% rate is acceptable for the 2010 season does not preclude adjustments to the RMP rates should further analysis of the RMP determine they were warranted.

maintaining overall escapements at current levels. Neither was identified as essential for recovery of the Puget Sound Chinook ESU. Both the life history and Green River genetic legacy of these populations are represented by other populations in the Central South Sound Region. The effects of the proposed August 2010-April 2011 fisheries will meet the recovery plan guidance of two to four populations representing the range of life histories displayed by the populations in that region at low risk including those specifically identified as needed for recovery of the Puget Sound Chinook ESU (White River and Nisqually). Therefore, the effects of the fisheries associated with the proposed actions when compared to no action, will adequately protect the survival and potential for recovery of the Central/South Sound region.

Hood Canal: There are two populations within the Hood Canal Region: the Skokomish River and the Mid-Hood Canal Rivers populations (Figure 2). Each population forms a separate management unit and hatchery contribution to natural escapement is significant for both populations, although available data for the Mid-Hood Canal population is limited (Table 2, Ruckelshaus 2006). Both the Skokomish and Mid-Hood Canal Rivers populations are considered Category 2 populations. NMFS determined that both populations must be at low extinction risk to recover the ESU so both populations will need to transition to Category 1 management over time. The two extant populations likely reflect the extensive influence of inter-basin hatchery stock transfers and releases in the region, mostly from the Green River broodstock (Ruckelshaus et al. 2006) and the extirpation of the original indigenous population. Genetic analysis indicates no difference between fish originating from the hatchery and those spawning naturally in the river (Marshall 1999, Marshall 2000). Historically, low flows resulting from operation of the Cushman dams and habitat degradation of freshwater and estuarine habitat have adversely affected the Skokomish population. A settlement agreement in 2008 between the Skokomish Tribe and the dam operator resulted in a plan to restore normative flows to the river, improve habitat and restore an early Chinook life history in the river using supplementation. In addition, significant work is occurring to improve and restore estuarine habitat through land acquisition, levee breaching and similar projects. The timing and magnitude of changes in harvest that occur in these watersheds as part of the longer-term transitional strategy must be coordinated with corresponding habitat and hatchery actions and take into account the current Category 2 status of the population. The transition will occur over years and perhaps decades as the habitat improves to support better production and the current population becomes locally adapted and less reliant on hatchery production to sustain it. The co-managers took the first step in the harvest component of the strategy in the 2004 Puget Sound Chinook Harvest RMP when they established and managed fisheries to achieve an escapement goal for naturally spawning adult Chinook rather than a hatchery escapement goal as was the case in the past. In their proposed 2010 Puget Sound Chinook Harvest RMP, the co-managers have defined the next step in the transitional strategy as a 50% exploitation rate ceiling for the Skokomish population. This rate represents a 20% decrease in the rate of change of the total exploitation rate compared to the recent year average of 60%.

Under the proposed actions, escapement for the Skokomish population is expected to exceed its rebuilding threshold, but escapement for the Mid-Hood Canal population is expected to fall below its critical threshold (Table 10). However, hatchery spawners contribute substantially to escapement for both populations and the current average estimated natural-origin escapements are below the critical thresholds for both populations (Table 2). Total exploitation rates for both populations are expected to exceed their RER or RER surrogate (Table 10). For the Mid-Hood Canal population the exploitation rate in the August 2010-April 2011 Puget Sound salmon fisheries is expected to be low (Table 10) and the resulting increased impacts from the May-July period (1 fish based on FRAM model Chin1010 compared with the May-July analysis in NMFS 2010; 9 fish taken in all 2010 Puget Sound salmon fisheries) would not effect the critical status of the Mid-Hood Canal population.

For the Skokomish population, the anticipated exploitation rate during the August 2010-April 2011 Puget Sound salmon fisheries is 26% for a total exploitation rate of 50% for the 2010 fishing season. The overall rate is consistent with the long term objective in the proposed 2010 RMP[16]. Although the anticipated 2010 rate is substantially higher than the RER, the anticipated 2010 rate represents a significant reduction in exploitation rate consistent with a transitional strategy designed to reduce rates over time in concert with improvements in habitat and adjustments in hatchery operations. Escapement trends and growth rates for natural-origin escapement under the recent year higher exploitation rates have been stable even under a declining growth rate in overall natural-origin return. This indicates that fisheries are providing some stabilizing influence to abundance and productivity; reducing demographic risks. When weighed against the consistency with the longer term transitional strategy for recovery of the population, the stability in escapements and the Category 2 status of the population, additional risks associated with exceeding the RER in 2010 should not significantly affect the long-term persistence of the Skokomish Chinook population. Further constraints on the remaining 2010 Puget Sound fisheries would not provide a substantive benefit to the Mid-Hood Canal population. Therefore, the effects of the fisheries associated with the proposed actions when compared to no action present a low risk to survival and recovery for both populations in the Hood Canal region.

Strait of Juan de Fuca: The Strait of Juan de Fuca Region has two watershed Category 1 populations including an early-timed population on the Dungeness, and a fall-timed population on the Elwha (Figure 2). Each population is managed as a separate management unit. NMFS determined that both populations must be at low extinction risk to recover the ESU. The status of both populations is constrained by significant habitat-related limiting factors that are in the process of being addressed. Survival and productivity of the Dungeness population are adversely affected by low flows from agricultural water withdrawals and by other land use practices (PSIT and WDFW 2010a). All but the lower 5 miles of the Elwha River is blocked to anadromous fish migration by two dams and the remaining habitat in the lower river is severely degraded. An ambitious plan to remove the dams and restore natural habitat in the watershed have been completed, with dam removal scheduled to begin in 2012. Given the condition of salmon habitat in the watersheds and the planned significant disruption to the Elwha system as a result of dam removal, the conservation hatchery programs currently operating in the Dungeness and Elwha will be key to restoring the Chinook populations in the Strait of Juan de Fuca Region. Productivity analyses have demonstrated a relative lack of response in terms of natural-origin production (Dungeness=1.05 growth rate of return, Elwha=0.96 growth rate of return, Table 2) which suggests that habitat and environmental factors within the watershed and in marine waters are limiting natural-origin recruitment.

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[16] Acceptance of the 50% rate for the 2010 season does not preclude adjustments to the RMP rates should further analysis determine they were warranted.

Under the proposed actions, escapement for the Elwha population is expected to exceed its rebuilding threshold, and escapement for the Dungeness is expected to exceed its critical threshold (Table 10). However, hatchery spawners contribute substantially to escapement for both populations. The current average natural-origin escapement for the Dungeness population is estimated to be below its critical threshold and productivity is less than 1.0 (Table 2). Exploitation rates for both populations are expected to exceed their RER surrogates. However, exploitation rates in the August 2010-April 2011 Puget Sound salmon fisheries and are expected to be very low, i.e., 2% (3% cumulatively in Puget Sound)(Table 10). Complete closure of the Puget Sound salmon fisheries during August 1, 2010-April 30, 2011 would result in only an additional 5[17] and 10 spawners to the Dungeness and Elwha escapements, respectively. The trend for aggregate escapement is stable or increasing for both populations (Table 2). The trends in growth rate for natural-origin escapements is stable or positive for both populations and higher than the growth rate for natural-origin return (Table 2). This indicates that sufficient fish are escaping the fisheries to provide some stabilizing influence to abundance and should reduce demographic risks. The conservation hatchery program operating in the Dungeness River also buffers the demographic risk to the Dungeness River population. Given the status of the Elwha population above its rebuilding threshold, the stable and increasing escapement trends of both populations within this region, the conservation program for the Dungeness population, the small exploitation rate of 2% anticipated from the proposed action, and the likelihood that any further decrease in Puget Sound salmon fisheries-related impacts would have negligible beneficial effects on these populations, the effects of the fisheries associated with the proposed actions when compared to no action, would have little effect on the survival or potential for recovery of either population in the region.

Other Effects on Puget Sound Chinook

Trampling of redds during fishing has the potential to cause mortality of salmonids. Boat operation can result in stranding and mortality related to pressure changes in juveniles (PFMC 1999). Salmon fisheries are closed or fishing activities do not occur in freshwater areas in Hood Canal, North Puget Sound and the Strait of Juan de Fuca during peak spawning, rearing and out-migration periods (T. Johnson, pers. comm., WDFW, Fisheries Biologist, April 26, 2010). Notices are posted near fishing access areas by WDFW and the Washington State Parks, and news releases are distributed regularly by WDFW explaining responsible fishing behavior, including avoidance of spawning areas and damage to riparian areas (Thom Johnson, pers. comm., WDFW, Fisheries Biologist, April 26, 2010). The Puyallup and White River in South Puget Sound are closed to salmon fishing through much of Chinook salmon migration and spawning. These management measures should minimize redd or juvenile fish disturbance associated with the proposed actions.

Effects on Critical Habitat

Most of the harvest related activities in Puget Sound occur from boats or along river banks with most of the fishing activity in the marine and nearshore areas. The gear that would be used includes hook-and-line, drift and set gillnets, beach seines, and to a limited extent, purse seines. These types of fishing gear in general actively avoid contact with the substrate because of the resultant interference with fishing and

[17] The anticipated escapement in the May-July 2010 biological opinion was erroneously noted as 570. The correct number was 540.

potential loss of gear. Also these effects would occur to some degree through implementation of fisheries or activities other than the Puget Sound salmon fisheries, i.e., recreational boating and marine species fisheries. Construction activities directly related to salmon fisheries are limited to maintenance and repair of existing facilities (such as boat launches), and are not expected to result in any additional impacts on riparian habitats. By removing adults that would otherwise return to spawning areas, harvest could affect water quality and forage for juveniles by decreasing the return of marine derived nutrients to spawning and rearing areas, although this has not been identified as a limiting factor for the ESU. The proposed actions incorporate management for maximum sustainable spawner escapement and implementation of management measures to prevent over-fishing. Both of these actions have been recommended as ways to address the potential adverse effects of removing marine derived nutrients represented by salmon carcasses. Therefore, there will be minimal disturbance to vegetation, and negligible harm to spawning or rearing habitat, water quantity and water quality from the proposed actions. The proposed actions will not affect the ability of critical habitat to remain functional or to retain the current ability for the PCEs to become functionally established and to serve the intended conservation role for the species.

2.3.2 Puget Sound Steelhead

During the August 1, 2010 through April 30, 2011 time period that is the subject of this consultation, steelhead mortality in non-treaty fisheries is limited. The retention of steelhead in non-Treaty commercial fisheries is prohibited. During August 1 through April 30, 17 steelhead were encountered in Puget Sound commercial salmon fisheries from 1991 to 2008 (J. Jording, pers. comm., WDFW, Fish and Wildlife Biologist, March 25, 2010). This equates to less than one fish per year so few encounters in these fisheries are anticipated during August 1 through April 30, 2011. Washington prohibits the retention of natural-origin steelhead (those without a clipped adipose fin) in recreational fisheries. However, some fish die as a result of encounters with the gear or subsequent handling. Creel survey information indicates few encounters with steelhead occur in salmon fisheries during the August through April time period. Creel surveys conducted during salmon recreational fisheries from 2003 and 2004 estimated an average fishing-related mortality of 10 natural-origin steelhead[18] per year from August 1 through April 30 (B. Leland, pers. comm. WDFW, Statewide Steelhead Manager, April 6, 2010). A comparable level of mortality is anticipated during August 1 through April 30 based on the similarity of 2010-11 proposed salmon fisheries and years in the creel surveys.

From 2001/2002 through 2007/2008, the fishing-related mortality averaged approximately 1%[19] on natural-origin steelhead caught incidentally each year in Puget Sound terminal recreational salmon and steelhead fisheries (PSIT and WDFW 2010b). From 2001/2002 through 2007/2008, the fishing-related mortality averaged 3.3% on natural-origin steelhead caught each year in terminal tribal salmon and steelhead fisheries (W. Beattie, unpub. data, NWIFC, Conservation Planning Coordinator, June 30, 2010). An annual average of 81 (hatchery and wild combined)(range = 32-157) steelhead were landed incidentally in treaty marine fisheries from all Puget Sound marine areas combined during 2001/2002

[18] Creel surveys provided a partial estimate of fishing related mortality for a subset of Puget Sound salmon fisheries.

[19] The harvest rate refers to the same five major watersheds NMFS referenced with regard to the listing determination (see Environmental Baseline discussion for Puget Sound Chinook and Steelhead). Data are not yet available for the Green and Snohomish watersheds for 2008/2009.

through 2006/2007. A similar level of mortality is anticipated in treaty fisheries during August 1, 2010 through April 30, 2011[20].

In summary, fishing-related mortality of natural origin steelhead anticipated in treaty and non-treaty Puget Sound salmon and steelhead fisheries during August 1, 2010 through April 30, 2011 is low. An estimated total combined fishing-related terminal harvest rate of approximately 4% on natural-origin steelhead is expected during treaty and non-treaty Puget Sound salmon and steelhead fisheries from August 1, 2010-April 30, 2011 as measured for five Puget Sound winter steelhead populations for which sufficient data are available to assess harvest rates (Skagit, Snohomish, Green, Puyallup and Nisqually). This includes landed and non-landed mortality. An additional 92 natural-origin steelhead are expected to be caught in Puget Sound recreational and commercial treaty and non-treaty marine fisheries. Data are currently insufficient to determine the proportion of wild steelhead caught in marine areas. However marine catch is comprised predominately of hatchery-origin (i.e. Chambers Creek) unlisted fish and, in northern areas like the Strait of Juan de Fuca, a component of Canadian steelhead (W. Beattie, pers. comm. NWIFC, Conservation Planning Coordinator, July 20, 2010). Since marine harvest is directed at hatchery-origin steelhead and other species of salmon, NMFS anticipates impacts to natural origin steelhead to be low. Based on the consistency in recent years of catch patterns in marine areas and harvest rates for the five proxy winter steelhead stocks, NMFS expects steelhead harvests in the remaining terminal areas for which data are insufficient to assess harvest rates to be within the impacts to listed steelhead during 2001/2002-2006/2007 period on which the 4% harvest rate was calculated as described for the listing determination.

In its listing determination for Puget Sound steelhead, NMFS determined that the current harvest management strategy that has eliminated direct harvest of wild steelhead in Puget Sound has largely addressed the threat of decline to the listed DPS posed by harvest (72 Fed. Reg. 26777, May 11, 2007). The annual terminal harvest rate on listed steelhead under the management strategy referenced in the listing determination averaged approximately 4% given the limited information available on five winter steelhead stocks (NMFS unpubl. data); consistent with the rate anticipated under the proposed actions for steelhead in these same watersheds. In several biological opinions evaluating comparable harvest rates for comparable Columbia River steelhead populations, NMFS determined harvest would not jeopardize the Columbia River populations and was not a risk factor (NMFS 2008f, NMFS 2008g, ODFW 2007)[21]. Therefore, the effects of the fisheries associated with the proposed actions when compared to no action, would not appreciably reduce the likelihood of survival and potential for recovery of the Puget Sound Steelhead DPS in the wild.

The evaluation of effects on Puget Sound steelhead in this opinion is based on very limited available information and analysis. Substantial new information may become available through several on-going efforts. The Puget Sound Steelhead Technical Recovery Team was convened to develop technical

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[20] This does not include the fish caught in marine areas adjacent to the Snohomish and Skagit Rivers that were included in the calculation of terminal harvests.

[21] NMFS has not established the 4% associated with the management strategy referenced in the listing strategy as a jeopardy standard. Rather NMFS has concluded that it would not pose jeopardy, but has not defined what level of harvest above 4% would be jeopardy at this time. In addition, standards are expected to change over time consistent with changes in stock status and other information related to the DPS.

delisting criteria and guidance associated with development of a Puget Sound steelhead recovery plan. Also as discussed earlier, NMFS is conducting an evaluation of a comprehensive harvest management plan for Puget Sound steelhead jointly developed by WDFW and the Puget Sound treaty tribes. NMFS expects that both efforts will provide new tools, data and technical analyses, refine Puget Sound steelhead population structure and better define the role of individual populations in the ESU. In addition, fisheries change from year to year to respond to changing abundances in both the species targeted in the fisheries and those caught incidentally in fisheries targeted at other species. For example, sockeye and spring Chinook abundance in the Skagit River is anticipated to increase in the next several years providing increased fishing opportunity on those species. Consequently, the co-managers may propose increased incidental catch of steelhead in those fisheries in subsequent years. As that information becomes available, NMFS will incorporate the new technical information in subsequent opinions and evaluate anticipated fishery-related impacts to steelhead in light of the improved information and the status of the steelhead populations at that time.

NMFS has not designated critical habitat for the Puget Sound Steelhead DPS.

2.3.3 Puget Sound/Georgia Basin Rockfish

Recreational and commercial salmon fishers employ diverse equipment, with each gear type having a different risk of incidentally catching (bycatch) yelloweye rockfish, canary rockfish and bocaccio. Many recreational salmon anglers use downriggers that consist of cables and weights that deliver fishing gear to specific depths, mostly while trolling artificial lures. A smaller fraction of recreational salmon fishers, often referred to as 'moochers,' use one to six ounces of weight with herring as bait, and free-drift or slowly troll. Some anglers also use weighted artificial lures and free drift while jigging. Most salmon anglers do not place their gear below 150 feet (46 meters) (Martinis 2008, Olander 1991). Salmon and rockfish both consume some similar or identical prey items that include herring, sand lance and smelt, making them vulnerable to the use of herring as bait and fishing lures imitating these prey items. As a result, anglers targeting salmon occasionally unintentionally hook yelloweye rockfish, canary rockfish or bocaccio. Between 2004 and 2008, recreational salmon anglers averaged nearly 350,000 trips annually (WDFW 2010). Though the frequency of ESA-listed rockfish bycatch by recreational salmon anglers is extremely low, the large numbers of angler trips nonetheless results in measurable incidental catches (described below).

Although recreational fishers are required by state law to return all rockfish species to the water, the mortality rate of released rockfish for many species may be high, particularly fish that are brought up from deeper than 60 feet (Jarvis and Lowe 2008, Parker et al. 2006, Palsson et al. 2009). When rockfish are brought from depths of deeper than 60 feet, the rapid decompression causes over-inflation and/or rupture of the swim bladder (termed barotrauma) which can result in multiple direct injuries. In addition, these injuries cause various levels of disorientation among rockfish species which can result in fish remaining at the surface for various periods after they are released (Hanna and Matteson 2007). Rockfish at the surface are susceptible to predation by birds, sharks or marine mammals, damage from solar radiation, and gas embolisms (Palsson et al. 2009). These factors, separately or in combination, often result in death.

Most commercial salmon fishers in the Puget Sound use purse seines and gill nets (WDFW 2010). A relatively small amount of salmon are harvested within the DPS by reef nets and beach seines. Gill nets and purse seines rarely catch rockfish of any species. From 1990 to 2008, no rockfish were recorded caught in the purse seine fishery (WDFW 2010). In 1991, one rockfish (of unknown species) was recorded in the gill net fishery, and no other fish were caught through 2008 (WDFW 2010). Low encounter rates may be attributed to a variety of factors. For each net type, the mesh size restrictions that target salmon based on size tend to allow juvenile rockfish to pass through. Gill net and purse seine operators also tend to avoid fishing over rockfish habitat, as rocky reef structures can damage their gear. In addition, nets are deployed in the upper portion of the water column away from the deeper water rockfish habitat, thus avoiding interactions with most adult rockfish. In the mid 1990's commercial salmon net closure zones were established in much of Puget Sound for seabird protection. Some of these closed areas overlap with rockfish habitat, reducing the potential for encountering rockfish. Specific areas are: (1) a closure of the waters inside the San Juan Islands, (2) a closure extending 1,500 feet along the northern shore of Orcas Island, and (3) a closure of waters three miles from the shore inside the Strait of Juan de Fuca (WDFW 2010).

The greatest risk to rockfish posed by gill nets and purse seines comes from the nets' inadvertent loss. Derelict nets generally catch on bottom structure such as rocky reefs and large boulders that are also attractive to rockfish (NRC 2007). Dead rockfish have been found in derelict nets because the net can continue to 'fish' when a portion of it remains suspended near the bottom and is swept by the current. Aside from killing fish, derelict nets alter habitat suitability by trapping fine sediments out of the water column, making a layer of soft sediment over rocky areas that changes habitat quality and suitability for benthic organisms (NRC 2007). This gear covers habitats used by rockfish for shelter and pursuit of food, and may thereby deplete food sources. For example, a study of several derelict nets in the San Juan Islands reported an estimated 107 invertebrates and 16 fish (of various species) entangled per day (NRC 2008). One net had been in place for 15 years, entangling an estimated 16,500 invertebrates and 2,340 fish (NRC 2008). Though these estimates are coarse, they illustrate the potential impacts of derelict gear on the DPS. The state has established a no-fault reporting system for lost gear for fishermen, and approximately 80 percent of lost nets reported by fishermen are recovered relatively soon after their loss (J. June, pers. comm., Natural Resource Consultants, November 2009). There are no devices installed on nets to track their location after they are lost, which complicates the recovery effort.

Reef nets are deployed near rockfish habitat in the San Juan Islands and Lummi Island, and are subject to the same area closures as gill nets and purse seines. Beach seines are used next to sandy or gravely beaches, and in each fishery all non-targeted fish are released. Because most adult yelloweye rockfish, canary rockfish and bocaccio occupy waters much deeper than surface waters fished by reef nets and beach seines, the bycatch of adults is likely minimal to non-existent. Similarly, such nets are not likely to catch juvenile rockfish because they are small enough to pass through the mesh. Moreover, juvenile yelloweye rockfish, canary rockfish and bocaccio are unlikely to be caught in beach seines because the seines are generally not used along kelp areas where juvenile canary rockfish and bocaccio tend to be found (WDFW 2010). If adult or juvenile yelloweye rockfish, canary rockfish and bocaccio were to be caught, the released fish would have a large chance of survival because they would not be brought to the surface from extreme depths.

Bycatch Estimates and Effects on Abundance

Given the nature of the commercial salmon fisheries described above, we do not anticipate that any adult or juvenile yelloweye rockfish, canary rockfish or bocaccio will be incidentally caught by actively fished nets during the August 2010, through April, 2011 time period. However, a small number of nets could become derelict gear near rockfish habitat.

All methods of recreational salmon fishing have the potential to encounter ESA-listed rockfish. The WDFW has estimated bycatch of rockfish from anglers targeting salmon, bottomfish and 'other' marine fishes from 2004 to 2008 (WDFW unpublished data). The WDFW catch estimates represent the best available information on contemporary bycatch levels of ESA-listed rockfish. However, their precision is unknown, and could be influenced by a number of factors. Caught and released fish could be mistakenly identified and reported by some anglers, or since the WDFW checks less than 100 percent of anglers returning to port, the catch of ESA-listed rockfish could go unreported. These factors could make the actual bycatch of yelloweye rockfish, canary rockfish or bocaccio higher or lower than WDFW's estimates. The recreational salmon fisheries proposed for August 1, 2010 through April 30, 2011 are expected to result in similar fishing techniques, locations, and anticipated numbers of angler-trips as were found in the years from 2004 to 2008. Therefore, the average bycatch of yelloweye rockfish, canary rockfish and bocaccio from fishers targeting salmon during this time period is expected to be similar to the bycatch found in recent salmon fisheries. Rockfish catch data provided by the WDFW show that 100 percent of yelloweye rockfish and 95 percent of the canary rockfish bycatch associated with salmon fishing occurs from May we presume that the timing is similar to that for canary and yelloweye rockfish. Therefore, given that most of the fishery will take place after the peak times for bycatch, we estimate that incidental catch of yelloweye rockfish, canary rockfish and bocaccio associated with recreational fisheries from August 1, 2010 through April 30, 2011 will total not more than 25 percent of the average annual estimated bycatch from 2004 to 2008.

Yelloweye Rockfish

The average annual estimated bycatch of yelloweye rockfish from salmon anglers was 102 fish from 2004 to 2008 (WDFW, unpublished data) (Figure 4). Thus we estimate that up to 26 fish may be incidentally caught during the August 1, 2010 through April 30, 2011 salmon fisheries. From 2004 to 2008, fish were caught in five of the nine Marine Catch Areas (WDFW unpublished data), and a similar spatial distribution of catch is anticipated in the current fishery. Though these fish will be released as mandated by state law, most will likely perish from barotrauma injuries or predation.

Canary rockfish

The average annual estimated bycatch of canary rockfish from salmon anglers was 229 fish from 2004 to 2008 (WDFW unpublished data) (Figure 5). We therefore estimate that up to 57 fish may be incidentally caught during the August 1, 2010 through April 30, 2011 salmon fisheries. Fish were caught in six of the nine Marine Catch Areas (WDFW unpublished data), and a similar spatial distribution of catch is anticipated in the current fishery. Though these fish will be released as mandated by state law, most will likely perish from barotrauma injuries or predation.

Bocaccio

The average annual estimated bycatch of bocaccio by salmon anglers was 9 fish from 2004 to 2008 (WDFW unpublished data) (Figure 6). We therefore estimate that up to 2 fish may be incidentally caught during the August 1, 2010 through April 30, 2011 salmon fisheries. The only bocaccio catch was from Marine Catch Area 11 in the Central Sound region (WDFW unpublished data). The only bocaccio likely to be caught during the fishery would therefore probably come from the South Sound, Central Sound, and San Juan Regions. Though these fish will be released as mandated by state law, most will likely perish from barotrauma injuries or predation.

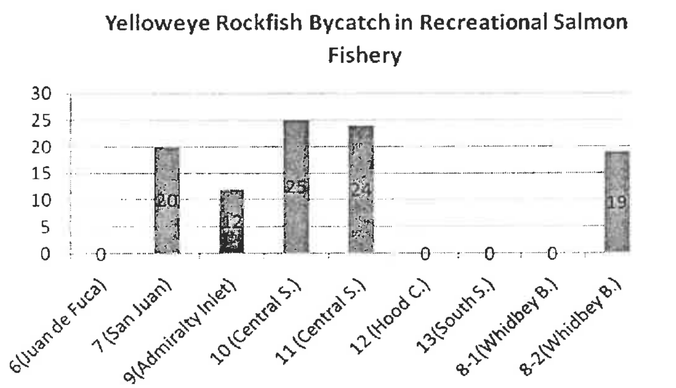

Figure 4. Average number of yelloweye rockfish incidentally caught per year (2004 to 2008) by recreational anglers for each Marine Catch Area.

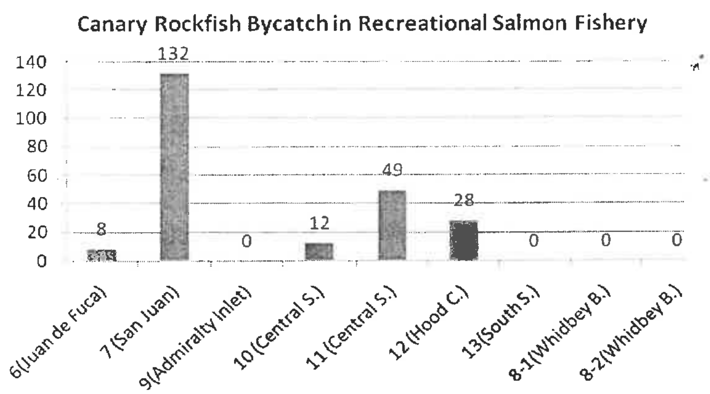

Figure 5. Average number of canary rockfish incidentally caught per year (2004 to 2008) by recreational anglers for each Marine Catch Area.

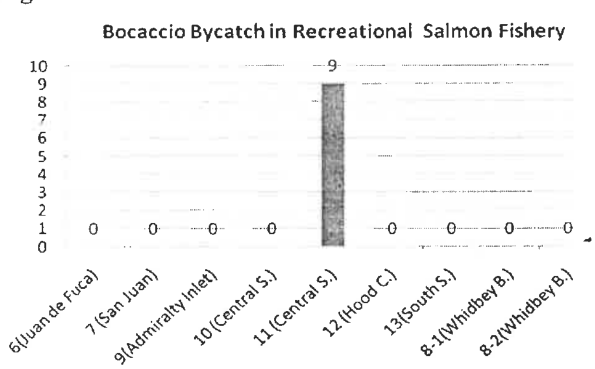

Figure 6. Average number of bocaccio incidentally caught per year (2004 to 2008) by recreational anglers for each Marine Catch Area.

Total mortality related to the overall population

As detailed in the Environmental Baseline, yelloweye rockfish, canary rockfish and bocaccio can also be caught by anglers targeting bottomfish and other marine species, and were likely caught by anglers targeting salmon from May 1 through July, 31 2010. To assess if August 1, 2010 through April 30, 2011 salmon fishery bycatch threatens the viability of each species, in combination with other sources of bycatch in the environmental baseline, we also review the population-level impact from the fisheries and research efforts combined. We anticipate that the new WDFW fishing regulations that prevent anglers from targeting rockfish, and fishing for bottomfish in waters deeper than 120 feet reduce bycatch of ESA-listed rockfish. However, we are unable to predict the extent of this reduction at this time, thus we use the 2004 to 2008 averages of bycatch from anglers targeting bottomfish and other marine species within our assessment of total mortality related to the overall population of ESA-listed rockfish.

In order to assess the true effects of the individual fish losses detailed above, we need to examine the effect on populations and, ultimately, the species. Our assessment of the effects bycatch has on population viability is informed by a methodology adopted by the Pacific Fishery Management Council (Council) for rockfish species. The decline of West coast groundfish stocks in the late 1990's prompted the Council to reassess harvest management (Ralston 1998, Ralston 2002). The Council held a workshop in 2000 to review procedures for incorporating uncertainty, risk, and the precautionary approach in establishing harvest rate policies for groundfish. The workshop participants assessed best available science regarding "risk-neutral" and "precautionary" harvest rates (Scientific and Statistical Committee, 2000). The workshop identified risk-neutral harvest rates of 0.75 (75 percent) of natural mortality, and precautionary harvest rates of 0.5 to 0.7 (50 to 70 percent) of natural mortality for rockfish species. These rates are supported by published and unpublished literature (Walters and Parma 1996, Scientific and Statistical Committee 2000), and have subsequently guided rockfish conservation efforts in British Columbia, Canada (Yamanaka and Lacko 2001). A fishery mortality rate of 0.5 of natural mortality was deemed most precautionary for rockfish species, particularly in data-limited settings, and was considered a rate that would not hinder population viability (Walters and Parma 1996, Scientific and Statistical Committee 2000). The exploitation benchmarks established by the council were designed to allow the persistence and recovery of depleted rockfish populations. Given the similar life histories of yelloweye rockfish, canary rockfish, and bocaccio to the coastal rockfish managed by the Council, we will use the above benchmarks in assessing the risk the fishery poses to these species. As new information comes to light about the status of yelloweye rockfish, canary rockfish, and bocaccio we will continue to refine the analysis of bycatch risk.

As described above in the Status of the Species, there are no reliable estimates of the abundance for any of the ESA-listed rockfish DPSs. The best available abundance data for any region for each species comes from the 2008 WDFW ROV surveys in the San Juan Islands area. In addition, canary rockfish were documented in the San Juan Islands and Straits of Georgia regions by WDFW bottom trawl and drop camera surveys (see Table 5). For purposes of this analysis, we made the conservative assumption that the estimated abundance in the surveyed San Juan Island and Straits of Georgia regions represented the total abundance of the DPS. The WDFW may have over-or-underestimated the abundance of each species when it expanded the data from the ROV, drop camera and bottom trawl surveys to produce abundance estimates. This risk is inherent in the study design of each methodology and a common challenge to fisheries management and species conservation. To address the possibility that each survey method resulted in over-estimates of abundance, our analysis includes three population scenarios – one based on the WDFW estimates, one that is roughly 50 percent less and one that is roughly 20 percent less. The confidence intervals for the WDFW ROV estimates were not reported. Thus, these reductions are examined to test the sensitivities of the abundance estimate for each species in the event that the estimates are larger than the actual population size. We also note that there may be equal probability that the WDFW population numbers are underestimates of abundance for each species.

The structure of this assessment thus purposefully underestimates the total abundance of each DPS and thereby generates a conservative evaluation of cumulative fishery bycatch mortality for each species. Additional conservative assumptions include: (1) we consider each caught fish to be a mortality; and, (2) we assume bycatch from anglers targeting bottomfish and other marine species will remain at recent levels, despite new regulations that will likely reduce bycatch. There will likely be some instances where yelloweye rockfish, canary rockfish, or bocaccio are caught in shallow water (i.e. less than 60 feet), are released alive, and survive, though we are unable to estimate that number at this time.

Annual natural mortality rates for yelloweye rockfish range from two to 4.6 percent (Wallace 2007, Yamanaka and Kronlund 1997), thus the precautionary range of fishing mortality would be one to 2.4 percent. The bycatch mortality associated with salmon angling throughout the range of the DPS (Table 11, column 1) would be well below the lowest precautionary level (one percent) for each of the yelloweye rockfish abundance scenarios. In addition, combined bycatch levels from anglers targeting salmon, bottomfish and other marine species (Table 11, column 2) would also be below the lowest precautionary level (one percent) for each of the population scenarios.

Table 11. Yelloweye Rockfish Fishery Mortality

	1	2
San Juan Island Region Abundance Scenario	Est. percent mortality from August 1, 2010 to April 30, 2011 salmon fishery within range of the DPS (26 fish)	Est. percent mortality from all fisheries within the DPS (273 fish*)
30,000	0.0009	0.9
40,000	0.0007	0.7
50,565	0.0005	0.5

* This total includes the expected number of bycatch from (1) salmon anglers from May 1, 2010 through July 31, 2010, (2) anglers targeting bottomfish and other marine species from May 1 2010 through April 30, 2011, and 3) six fish authorized by NMFS to be taken in research efforts, Permit Number 15119.

Annual natural mortality rates for canary rockfish range from six to nine percent (Methot and Stewart 2005, Stewart 2007), thus the precautionary level of fishing mortality would be three to 4.5 percent. The bycatch mortality associated with salmon anglers from August 1, 2010 through April 30, 2011 throughout the range of the DPS (Table 12, column 1) would be well below the lowest precautionary level for all of the canary rockfish abundance scenarios. In addition, combined bycatch levels from anglers targeting salmon, bottomfish and other marine species from May 1, 2010 through April 30, 2011 (Table 12, column 2) would also be below the lowest precautionary level for two of the abundance scenarios. In one scenario, the lowest population (10,000 fish), and the combined mortality from all fisheries plus research (421 fish) would be 1.2 percent over the lowest precautionary level described by Walters and Parma (1996) and the Scientific and Statistical Committee (2000).

Table 12. Canary Rockfish Fishery Mortality

	1	2
San Juan/Strait of Georgia Region abundance scenario	Est. percent mortality from August 1, 2010 to April 30, 2011 salmon fishery within range of the DPS (57 fish)	Est. percent mortality from all fisheries within the DPS (421 fish*)
10,000	0.6	4.2
15,000	0.4	2.8
20,499	0.3	2.1

* This total includes the expected number of bycatch from 1) salmon anglers from May 1, 2010 through July 31, 2010, 2) anglers targeting bottomfish and other marine species from May 1 2010 through April 30, 2011, and 3) six fish authorized by NMFS to be taken in research efforts, Permit Number 15119.

The annual natural mortality rate for bocaccio is approximately 15 percent (Tolimieri and Levin 2005), thus the precautionary level of fishing mortality would be less than 7.5 percent. Bycatch mortality from salmon anglers and from all fisheries in the DPS would be well below the precautionary level for each of the abundance scenarios (Table 13).

Table 13. Bocaccio rockfish bycatch mortality

San Juan Island region abundance scenario	Est. percent mortality from August 1, 2010 to April 30, 2011 salmon fishery within range of the DPS (2 fish)*	Est. percent mortality from all fisheries within the DPS (10 fish)**
2,000	0.1	0.5
3,000	0.07	0.3
4,487	0.04	0.2

* The 2-fish estimate is based on WDFW's estimate of 9 bocaccio incidentally caught in the salmon fishery (WDFW unpublished data) times .25. Because most salmon effort is in the summer, we make the conservative assumption that 75 percent of WDFW's estimated bycatch will occur from May through July.
** No bocaccio were reported caught in other (non-salmon) fisheries from 2004-2008. This total includes one fish authorized by NMFS to be taken in research efforts, Permit Number 15119.

Our analysis used the estimated 2004 to 2008 average annual bycatch for each species, and this average bycatch could be exceeded in 2010. The calculated total-fishery mortality rates for each of the abundance scenarios of yelloweye rockfish, canary rockfish and bocaccio illustrate that even for total bycatch rates of over 100 fish (for each species) greater than the 2004 to 2008 average, the total effect would still remain under what is considered to be the precautionary level for such a fishery's effects at the WDFW abundance scenario.

In addition to fishery mortality, rockfish are killed by derelict fishing gear (Palsson et al. 2009, WDFW 2010). To date, one canary rockfish has been found within derelict gear (J. June, pers. comm., Natural

Resource Consultants, electronic communication, February, 2010), and it is unknown how many ESA-listed rockfish are killed on an annual basis. The ongoing removal of thousands of nets will reduce the mortality and improve habitat conditions of all rockfish species. Most of these nets are within waters shallower than 100 feet, and 214 rockfish (of a variety of species) have been found entangled, though many fish decay prior to the removal of the net and are undocumented. The removal of nets shallower than 100 feet improves habitat conditions for juvenile yelloweye rockfish, canary rockfish and bocaccio. To date, 32 nets have been found in waters deeper than 100 feet (J. June, pers. comm., Natural Resource Consultants, March, 2010), but additional surveys and removal of deepwater nets would alleviate an additional source of mortality that likely also impacts yelloweye rockfish and bocaccio. The greatest risk to rockfish from the use of gill nets and purse seines comes from their inadvertent loss. Derelict nets generally catch on bottom structure such as rocky reefs and large boulders that are also attractive to rockfish (NRC, 2007). Dead rockfish have been found within derelict nets because the net can continue to 'fish' when a portion of it remains suspended near the bottom and is swept by the current

The state has established a no-fault reporting system for lost gear for fishermen. In recent years it is estimated that fewer than 12 nets become derelict in the Puget Sound region per year (K. Antonelis, Natural Resource Consultants, personal communication, April 2010.). Approximately 80 percent of lost nets reported by fishermen are recovered relatively soon after their loss (J. June, Natural Resource Consultants, personal communication, November 2009). It is possible that one or two nets would be lost, reported to authorities, but not successfully retrieved before it becomes derelict during the course of the August 1, 2010 through April 30, 2011 salmon fisheries. The impacts of a lost net would depend upon its location and drift trajectory, the habitat where it ends up, and the occurrence of ESA-listed rockfish within or near that habitat. We estimate that up to two nets will be lost in the Puget Sound/Georgia Basin, and not retrieved immediately, from August 1, 2010 through April 30, 2011, and that these nets would degrade approximately 22,500 square feet of benthic habitat. It unlikely that any such net would kill any ESA-listed rockfish, and if a small amount of mortality did occur, it certainly would not create an effect strong enough to further reduce the viability of the yelloweye rockfish, canary rockfish or bocaccio DPSs.

Effects on Spatial Structure and Connectivity

Bycatch (or death of fish in new derelict gear) of ESA-listed rockfish could alter spatial structure in several ways. First, if anglers incidentally catch a greater proportion of the total population of yelloweye rockfish, canary rockfish, or bocaccio in one or more of the regions of the DPSs, the spatial structure and connectivity of each DPS could be degraded. The lack of reliable population abundance estimates from the regions of Puget Sound Proper complicates this type of assessment. Second, because most salmon anglers fish in waters shallower than 150 feet, there may be a disproportionate removal of fish from the shallow portion of the range of adult habitat. The removal of these fish could reduce the spatial structure of the overall population. Yelloweye rockfish are the most susceptible to each type of spatial structure impact because of their sedentary nature. Localized losses of yelloweye rockfish are less likely to be replaced, compared to canary rockfish and bocaccio, which are better able to recolonize habitats due to the propensity of some individuals to travel long distances.

Diversity and Productivity

Bycatch of yelloweye rockfish, canary rockfish and bocaccio can alter diversity primarily by the removal of larger fish. Larger fish of each species are able to target baits and lures more so than juveniles, thus it is likely that bycatch disproportionately kills larger yelloweye rockfish, canary rockfish, and bocaccio. The loss of fish that are reproductively mature, or nearly so, would hinder the demographic diversity (and productivity) of each species. The impacts on fish within Puget Sound Proper could be greater than the San Juan Island and Straits of Juan de Fuca region if anglers incidentally catch a greater proportion of the total population of each species. The lack of contemporary demographic information for yelloweye rockfish, canary rockfish and bocaccio complicates this type of assessment.

2.4 Cumulative Effects

Cumulative effects, defined in 50 CFR 402, include the effects of future state, tribal, local, or private actions not involving Federal activities that are reasonably certain to occur within the action area of the Federal action subject to this consultation. Future Federal actions that are unrelated to the proposed actions are not considered in this section because they require separate consultation pursuant to Section 7 of the ESA. For the purpose of this analysis, the action area includes all marine and freshwater fishing areas in Puget Sound and the western Strait of Juan de Fuca to Cape Flattery (Figure 1, see description in Section 1.4-Action Area).

Activities occurring in the Puget Sound area were considered in the discussion of cumulative effects in the biological opinion on the Puget Sound Harvest Resource Management Plan (NMFS 2004a) and remain current. That opinion discussed the types of activities taken to protect listed species through habitat restoration, hatchery and harvest reforms, and water resource management actions. A Final Recovery Plan for Southern Resident killer whales was published January 24, 2008 (NMFS 2008e). 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 Fed. Reg. 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.

Cumulative effects for ESA-listed rockfish will be influenced by the new state fishing regulations that prohibit anglers retaining rockfish of any species, and restricting fishing deeper than 120 feet for anglers targeting bottomfish. As discussed elsewhere in this document, these actions will reduce ESA-listed rockfish bycatch. The state is also planning on closing several commercial fisheries that likely result in bycatch of rockfish.

Some types of human activities that contribute to cumulative effects are expected to have adverse impacts on populations and PCEs, many of which are activities that have occurred in the recent past and had an effect on the environmental baseline. These can be considered reasonably certain to occur in the future because they occurred frequently in the recent past, especially if authorizations or permits have not yet expired. Within the freshwater portion of the action area, non-Federal actions are likely to include human population growth, water withdrawals (i.e., those pursuant to senior state water rights) and land use practices. In marine waters within the action area, state, tribal, and local government actions are likely to be in the form of legislation, administrative rules, or policy initiatives, shoreline growth management and resource permitting. Private activities include continued resource extraction, vessel traffic, development and other activities which contribute to non-point source pollution and storm water run-off. Although these factors are ongoing to some extent and likely to continue in the future, past occurrence is not a guarantee of a continuing level of activity. That will depend on whether there are economic, administrative, and legal impediments (or in the case of contaminants, safeguards). Therefore, although NMFS finds it likely that the cumulative effects of these activities will have adverse effects commensurate to those of similar past activities; it is not possible to quantify these effects.

2.5 Conclusions

2.5.1 Puget Sound Chinook

Under the proposed actions, the combined ocean and Puget Sound exploitation rates for the 2010 fishing year for five of the 14 management units in the ESU are expected to be under their RER or RER surrogates (Table 10). NMFS considers the proposed fisheries to present a low risk to populations that do not exceed their RERs (NMFS 2004c). For the populations above their RERs or RER surrogates: (1) current and anticipated population status in 2010 and positive trends in escapement and growth rate alleviated concerns about additional risk (Skykomish, Snoqualmie, Duwamish-Green and Cedar); (2) anticipated impacts from the proposed Puget Sound fisheries during August 1, 2010-April 30, 2011 are low and the effect on the population is negligible (Mid-Hood Canal Rivers, Dungeness and Elwha); (3) indigenous populations in the watershed have been extirpated and either the proposed fisheries are consistent with long-term strategies for local adaptation and rebuilding of the remaining populations (Nisqually, Skokomish). Some potential increased risks were identified for the Puyallup and Sammamish populations but the recovery plan criteria for the Central/South Sound Region would still be met. Eighteen of the 22 populations in the ESU are expected to exceed their critical thresholds and 11 are expected to exceed their rebuilding thresholds (see caveat above regarding representation of natural-origin fish). For populations anticipated to be below their critical thresholds, exploitation rates either did not exceed their RERs (South Fork Stillaguamish, Suiattle), or the fisheries effect on the population status would be negligible (South Fork Nooksack, Mid-Hood Canal Rivers).

After reviewing the current status of Puget Sound Chinook, the environmental baseline for the action area, the effects of the proposed fisheries, and the cumulative effects, NMFS concludes that the proposed actions would adequately protects the survival and potential for recovery of each of the five regions of the ESU. Therefore, NMFS concludes that the proposed actions are not likely to jeopardize the continued existence of the Puget Sound Chinook salmon ESU. For the reasons discussed in section 2.3.1 above, NMFS also concludes that the actions considered in this consultation are not likely to destroy or adversely modify designated critical habitat for Puget Sound Chinook.

2.5.2 Puget Sound Steelhead

Estimated fishing-related mortality for natural origin steelhead in treaty and non-treaty Puget Sound salmon and steelhead fisheries from August 1 through April 30 is low. An estimated total combined fishing-related terminal harvest rate of 4% on natural-origin steelhead is anticipated during Puget Sound salmon and steelhead treaty and non-treaty commercial and recreational fisheries from August 1, 2010 through April 30, 2011 as measured against the subset of stocks for which data are available to calculate harvest rates. The harvest rate of 4% anticipated from the proposed action is consistent with the average harvest rate of 4% on natural steelhead associated with the harvest management strategy that NMFS determined has largely addressed the threat of decline to the survival and recovery of the listed DPS posed by harvest (72 Fed. Reg. 26777, May 11, 2007). An additional 92 (hatchery and wild combined) steelhead are anticipated to be caught in Puget Sound treaty and non-treaty marine recreational and commercial fisheries from August 1, 2010 through April 30, 2011. NMFS also expects harvest of steelhead in the remaining terminal fisheries in Puget Sound where data are insufficient to assess harvest rates to be consistent with harvest in recent years and thus the management regime that NMFS determined has largely addressed the threat of decline to the survival and recovery of the listed DPS posed by harvest.

Based on the considerations summarized here and discussed in more detail elsewhere in this opinion, and after reviewing the current status of Puget Sound steelhead, the environmental baseline for the action area, the effects of the proposed fisheries, and the cumulative effects, NMFS concludes that the proposed actions are not likely to jeopardize the continued existence of the Puget Sound Steelhead DPS.

Critical Habitat for Puget Sound steelhead has not yet been designated.

2.5.3 Puget Sound/Georgia Strait Rockfish

The three listed DPS' are at risk with regard to the each of the four VSP criteria, and habitats utilized by ESA-listed rockfish are impacted by nearshore development, derelict fishing gear, contaminants within the food-web and regions of poor water quality, among other stressors. Benefits to habitat within the DPSs have come through the removal of thousands of derelict fishing nets, though nets deeper than 100 feet remain a threat. Degraded habitat and its consequences to ESA-listed rockfish can only be described qualitatively because the precise spatial and temporal impacts to populations of yelloweye rockfish, canary rockfish and bocaccio are poorly understood. However, there is sufficient evidence to indicate that ESA-listed rockfish productivity may be reduced because of alterations to habitat structure and function.

Because most adult yelloweye rockfish, canary rockfish and bocaccio occupy waters much deeper than surface waters fished by commercial net gear, the bycatch of adults in commercial salmon fisheries is likely low to non-existent. However, derelict gear is a source of potential incidental mortality. The recreational bycatch levels from the August 1, 2010 through April 30, 2011 salmon fishery, in combination with anticipated bycatch from other fisheries, their current status, the condition of the environmental baseline, and cumulative effects would not threaten the survival and recovery of yelloweye rockfish, canary rockfish and bocaccio. The structure of our analysis provides conservative population scenarios for the total population of each DPS, and slightly overestimates the total mortalities of caught and released fish. Within this analysis, all of the calculated bycatch levels except one (for canary rockfish) were below the precautionary mortality rates identified for overfished rockfish of the

Pacific Coast. The one that was exceeded was by a small amount (1.2 percent) for the most pessimistic abundance scenario of canary rockfish. Concerns remain about fishery-mortality effects to spatial structure, connectivity and diversity for each species. These concerns are partially alleviated because of the low bycatch rates for each species, and considering that the abundance of each species is likely higher than assessed within our analysis.

After reviewing the current status of yelloweye rockfish, canary rockfish and bocaccio within the Puget Sound/Georgia Basin DPSs, the environmental baseline for the action area, the effects of the proposed fisheries, and the cumulative effects, NMFS concludes that the proposed actions are not likely to jeopardize the continued existence of ESA-listed rockfish.

3 Endangered Species Act Incidental Take Statement

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

This incidental take statement specifies the impact of any incidental taking of endangered or threatened species. It also provides reasonable and prudent measures that are necessary or appropriate to minimize impacts and sets forth terms and conditions in order to implement the reasonable and prudent measures.

3.1 Amount or Extent of Incidental Take

3.1.1 Puget Sound Chinook

NMFS anticipates Puget Sound salmon fisheries occurring between August 1, 2010 and April 30, 2011 together with ocean and Puget Sound fisheries approved under existing consultations will not exceed the exploitation rates summarized in Table 10 in the column titled Ocean+Puget Sound. Test, research, update and evaluation fisheries that inform fishery management decisions are included as part of the fishery-related mortality in FRAM model run Chin1010 summarized in Table 10. Exploitation rates are used to define the extent of take for several reasons: (1) they are a direct measure of the take of the listed species; (2) they are a key parameters used to analyze the effects of the proposed actions; (3) fisheries are designed and managed based on exploitation rates; (4) they can be monitored and assessed; and, (5) they are responsive to changes in abundance.

3.1.2 Puget Sound Steelhead

NMFS anticipates the fishing-related mortality on ESA listed Puget Sound winter steelhead in Puget Sound salmon and steelhead fisheries from August 1, 2010 through April 30, 2011 will be approximately 4% (landed and non-landed mortality combined) as averaged across the five Puget Sound winter steelhead for which data are available to assess harvest rates (Skagit, Snohomish, Green, Puyallup and Nisqually). That is, the 4% represents an average across the five winter steelhead stocks, it is not a stock specific terminal harvest rate limit. Based on the consistency in recent years of catch patterns in marine areas and harvest rates for the five proxy winter steelhead stocks, NMFS anticipates steelhead harvests in the remaining terminal areas for which data are insufficient to assess harvest rates to be within the impacts to listed steelhead during 2001/2002-2006/2007 period on which the 4% harvest rate was calculated for the five winter steelhead stocks. NMFS expects that less than 100 additional steelhead will be caught in Puget Sound treaty and non-treaty commercial and recreational salmon fisheries in marine catch areas outside the terminal areas used in the calculation of the 4% rate for the five winter stocks during the same August-April period.

It is important to clarify that the 4% harvest rate is not a jeopardy standard and does not set precedence for future treaty and non-treaty fishery impacts, but has been determined not to pose jeopardy on listed steelhead for this interim biological opinion during the August 1, 2010 through April 30, 2011 time period based on the actions as proposed.

3.1.3 Puget Sound/Georgia Strait Rockfish

NMFS anticipates that incidental take of ESA listed rockfish will occur by two separate factors. (1) Bycatch of ESA-listed rockfish by anglers targeting salmon, and (2) fishing nets that become incidentally lost (derelict). NMFS anticipates that up to 26 yelloweye rockfish, 57 canary rockfish and 2 bocaccio will be killed as bycatch by anglers during the Puget Sound salmon fisheries from August 1, 2010 to April 30, 2011. The WDFW monitors the bycatch estimates of ESA-listed rockfish species through dockside and phone surveys of anglers within the DPS and provides this data to NMFS on an annual basis. NMFS anticipates that some take of ESA-listed rockfish will occur as a result of the indirect effects of lost nets in the Puget Sound/Georgia Basin. In recent years it is estimated that less than 12 nets have become derelict within the Puget Sound region per year (though not all nets lost are associated with fisheries assessed in this document), and approximately 80% are recovered soon after their loss. Estimating the specific number of ESA-listed rockfish that may be killed from a derelict net is difficult to quantify because of several factors that include the location of its loss, the habitat which it eventually catches on, and the occurrence of fish within or near that habitat. NMFS estimates that two nets used in the August 1, 2010 to April 30, 2011 salmon fisheries may become derelict and degrade benthic habitats potentially used by ESA-listed rockfish. The co-managers also track derelict nets through their reporting system and partnership with the Northwest Straits Initiative.

3.1.4 Southern Resident Killer Whales

The harvest of Chinook salmon that would occur under the proposed action could result in some level of harm to Southern Resident killer whales by reducing prey availability, which may cause animals to forage for longer periods, travel to alternate locations, or abandon foraging efforts. All individuals of the Southern Resident killer whale population have the potential to be adversely affected in inland waters of their range. However, the extent of take from this adverse impact is not anticipated to appreciably reduce the survival and recovery of Southern Resident killer whales, because it is not anticipated that take will increase the risk of mortality (i.e., and therefore will not rise to the level of serious injury or mortality), or hinder the reproductive success of any individual Southern Resident killer whales.

It is not possible to monitor individual Southern Resident killer whales directly to evaluate the extent of take on the whales themselves, and NMFS therefore uses Chinook kilocalories available to Southern Residents as a take indicator. Using this indicator, Chinook food energy available from the Puget Sound fisheries cannot be lower than specified in Appendix 5 of the Pacific Salmon Treaty Opinion in inland waters during any of the three annual time-periods identified (NMFS 2008; kilocalories with agreement, in 1994, high selectivity) and cannot be lower than specified in Appendix 1 of the 2009 U.S. Fraser Panel Fisheries opinion on Southern Resident killer whales per the three annual time-periods identified (NMFS 2009; kilocalories with the fisheries, ceiling, high selectivity). NMFS also uses the extent/amount of take specified for ESA-listed Chinook as an important take indicator for Southern Resident killer whales to ensure that ESA-listed Chinook are available to Southern Residents in the long term.

3.2 Effect of the Take

In the accompanying biological opinion, NMFS determined that the level of anticipated incidental take of listed species in the proposed Puget Sound fisheries is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

3.3 Reasonable and Prudent Measures

There are three reasonable and prudent measures included in this incidental take statement for the ESUs and DPSs considered in this opinion:

(1) In-season management actions taken during the course of the fisheries shall be consistent with the level of incidental take established preseason that were analyzed in the accompanying biological opinion (see section 10.1);
(2) Catch and other management measures used to control fisheries shall be monitored using best available measures; and,
(3) The fisheries shall be sampled for stock composition and other biological information.

NMFS also concludes that the following reasonable and prudent measure is necessary to minimize the impacts to ESA listed Puget Sound/Georgia Basin rockfish.

> Derelict gear impacts on listed rockfish shall be reported using best available measures.

3.4 Terms and Conditions

The BIA, USFWS and NMFS must comply with the following terms and conditions, which implement the reasonable and prudent measures, described above and outline required reporting/monitoring requirements in order to be exempt from the prohibitions of section 9 of the ESA.

These terms and conditions are non-discretionary.

(1) the BIA, USFWS and NMFS, to the extent of their authority, shall work with WDFW and affected tribes to ensure that preseason plan, and in-season management actions taken during the course of the fisheries are consistent with the levels of anticipated take.
(2) the BIA, USFWS and NMFS, to the extent of their authority, shall work with WDFW and the affected tribes to ensure that the catch and implementation of other management measures associated with fisheries that are the subject of this Opinion are monitored at levels that are comparable to those used in recent years.
(3) the BIA, USFW and NMFS, to the extent of their authority, shall work with WDFW and the affected tribes to ensure that the fisheries that are the subject of this Opinion are sampled for stock composition including the collection of coded-wire tags and other biological information (age, sex, and size) to allow for a thorough post-season analysis of fishery impacts on listed species,
(4) the BIA, USFWS and NMFS, in cooperation with the Washington State Department of Fish and Wildlife, and Puget Sound tribes as appropriate, shall ensure that commercial fishers report the loss of any fishing gear immediately to appropriate authorities.

4 Endangered Species Act Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of threatened and endangered species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. NMFS believes the following conservation recommendations are consistent with these obligations, and therefore should be implemented by the BIA, USFWS and NMFS.

(1) The BIA, USFWS and NMFS in collaboration with the affected states and tribes should continue to evaluate improvement in gear technologies and fishing techniques in commercial and recreational fisheries to reduce impacts on listed species without compromising data quality used to manage fisheries.
(2) The BIA, USFWS and NMFS in collaboration with the affected states and tribes, should continue to evaluate the potential selective effects of fishing on the size, sex composition, or age composition of salmon populations.
(3) The BIA, USFWS and NMFS in collaboration with the Washington State Department of Fish and Wildlife, and tribes, should continue to evaluate technologies and practices to prevent the loss of commercial fishing nets, and systems to track nets upon their loss to better aid their retrieval.

5 Endangered Species Act Reinitiation of Consultation

This concludes formal consultation on the BIA, USFWS, and NMFS actions as they relate to impacts of the Puget Sound salmon and steelhead fisheries from August 1, 2010 through April 30, 2011 on listed species under NMFS' jurisdiction. As provided in 50 CFR §402.16, re-initiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained (or is authorized by law) and if:

(1) The amount or extent of taking specified in the incidental take statement is exceeded;
(2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered;
(3) the identified action is subsequently modified in a manner that causes an effect to listed species or critical habitat that was not considered in the biological opinion; or
(4) a new species is listed or critical habitat designated that may be affected by the identified action.

6 Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation

This is NMFS' Magnuson-Stevens Fishery Conservation and Management Act (MSA) consultation on the proposed BIA funding, and USFWS and NMFS fishery authorization actions as described in the above ESA section 7 consultation.

6.1 Background

The MSA, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures designed to identify, conserve, and enhance Essential Fish Habitat (EFH) for those species regulated under a Federal fisheries management plan. Pursuant to the MSA:

- Federal agencies must consult with NMFS on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH including actions that occur outside EFH, such as certain upstream and upslope activities. (Section 305 (b)(2));
- NMFS must provide conservation recommendations for any Federal or State action that would adversely affect EFH (Section 305(b)(4)(A));
- Federal agencies must provide a detailed response in writing to NMFS within 30 days after receiving EFH conservation recommendations. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with NMFS' EFH conservation recommendations, the Federal agency must explain its reasons for not following the recommendations (Section 305(b)(4)(B)).

EFH means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (MSA Section 3). For the purpose of interpreting this definition of EFH: 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; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle (50 CFR 600.10). Adverse effect means any impact which reduces quality and/or quantity of EFH, and may include direct (*e.g.*, contamination or physical disruption), indirect (*e.g.*, loss of prey or reduction in species fecundity), site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810).

The objectives of this EFH consultation are to determine whether the proposed actions would adversely affect designated EFH and to recommend conservation measures to avoid, minimize, or otherwise offset potential adverse effects on EFH.

6.2 Identification of Essential Fish Habitat

Pursuant to the MSA, the Pacific Fisheries Management Council (PFMC) has designated EFH for three species of federally-managed Pacific salmon: Chinook salmon; and coho salmon; and Puget Sound pink salmon (PFMC 1999). Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other water bodies currently, or historically accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable man-made barriers (PFMC 1999), and longstanding, naturally-impassable barriers (i.e., natural waterfalls in existence for several hundred years). Detailed descriptions and identifications of EFH for salmon are found in Appendix A to Amendment 14 to the Pacific Coast Salmon Plan (PFMC 1999). Assessment of potential adverse effects on these species' EFH from the proposed action is based, in part, on this information.

6.3 Proposed Action and Action Area

The proposed action and action area are detailed in the above Opinion. The action area for this EFH consultation encompasses Washington freshwater and marine waters from the mouth of the Strait of Juan de Fuca at Cape Flattery, eastward. The action area includes habitats that have been designated as EFH for various life-history stages of Puget Sound Chinook salmon. The duration of the proposed Federal actions is August 1, 2010 through April 30, 2011.

6.4 Effects of the Proposed Action

The harvest-related activities of the proposed actions considered in this consultation involve boats using hook-and-line gear and commercial net gear. The use of these gears affects the water column and the shallower estuarine and freshwater substrates, 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 to the Pacific Coast Salmon Plan (PFMC 1999).

The PFMC identified five types of impact on EFH: (1) gear effects; (2) harvest of prey species by commercial fisheries; (3) removal of salmon carcasses; (4) redd or juvenile fish disturbance; and (5) fishing vessel operation on habitat. Of the five types of impact on EFH identified by the PFMC for fisheries, the concern regarding gear-substrate interactions, removal of salmon carcasses, redd or juvenile fish disturbance and fishing vessel operation on habitat are also potential concerns for the salmon fisheries in Puget Sound.

(1) *Gear effects and fishing vessel operation*: Possible fishery-related impacts on riparian vegetation and habitat would occur primarily through bank fishing, movement of boats and gear to the water, and other stream side usages. The types of salmon fishing gear that are used in Puget Sound salmon fisheries in general actively avoid contact with the substrate because of the resultant interference with fishing and potential loss of gear. Also these effects would occur to some degree through implementation of fisheries or activities other than the Puget Sound salmon fisheries, i.e., recreational boating and marine species fisheries. Construction activities directly related to salmon fisheries are limited to maintenance and repair of existing facilities (such as boat launches), and are not expected to result in any additional impacts on riparian habitats because of the proposed salmon fisheries. The facilities used in association with the fisheries are essentially all in place. Therefore, the proposed fisheries would have a negligible additional impact on the physical environment.

(2) *Removal of salmon carcasses*: By removing adults that would otherwise return to spawning areas, harvest could affect water quality and forage for juveniles by decreasing the return of marine derived nutrients to spawning and rearing areas. The PFMC conservation recommendation to address the concern regarding removal of salmon carcasses was to manage for maximum sustainable spawner escapement and implementation of management measures to prevent over-fishing. Both of these conservation measures are basic principles of the fisheries in the proposed actions.

(3) *Redd or juvenile fish disturbance*: Trampling of redds during fishing has the potential to cause mortality of salmonids. Boat operation can result in stranding and mortality related to pressure changes in juveniles (PFMC 1999). The PFMC report recommended angler education and the closer of key spawning areas during the time that eggs and juvenile salmon were present. Salmon fisheries are closed or fishing activities do not occur in freshwater areas in Hood Canal, North Puget Sound and the Strait of Juan de Fuca during peak spawning, rearing and out-migration periods (T. Johnson, pers. comm., WDFW, Fisheries Biologist, April 26, 2010). Notices are posted near fishing access areas by WDFW and the Washington State Parks, and news releases are distributed regularly by WDFW explaining responsible fishing behavior, including avoidance of spawning areas and damage to riparian areas (Thom Johnson, pers. comm., WDFW, Fisheries Biologist, April 26, 2010). The Puyallup and White River in South Puget Sound are closed to salmon fishing through much of Chinook salmon migration and spawning. These management measures should minimize redd or juvenile fish disturbance due to conduct of the proposed Puget Sound salmon fisheries.

6.5 Conclusion

For the reason discussed above, NMFS concludes that the proposed Federal actions would not adversely affect designated EFH for Chinook salmon or for other fish species for which EFH has been designated.

6.6 EFH Conservation Recommendation

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, because NMFS concluded that the Puget Sound salmon fisheries implemented under the proposed actions would not adversely affect the EFH, no conservation recommendations are needed.

6.7 Statutory Response Requirement

Because there are no conservation recommendations, there are no statutory response requirements.

6.8 Consultation Renewal

The NMFS must reinitiate EFH consultation if the proposed actions are 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 Section 600.920(k)).

7 Data Quality Act Documentation and Pre-Dissemination Review

Section 515 of the Treasury and General Government Appropriations Act of 2001 (Public Law 106-554) ("Data Quality Act") specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the Biological Opinion and the Magnuson-Stevens Act Essential Fish Habitat Consultations addresses these DQA components, documents compliance with the Data Quality Act, and certifies that this Biological Opinion and Magnuson-Stevens Act Essential Fish Habitat Consultations have undergone pre-dissemination review.

7.1 Utility

Consultation by Federal agencies with NMFS is required under section 7 of the ESA whenever a Federal agency approves funds or carries out an action that might affect a listed species. This consultation was required under the ESA to determine whether the implementation of the proposed Puget Sound salmon and steelhead fisheries would appreciably reduce survival and recovery of several listed species, jeopardizing, the affected ESU and DPS' before the BIA could proceed with administration of tribal fishery management programs, the USFWS could approve fishing activities involving the proposed Puget Sound salmon and steelhead fisheries, or NMFS could implement actions regarding the U.S. Fraser Panel. Supplying copies of the document to the management agencies provides them with the documentation that NMFS has determined that the proposed fisheries will not jeopardize the continued existence of the affected ESUs. Providing copies to WDFW and the NWIFC is consistent with their roles as fishery managers for the affected ESUs and with NMFS' obligations under Secretarial Order 3206 (Department of Interior Order 3206, American Indian Tribal Rights, Federal-Tribal Trust Responsibilities and the Endangered Species Act).

7.2 Integrity

This consultation was completed on a computer system managed by NMFS in accordance with relevant information 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.

7.3 Objectivity

Information Product Category: Natural Resource Plan.

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased, and were developed using commonly accepted scientific research methods. They adhere to published standards including the NMFS ESA Consultation Handbook, ESA Regulations, 50 CFR 402.01 et seq., and the Magnuson-Stevens Fishery Conservation and Management Act (MSA) implementing regulations regarding Essential Fish Habitat, 50 CFR 600.920(j).

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the literature cited section. The analyses in this biological opinion/EFH consultation 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 and MSA implementation, and reviewed in accordance with Northwest Region ESA quality control and assurance processes.

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