National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Endangered Species Act (ESA) Section 7 Consultation
Biological Opinion and Magnuson-Stevens Act Essential Fish Habitat Consultation

Action Agency: NOAA's National Marine Fisheries Service (NMFS)

Species/ESU Affected: Puget Sound Chinook Salmon *(Oncorhynchus tshawytscha)*
Lower Columbia River Chinook Salmon (*O. tshawytscha*)

Activities Considered: National Marine Fisheries Service's promulgation of ocean fishing regulations within the Exclusive Economic Zone (EEZ) of the Pacific Ocean conducted under the Pacific Coast Salmon Plan and NMFS' regulation of U.S. Fraser Panel fisheries in northern Puget Sound.

Consultation Conducted by: The Sustainable Fisheries Division, Northwest Region, Consultation Number: 2004/00204

This document constitutes NOAA's National Marine Fisheries Service's (NMFS) biological opinion for proposed Federal actions that are likely to affect the listed Puget Sound and Lower Columbia River Chinook Salmon Evolutionarily Significant Units (ESU). The Federal actions are NMFS' promulgation of ocean fishing regulations within the Exclusive Economic Zone (EEZ) of the Pacific Ocean conducted under the Pacific Coast Salmon Plan and NMFS' regulation of U.S. Fraser Panel fisheries in northern Puget Sound. NMFS concludes that these actions are not likely to jeopardize the continued existence of the Puget Sound or Lower Columbia River chinook salmon ESUs. Regarding the effect of the proposed actions on Essential Fish Habitat, NMFS concludes that (1) conservation recommendations have been previously made and adopted for the Pacific Ocean fisheries and (2) the proposed U.S. Fraser Panel fisheries would not adversely affect EFH. No additional conservation recommendations beyond those identified and already adopted are needed.

This Opinion has been prepared in accordance with section 7 of the Endangered Species Act (ESA) of 1973 as amended (16 U.S.C. 1531 *et seq*.). It is based on information provided to NMFS by the Pacific Fisheries Management Council and its technical committees, Washington state and tribal co-managers, published and unpublished scientific information on listed salmon and steelhead in the action area, and other sources representing the best available scientific information. A complete administrative record of this consultation is on file with the Sustainable Fisheries Division, Seattle, Washington.

Peter N Dygert (For)
D. Robert Lohn
Regional Administrator

APR 29 2004
Date

Attachments

Endangered Species Act - Section 7 Consultation (Puget Sound) and
Re-initiated Section 7 Consultation (Lower Columbia River)

BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT

Effects of the Pacific Coast Salmon Plan and
U.S. Fraser Panel Fisheries on the
Puget Sound Chinook and Lower Columbia River Chinook Salmon
Evolutionarily Significant Units

Agency: National Marine Fisheries Service,
Sustainable Fisheries Division

Consultation Conducted by
National Marine Fisheries Service
Sustainable Fisheries Division

Date Issued: APR 29 2004

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1 INTRODUCTION

NOAA's National Marine Fisheries Service (NMFS) is required under section 7 of the Endangered Species Act (ESA) to conduct consultations which consider the impacts of salmon fisheries to species listed under the ESA. This biological opinion considers the effects of Pacific coast ocean salmon fisheries conducted under the Pacific Coast Salmon Plan (PFMC fisheries) and U.S. Fraser Panel fisheries in northern Puget Sound conducted under the Pacific Salmon Treaty (PST) on the Puget Sound and Lower Columbia River chinook salmon Evolutionarily Significant Unit (ESU). Other listed salmon and steelhead are already covered by existing opinions. Sacramento winter chinook are currently undergoing consultation (Table 1).

NMFS is consulting with itself under section 7 on the Federal actions of (1) promulgating ocean fishing regulations within the Exclusive Economic Zone (EEZ) of the Pacific Ocean conducted under the Pacific Coast Salmon Plan and, (2) NMFS' regulation of U.S. Fraser Panel fisheries in northern Puget Sound.

2 CONSULTATION HISTORY

NMFS has considered the effects on salmon species listed under the ESA resulting from PFMC fisheries and issued biological opinions since 1991 based on the regulations implemented each year rather than the FMP itself. In a biological opinion dated March 8, 1996, NMFS considered the impacts on all salmon species then listed under the ESA resulting from implementation of the Pacific Coast Fishery Management Plan (FMP) including spring/summer chinook, fall chinook, and sockeye salmon from the Snake River and Sacramento River winter chinook. Provisions of the March 8, 1996, opinion regarding Sacramento River winter chinook were revised in reinitiated section 7 biological opinions in 1997 and 2002 (NMFS 1997a, NMFS 2002a). The impact of the PFMC fisheries on the Sacramento River Winter-run Chinook Salmon ESU is currently undergoing a reinitiated consultation for the 2004 fishing season. Subsequent biological opinions beginning in 1997 considered the effects of PFMC fisheries on the growing catalogue of listed species (NMFS 1997a; NMFS 1997b; NMFS 1998a; NMFS 1999a; NMFS 2000c). However, these latter opinions were specific to the annual regulations adopted pursuant to implementation of the FMP and therefore were limited in duration to the year in question. Currently, NMFS has provided long term coverage for the majority of listed salmon ESUs either because the action was programmatic in nature (NMFS 1999b, NMFS 1999c, NMFS 2000a, NMFS 2001b) or fishing related impacts were determined to be historically and consistently very low (NMFS 2001c)(Table 1). NMFS reinitiates consultation when new information becomes available on the status of the ESUs or on the impacts of the FMP on the ESUs.

Beginning with its biological opinion on the 2000-2001 cycle fisheries, NMFS combined its consultation on Pacific coast salmon fisheries with those that occurred in Puget Sound for reasons of efficiency, because of the interrelated nature of the preseason planning processes, and to provide a more inclusive assessment of harvest-related impacts on the listed species. In April, 2001, NMFS approved the Pacific coast ocean and Puget Sound fisheries impacting the listed Hood Canal summer chum ESU under Limit 6 of the 4(d) rule (65 FR 42422, July 10, 2000). NMFS also approved under Limit 6 the Pacific coast ocean and Puget Sound fisheries impacting listed Puget Sound chinook in 2001 for two years and again in 2003 for one year. Therefore, take prohibitions described in section 9 of the ESA for the Puget Sound chinook and Hood Canal summer-run chum ESUs did not apply to these fisheries, as long as they are conducted in accordance with the joint resource management plans (RMP) provided by the Puget Sound treaty tribes and Washington Department of Fish and Wildlife (WDFW) (WDFW/PNPTT 2000, WDFW/PSTT 2001) and approved under the 4(d) rule (NMFS 2001a, NMFS 2001b). U.S. fisheries, including the Pacific coastal ocean fisheries, were managed to meet the Puget Sound chinook and Hood Canal summer chum harvest management objectives described in the RMPs

The take exemption for listed Hood Canal summer chum salmon remain in effect. However, NMFS' approval of the Puget Sound chinook salmon fishery under Limit 6 of the 4(d) Rule expires on May 1, 2004. The co-managers have provided another jointly-developed harvest RMP for Puget Sound commercial and recreational salmon, and steelhead net fisheries taking listed Puget Sound chinook salmon to NMFS for consideration under Limit 6 of the Endangered Species Act (ESA) section 4(d) rule for the 2004-2009 fishing years, beginning May 1, 2004. Although the action area of the proposed RMP is Puget Sound, in practice the Washington co-managers consider the impacts of ocean fisheries on Puget Sound chinook salmon and may modify them to achieve management objectives for Puget Sound chinook salmon defined in the RMP. The RMP is currently undergoing evaluation by NMFS which will not be completed by the time the PFMC fisheries are scheduled to begin on May 1, 2004. Therefore, this biological opinion will consider the effects of PFMC ocean fisheries and U.S. Fraser Panel fisheries on the Puget Sound Chinook Salmon ESU. The effect of Puget Sound salmon fisheries will be considered in the environmental baseline.

In the 2001 biological opinion for the Upper Willamette Spring Chinook, Lower Columbia River Chinook and Lower Columbia River Chum Salmon ESUs for the PFMC and U.S. Fraser Panel fisheries, the incidental take statement stated that the "PFMC and U.S. Fraser Panel fisheries must be managed such that the total brood year exploitation rate for the Coweeman stock [representing the Lower Columbia River tule fall stocks], in all fisheries combined, does not exceed 0.65."(NMFS 2001c). Since that time, the exploitation rate standard was revised to 0.49 based on new information. 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 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. Based on the requirements for re-initiation in the 2001 biological opinion, the change in the allowable take for the fall tule component of the Lower Columbia River chinook ESU requires re-initiation of consultation for this ESU. NMFS' assessment of the other two components of the Lower Columbia River Chinook Salmon ESU (spring and bright fall chinook) remains unchanged.

This consultation history provides a mix of long and short-term no-jeopardy determinations for the various ESUs with respect to PFMC ocean salmon fisheries. Currently, the effects of implementing the FMP on all listed salmon ESUs except for the Puget Sound, Lower Columbia and Sacramento winter run chinook salmon ESUs, have been considered for ESA compliance by either long-term biological opinions or 4(d) rules (see Table 1). These ESUs will not be discussed further in this opinion. The effect of PFMC ocean salmon fisheries on the Sacramento winter-run chinook salmon ESU is currently undergoing a separate reinitiated consultation under section 7. This biological opinion therefore considers the effects of PFMC and U.S. Fraser Panel fisheries on the Puget Sound and Lower Columbia River chinook salmon ESUs and is intended to remain in place indefinitely unless new information requires re-initiation of consultation (see Section 6).

Table 1. NMFS ESA decisions regarding ESUs affected by ocean fisheries implemented under the FMP and duration of the decision (4(d) Limit or biological opinion (BO). Only those decisions currently in effect are included.

Date (Coverage)	Duration	Citation	ESU considered
March 8, 1996 (BO)	until reinitiated	NMFS 1996c	Snake River spring/summer and fall chinook, and sockeye
April 28, 1999 (BO)	until reinitiated	NMFS 1999b	S. Oregon/N. California Coast coho Central California Coast coho Oregon Coast coho
April, 2000 (BO)	until reinitiated	NMFS 2000a	Central Valley spring-run chinook California Coastal chinook
April, 2001 (4(d) Limit)	until withdrawn	NMFS 2001b	Hood Canal summer-run chum
April, 2001 (BO)	until withdrawn	NMFS 2001c	Upper Willamette River chinook Lower Columbia River chinook[1] Columbia River chum Ozette Lake sockeye Upper Columbia River spring-run chinook Ten listed steelhead ESUs
April, 2004 (BO)	until 2010	in press	Sacramento River winter-run chinook

[1]Consultation on the Lower Columbia River Chinook Salmon ESU was re-initiated and is a subject of this biological opinion.

3 BIOLOGICAL OPINION

3.1 Description of the Proposed Action and Action Area

3.1.1 Proposed Action

This opinion considers the effects of two actions on listed Puget Sound and Lower Columbia River chinook salmon: NMFS' promulgation of ocean fishing regulations within the Exclusive Economic Zone (EEZ) of the Pacific Ocean and NMFS' regulation of U.S. Fraser Panel fisheries in northern Puget Sound under the Pacific Salmon Treaty (PST). The ocean salmon fisheries in the EEZ (3-200 nautical miles offshore) off Washington, Oregon, and California are managed under authority of the Magnuson-Stevens Act. Annual management recommendations are developed according to the "Pacific Coast Salmon Plan" (FMP) of the Pacific Fishery Management Council (PFMC). Annual regulations apply to the period from May 1 of the current year through April 31 of the following year. Pursuant to the Magnuson-Stevens Act, NMFS proposes to promulgate ocean salmon fishing regulations developed in accordance with the FMP as amended by Amendments 13 and 14 (see Review of 2003 Ocean Salmon Fisheries)(PFMC 2004) for details on the specific fishery locations and historical catch and effort data). These ocean fisheries are generally recreational and troll fisheries targeting chinook and coho. The PFMC provides its management recommendations to the Secretary of Commerce (Secretary), who implements the measures in the EEZ if they are found to be consistent with the Magnuson-Stevens Act and other applicable law such as the ESA. Because the Secretary, acting through NMFS, has the ultimate authority for the FMP and its implementation, NMFS is both the action agency and the consulting agency with respect to PFMC fisheries.

NMFS has authority to regulate U.S. Fraser Panel fisheries in northern Puget Sound and annually decides whether to relinquish control to the bilateral Fraser Panel pursuant to the PST. The bilateral Fraser Panel controls sockeye and pink fisheries conducted in the Strait of Juan de Fuca and San Juan Island region (northern Puget Sound), the Georgia Strait and 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 (a detailed description of U.S. panel waters can be found at CFR 300.91, Definitions). The Fraser Panel assumes control from July 1 through September, although the fisheries generally occur between late July and August.

The two actions have been grouped into this single biological opinion for efficiency and in compliance with the regulatory language of section 7, which allows NMFS to group similar, individual actions within a given geographic area or segment of a comprehensive plan (50 CFR 402.14(b)(6)).

3.1.2 Action Area

In developing management recommendations, the PFMC analyzes several management options for ocean fisheries occurring in the EEZ. The analysis includes assumptions regarding the levels of harvest in state marine, estuarine, and freshwater areas, which are regulated under authority of the states. The states of Washington, Oregon and California generally manage their marine waters consistent with the management regime approved by the Secretary of Commerce. NMFS establishes fishery management measures for ocean salmon fisheries occurring in the EEZ (3-200 nautical miles off shore). In the case where a state's actions substantially and adversely affect the carrying out of the FMP, the Secretary may, under the Magnuson-Stevens Act, assume responsibility for the regulation of ocean fishing in state marine waters; however that authority does not extend to a state's internal waters. For the purposes of this consultation, for the PFMC fisheries the action area is the EEZ, which is directly affected by the federal action, and the coastal marine waters of the states of Washington, Oregon and California, which may be indirectly affected by the federal action.

For the purposes of this opinion, for the U.S. Fraser Panel fisheries, the action area also includes the U.S. waters of the Strait of Juan de Fuca and the San Juan Islands in northern Puget Sound during the period of Fraser Panel control (a detailed description of U.S. panel waters can be found at CFR 300.91, Definitions).

3.2 Status of the Species and Critical Habitat

NMFS has determined that the actions being considered in this biological opinion may adversely affect the Puget Sound and Lower Columbia River chinook ESUs which are provided protection under the Endangered Species Act of 1973 (16 U.S.C. 1531 *et seq.*; ESA) (see Table 2). Other listed salmon species affected by the proposed actions are addressed in existing biological opinions or are currently being addressed in separate consultations (Table 1). NMFS is also the lead agency responsible for administering the Marine Mammal Protection Act of 1972 (MMPA) as it relates to certain marine mammals. NMFS has concluded that PMFC troll and recreational salmon fisheries would result in a remote likelihood or no known serious injuries or mortalities to marine mammals, and that the U.S. Fraser Panel fisheries would result at most in occasional serious injuries and mortalities (68 FR 1414, January 10, 2003). No listed marine mammal species were documented to have been killed or caught and released in either of these fisheries. Consequently, these species will not be considered further in this opinion.

NMFS has identified four criteria to assess the viability of salmon populations: abundance, population productivity trends, spatial distribution, and diversity (McElhany *et al.* 2000). Although all four criteria are important, information and specific thresholds are currently unavailable for the spatial distribution and diversity criteria, and, for most populations, productivity as well, so assessments generally rely more on abundance. Assessment of abundance takes into account both the trend and magnitude of abundance as compared with two abundance thresholds. The critical abundance threshold generally represents a state where a population is at such low abundance or productivity that it is at relatively high risk of extinction in the near future. At the viable abundance threshold, a population is functioning properly and at a self-sustaining abundance level. Derivation of these thresholds for abundance are based on population-specific information where available. Where data are unavailable, NMFS used information from the scientific literature to provide rules of thumb for setting either critical or viable abundance thresholds (McElhany *et al.* 2000). In general, if population abundance is less than 500 to 5,000 per generation, there is an increased risk of extinction. If the salmonid population generation length is three to four years (the approximate generation length for steelhead and chum salmon), the annual spawner abundance at this critical level would be in the range of 125-167 to 1,250-1,670 fish. At viable levels, abundance would range from 5,000 to 10,000 fish per generation, or (for fish with a four-year generation length) 1,250 to 2,500 spawners per year. NMFS used the generic guidance, information from existing scientific literature, and population-specific information, to make preliminary threshold determinations for chinook populations in the ESUs considered in this biological opinion.

Table 2. Summary of salmon species listed under the Endangered Species Act.

Species	Evolutionarily Significant Unit	Present Status	Federal Register Notice	
Chinook Salmon (*O. tshawytscha*)	Sacramento River Winter-run	Endangered	54 FR 32085	8/1/89
	Snake River Fall-run	Threatened	57 FR 14653	4/22/92
	Snake River Spring/Summer-run	Threatened	57 FR 14653	4/22/92
	Puget Sound	**Threatened**	**64 FR 14308**	**3/24/99**
	Lower Columbia River	**Threatened**	**64 FR 14308**	**3/24/99**
	Upper Willamette River	Threatened	64 FR 14308	3/24/99
	Upper Columbia River Spring-run	Endangered	64 FR 14308	3/24/99
	Central Valley Spring-run	Threatened	64 FR 50394	9/16/99
	California Coastal	Threatened	64 FR 50394	9/16/99
Chum Salmon (*O. keta*)	Hood Canal Summer-Run	Threatened	64 FR 14570	3/25/99
	Columbia River	Threatened	64 FR 14570	3/25/99
Coho Salmon (*O. kisutch*)	Central California Coast	Threatened	61 FR 56138	10/31/96
	S. Oregon/ N. California Coast	Threatened	62 FR 24588	5/6/97
	Oregon Coast	Threatened	63 FR 42587	8/10/98
Sockeye Salmon (*O. nerka*)	Snake River	Endangered	56 FR 58619	11/20/91
	Ozette Lake	Threatened	64 FR 14528	3/25/99
Steelhead (*O. mykiss*)	Southern California	Endangered	62 FR 43937	8/18/97
	South-Central California Coast	Threatened	62 FR 43937	8/18/97
	Central California Coast	Threatened	62 FR 43937	8/18/97
	Northern California	Threatened	65 FR 6960	2/11/00
	Upper Columbia River	Endangered	62 FR 43937	8/18/97
	Snake River Basin	Threatened	62 FR 43937	8/18/97
	Lower Columbia River	Threatened	63 FR 13347	3/19/98
	California Central Valley	Threatened	63 FR 13347	3/19/98
	Upper Willamette River	Threatened	64 FR 14517	3/25/99
	Middle Columbia River	Threatened	64 FR 14517	3/25/99

Survival and recovery will depend, over the long term, on actions in all sectors, especially habitat actions. There is an ongoing recovery planning effort for the Puget Sound Chinook Salmon ESU. Completion of the recovery plan and decisions regarding the form and timing of recovery efforts described in the recovery plan will determine the kinds of harvest actions that may be necessary and appropriate in the future. Absent that guidance, NMFS must evaluate proposed harvest actions by examining the impacts of harvest within the current context. Therefore, future performance of the population is evaluated under current productivity conditions, i.e., assuming that the impact of hatchery and habitat management actions remain as they are now.

3.2.1 Species Description

This section first provides a general life history overview, followed by more specific information about the Puget Sound and Lower Columbia River chinook salmon ESU, including information regarding the distribution and population structure, and size, variability, and trends of the populations within the ESUs.

3.2.1.1 General Life History

Chinook salmon is the largest of the Pacific salmon species. The species' distribution historically ranged from the Ventura River in California to Point Hope, Alaska in North America, and in northeastern Asia from Hokkaido, Japan to the Anadyr River in Russia (Healey 1991). Additionally, chinook salmon have been reported in the Mackenzie River area of northern Canada (McPhail and Lindsey 1970). Of the Pacific salmon, chinook salmon exhibit arguably the most diverse and complex life history strategies. Healey (1986) described 16 age categories for chinook salmon, seven total ages with three possible freshwater ages. Two generalized freshwater life-history types were initially described by Gilbert (1912): "stream-type" chinook salmon reside in freshwater for a year or more following emergence, whereas "ocean-type" chinook salmon migrate to the ocean within their first year. Healey (1983, 1991) has promoted the use of broader definitions for "ocean-type" and "stream-type" to describe two distinct races of chinook salmon. This racial approach incorporates life history traits, geographic distribution, and genetic differentiation and provides a valuable frame of reference for comparisons of chinook salmon populations. For the purposes of this Opinion, those chinook salmon (spring and summer runs) that spawn upriver from the Cascade crest are generally "stream-type"; those which spawn down river of the Cascade Crest (including in the Willamette River) are generally "ocean-type."

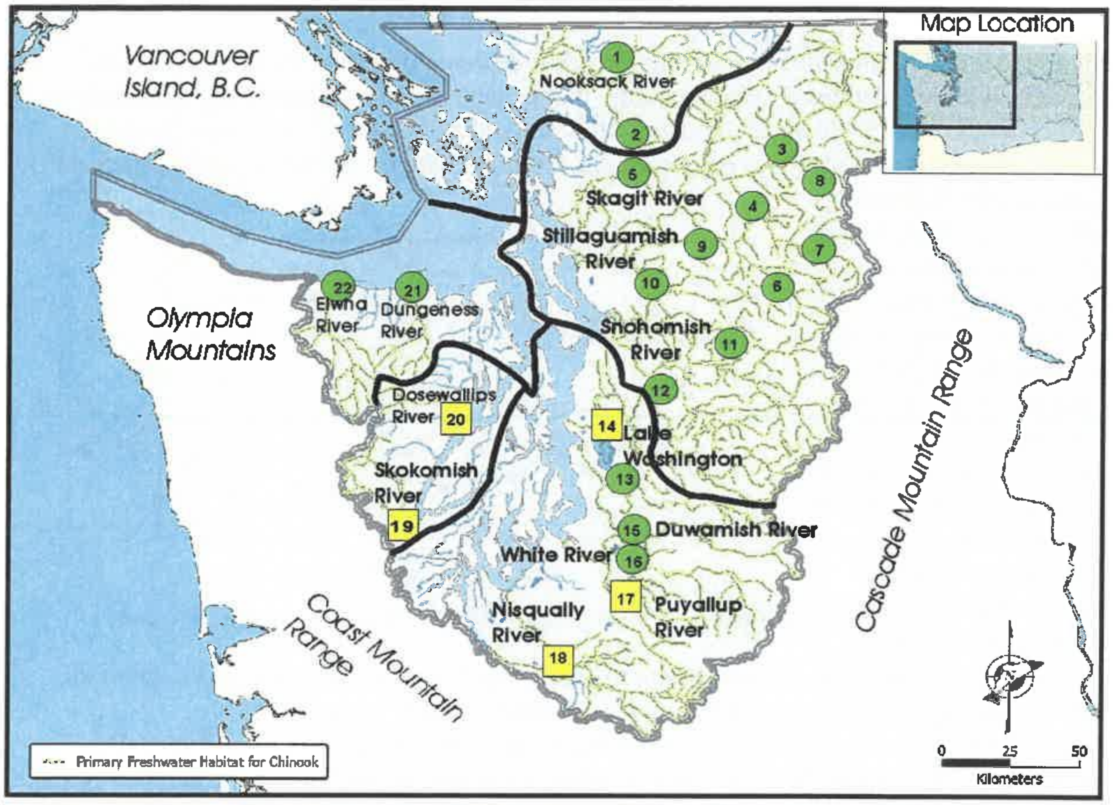
The generalized life history of Pacific salmon involves incubation, hatching, and emergence in freshwater, migration to the ocean, and subsequent initiation of maturation and return to freshwater for completion of maturation and spawning. Juvenile rearing in freshwater can be minimal or extended. Additionally, some male chinook salmon mature in freshwater, thereby foregoing emigration to the ocean. The timing and duration of each of these stages is related to genetic and environmental determinants and their interactions to varying degrees. Chinook salmon may spend one to six years in the ocean before returning to their natal streams to spawn. Salmon exhibit a high degree of variability in life-history traits; however, there is considerable debate as to what degree this variability is the result of local adaptation or the general plasticity of the salmonid genome (Ricker 1972, Healey 1991, Taylor 1991). More detailed descriptions of the key features of chinook salmon life history can be found in Myers *et al.* (1998) and Healey (1991).

3.2.1.2 Puget Sound chinook

The Puget Sound Chinook Salmon ESU was listed as threatened in March, 1999 (64 FR 14308). It includes all runs of chinook salmon in the Puget Sound region from the North Fork Nooksack River to the Elwha River on the Olympic Peninsula (Figure 1). Chinook hatchery populations from Kendall Creek, the North Fork Stillaguamish River, White River, and Dungeness River, and the Elwha River are listed. Chinook salmon in this area all exhibit an ocean-type life history. Although some spring-run 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. Puget Sound stocks all tend to mature at ages 3 and 4 and exhibit similar, coastally-oriented, ocean migration patterns.

NMFS is currently delineating the population structure of this and other ESUs as an initial step in a formal recovery planning process that is now underway. At this time, the Puget Sound Technical Recovery Team (PSTRT), in cooperation with the co-managers, has completed a preliminary analysis to identify populations of chinook salmon within the Puget Sound chinook salmon ESU, identifying 22 demographically independent populations within the ESU, representing the primary historical spawning areas of chinook salmon (PSTRT 2004a)(Figure 1). The PSTRT reviewed several sources of information in deriving the preliminarily recognized delineations. These sources of information include geography, migration rates, genetic attributes, patterns of life history and phenotypic characteristics, population dynamics, and, environmental and habitat characteristics of potential populations. The annual escapement of populations within the ESU since 1990 is provided in Table 5.

The status of Puget Sound chinook populations ranges from healthy to critical depending largely on the status of the habitat. Puget Sound includes areas where the habitat still supports self-sustaining natural production of chinook, areas where habitat for natural production has been irrevocably lost, and areas where chinook salmon were never self-sustaining. In some areas stocks and introduced hatchery fish that may or may not be of local origin. In some areas where indigenous populations persist, whereas populations in other areas are a composite of indigenous natural production has been lost, hatchery production has been used to mitigate for lost natural production. Detailed information on each of the populations can be found in *Independent Populations of Chinook in Puget Sound* (PSTRT 2004a) and the *Salmon and Steelhead Stock Inventory* (WDF *et al.* 1993).



Key: Draft chinook salmon populations (Puget Sound Technical Recovery Team, 2003). Categories as defined by Sustainable Fisheries Division, NMFS, 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 - Sammamish River
15 - Duwamish-Green River
16 - White River
17 - Puyallup River
18 - Nisqually River
19 - Skokomish River
20 - Dosewallips River
21 - Dungeness River
22 - Elwha River

Category 1

Category 2

Figure 1. Location of Puget Sound chinook salmon populations by watershed type and geographic region.

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 likely to be relatively high. In its 1998 status review, NMFS noted that the average potential run size (hatchery + natural) at that time was approximately 240,000 with natural spawning escapement averaging 25,000 (Myers *et al.* 1998). Since 1998, natural spawning escapement has averaged approximately 37,000 with increases in the spring, summer, and fall components (Figure 2). The long- and short-term escapement trends for natural chinook salmon runs in North Puget Sound were predominately negative through the mid-1990s when the North Fork Nooksack, Stillaguamish and Snohomish systems began to show improvements in escapements. In South Puget Sound and Hood Canal, both long- and short-term trends in escapements are predominantly positive. However, the contribution of hatchery fish to natural escapements in these regions may be substantial, masking the trends in natural production.

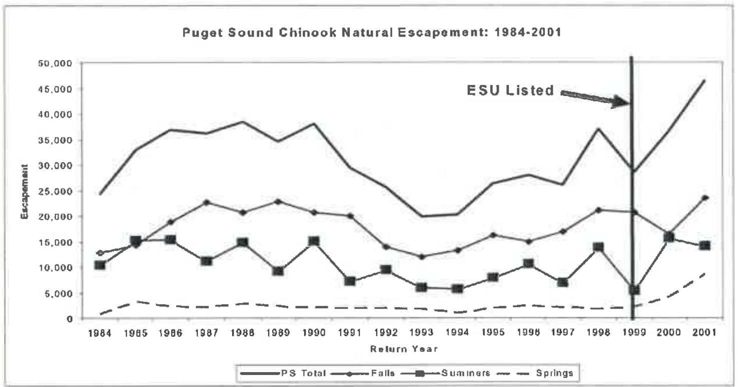


Figure 2. Puget Sound chinook natural escapement trends.

Increased escapements observed in recent years may be the result of improved ocean survival and evolving harvest management strategies implemented since the mid-1990s. Overall, exploitation rates on Puget Sound spring and summer/fall chinook have declined by 64 percent and 45 percent, respectively, since 1984, with most of the decrease occurring after 1992 (Figure 3).

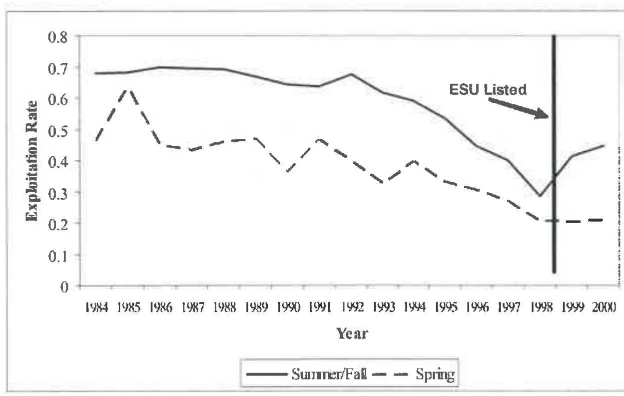


Figure 3. Exploitation rates on Puget Sound chinook.

To help characterize the diversity of chinook populations in Puget Sound, NMFS stratified the populations into five geographic regions and three life history types. To help further describe the varied circumstances of populations in the ESU, Puget Sound populations have also been categorized based on the quality of the watershed habitat and the genetic integrity of the population (described below).

Category 1 populations are genetically unique and indigenous to watersheds of Puget Sound. Seventeen populations have been identified in this category (Figure 1, Table 3). Although hatchery and natural production is heavily integrated for some of these populations (Elwha, Dungeness, North Fork Nooksack, North Fork Stillaguamish, White, Green) genetic analysis indicates the indigenous genetic profile remains intact. In making its decisions on harvest actions, NMFS' objective for Category 1 populations is to protect and recover these indigenous populations.

Category 2 populations are located in watersheds where indigenous populations may no longer exist, but where sustainable populations existed in the past and where the habitat could still support such populations. These are primarily areas in Hood Canal and South Sound where hatchery production has been used to mitigate for natural production lost to habitat degradation. Consequently, these areas have been managed primarily for hatchery production for many years. Broodstock for the hatchery programs often came from areas outside these watersheds, most commonly the Green River. Natural spawning in these systems continues, but is primarily the result of hatchery-origin strays. Over time, the combination of low natural production and the heavy influence of the out of basin hatchery production is believed to have resulted in the loss of the indigenous stock. Five populations have been identified in this category (Figure 1, Table 3). In making its decisions on harvest actions, NMFS' objective for Category 2 populations is to use the most locally-adapted population to re-establish naturally-sustainable populations, and preserve options for alternatives that may be developed through recovery planning.

The state and Tribes identified a third population category. Category 3 populations are generally found in small independent tributaries of Puget Sound that may now have some spawning, but never had independent, self-sustaining populations of chinook salmon. Many of these watersheds do not have the morphological characteristics needed for chinook and may be better suited for coho and chum salmon, cutthroat trout or resident freshwater species. Chinook salmon that are observed occasionally in these watersheds are primarily the result of hatchery strays since there is presumably little natural production. The PSTRT did not recognize populations identified as Category 3 because they were not determined to be independently spawning aggregations that would persist 100 years or more and thus, by PSTRT definition, are not populations (PSTRT 2004a). In making its decisions on harvest actions, NMFS' objective for Category 3 is directed toward protection of other species, but no specific harvest actions are proposed to promote the natural production of chinook salmon. Therefore, NMFS' consideration of Category 3 populations is not discussed further in this biological opinion.

An ESU with well-distributed viable populations avoids the situation where populations succumb to the same catastrophic risk(s), allows for a greater potential source of diverse populations for recovery in a variety of environments (i.e., greater options for recovery), and will increase the likelihood of the ESU's survival in response to rapid environmental changes, such as a major earthquake. Geographically diverse populations in different regions also distribute the ecological and ecosystem services provided by salmon across the ESU. The PSTRT recommends

Table 3. Puget Sound chinook populations stratified by geographic region, major life history type, and watershed category (NMFS 2001a, PSTRT 2002; PSTRT 2004a).

Geographic Region (PSTRT)	Major Life History (WDF et al. 1992)	Watershed Category (NMFS)[2]	Population (PSTRT)
(1) Strait of Georgia	spring	1	North Fork Nooksack
		1	South Fork Nooksack
(2) Whidbey/Main Basin	spring	1	Upper Cascade
		1	Upper Sauk
		1	Suiattle
	fall	1	Lower Skagit
	summer	1	Upper Skagit
	summer	1	Lower Sauk
	summer	1	North Fork Stillaguamish
	fall	1	South Fork Stillaguamish
	summer/fall	1	Skykomish
		1	Snoqualmie
(3) Southern Basin	fall	2	Sammamish
		1	Cedar
		1	Green
		2	Puyallup
		2	Nisqually
	spring	1	White
(4) Hood Canal	fall	2	Skokomish
		2	Hood Canal Tributaries
(5) Strait of Juan de Fuca	fall	1	Elwha
	spring	1	Dungeness

that an ESU-wide recovery scenario should include at least two to four viable chinook salmon populations in each of five geographic regions within Puget Sound, depending on the historical biological characteristics and acceptable risk levels for populations within each region (PSTRT 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

[2]Category 1 watersheds contain populations that are genetically unique and indigenous to Puget Sound. Category 2 populations are located in watersheds where indigenous populations may no longer exist, but where sustainable populations existed in the past and where the habitat could still support such populations.

historically present within that geographic region (PSTRT 2002).

Based on this framework, in each geographic region, Category 1 populations are the core populations that provide the focus for the analysis of proposed harvest actions. Consideration of harvest management impacts on Category 2 populations are more important in regions that are not adequately represented by Category 1 populations in order to make sure the proposed harvest actions are adequately protective of the geographic distribution (regions) and life history strategies represented in the ESU. In the future, Category 2 populations may require changes in the management objectives. For example, an outcome of recovery planning may be a recommendation that the population be managed as a self-sustaining natural run. It is important that current management not preclude future options.

Because of the complexity of the ESU, NMFS uses the geographic regions, life history types, and watershed categories described in Table 3 to assess whether the proposed harvest action adequately protects the diversity of populations within the ESU. The critical and viable escapement thresholds against which NMFS assesses status are noted in Table 4.

Following is a brief description of the status of populations in each geographic region.

The two spring chinook populations in the **Strait of Georgia Region** are the North Fork Nooksack and the South Fork Nooksack (Figure 1). Both are watershed Category 1 populations. The two populations are genetically distinct from each other because of prevailing habitat conditions. One is strongly influenced by glacial flow; the other is not. Habitat conditions in both areas are substantially degraded due largely to timber harvest and associated road building activities. Escapement to the North Fork was below 500 fish in all but two years from 1984 through 1998 (Table 5). However, escapement has increased in recent years, averaging 180 natural origin spawners (2,050 total natural spawners[3]) since 1999.The increase in recent years has been primarily due to large returns from a hatchery supplementation program. The annual spawning escapement to the South Fork ranged from 103 to 620 fish between 1984 and 2002, and the overall trend in escapement during this period has remained flat. Escapement from 1999 through 2002 averaged 249 natural origin spawners (338 total natural spawners) (Table 5). When compared to hatchery-origin returns, the lack of a similar dramatic increase escapement trend in natural-origin fish, even in response to past harvest rate reductions, suggests constraints on productivity due to limitations in marine, estuarine or freshwater habitat.

[3]Natural origin spawners are those whose parents spawned in the wild. Natural escapement also includes adults produced from hatcheries and stray to the spawning grounds.

Table 4. Recent average annual escapement levels compared with NMFS-derived lower and upper thresholds for Puget Sound chinook salmon management units and individual populations.

Management Unit	Population	1990 to 1998 Average Escapement	1999 to 2002 Average Escapement	Abundance Thresholds Critical	Viable
Nooksack	Natural-Origin Spawner:	297	429	*400*	*500*
	North Fork Nooksack	144	180	*200*	-
	South Fork Nooksack	153	249	*200*	-
Skagit Summer/Fall	Natural Spawners:	8,698	13,810	-	-
	Upper Skagit River	6,676	10,144	*967*	*7,454*
	Lower Sauk River	539	721	*200*	*681*
	Lower Skagit River	1,484	2,944	*251*	*2,182*
Skagit Spring	Natural Spawners:	1,014	1,075		
	Upper Sauk River	392	364	*130*	*330*
	Suiattle River	398	380	*170*	*400*
	Upper Cascade River	224	330	*170*	-
Stillaguamish	Natural-Origin Spawners:	828	980		
	N.F. Stillaguamish River	557	697	*300*	*552*
	S.F. Stillaguamish River	271	283	*200*	*300*
Snohomish	Natural-Origin Spawners:	2,627	3,936		
	Skykomish River	1,625	2,118	*1,650*	*3,500*
	Snoqualmie River	1,003	1,818	*400*	-
Lake Washington	Natural Spawners:	624	767		
	Cedar River	417	385	*200*	*1,200*
	Sammamish River	208	373	*200*	*1,250*
Green River	Natural Spawners:				
	Duwamish-Green River	6,737	9,299	*835*	*5,523*
White River	Natural Spawners:				
	White River	403	1,220	*200*	*1,000*
Puyallup	Natural Spawners:				
	Puyallup River	2,173	1,672	*200*	*1,200*
	South Prairie Cr. Index Area	1,032	1,029		
Nisqually	Natural Spawners:				
	Nisqually River	893	1,318	*200*	*1,100*
Skokomish	Natural Spawners:				
	Skokomish River	981	1,503	*200*	*1,200*
Mid-Hood Canal	Natural Spawners:	178	404	*200*	*1,250*
	Mid-Hood Canal Tributaries				
Dungeness	Natural Spawners:				
	Dungeness River	138	345	*200*	*925*
Elwha	Natural Spawners:				
	Elwha River	1,994	2,009	*200*	*2.900*

[1] Critical threshold under current habitat and environmental conditions.

[2] Viable thresholds under current habitat and environmental conditions

[3] Skokomish Management Unit's critical escapement threshold of 1,300 spawners is composed of 800 natural-origin spawners and 500 hatchery-return spawners.

[4] Skokomish Management Unit's escapement goal of 3,650 spawners is composed of 1,650 natural-origin spawners and 2,000 hatchery-return spawners. If the recruit abundance is insufficient for the goal to be met, OR regardless of the total escapement, the naturally spawning component of the Skokomish River population is expected to fall below 1,200 spawners, *or* the hatchery component is expected to result in less than 1,000 spawners, additional terminal fishery management measures will be taken, with the objective of meeting or exceeding the 1,200 naturally spawning levels (PSIT/WDFW 2004).

Table 5. Natural-origin or natural escapement for Puget Sound chinook salmon populations, 1990 to 2002.

Management Unit	Population	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Nooksack	Natural-Origin Spawner:	142	444	403	444	113	421	353	223	128	255	442	517	503
	North Fork Nooksack	6	87	345	285	26	175	210	121	39	91	159	250	221
	South Fork Nooksack	136	357	58	159	87	246	143	102	89	164	283	267	282
Skagit Summer/Fall	Natural Spawners:	16,792	5,824	7,348	5,801	5,549	6,877	10,613	4,872	14,609	4,924	16,930	13,793	19,591
	Upper Skagit River [1]	11,793	3,656	5,548	4,654	4,565	5,948	7,989	4,168	11,761	3,586	13,092	10,084	13,815
	Lower Sauk River [1]	1,294	658	469	205	100	263	1,103	295	460	295	576	1,103	910
	Lower Skagit River [1]	3,705	1,510	1,331	942	884	666	1,521	409	2,388	1,043	3,262	2,606	4,866
Skagit Spring	Natural Spawners:	1,511	1,346	986	783	470	855	1,051	1,041	1,086	471	906	1,856	1,065
	Upper Sauk River [1]	557	747	580	323	130	190	408	305	290	180	273	543	460
	Suiattle River [1]	685	464	201	292	167	440	435	428	473	208	360	688	265
	Upper Cascade River [1]	269	135	205	168	173	225	208	308	323	83	273	625	340
Stillaguamish	Natural-Origin Spawners:	701	1,279	716	725	743	654	935	839	863	767	1,127	936	1,090
	N.F. Stillaguamish River	434	978	422	380	456	431	684	613	615	514	884	653	737
	S.F. Stillaguamish River	267	301	294	345	287	223	251	226	248	253	243	283	353
Snohomish	Natural-Origin Spawners:	3,662	2,447	2,242	3,190	2,039	1,252	2,379	3,517	2,919	2,430	2,900	5,869	4,544
	Skykomish River	2,551	1,951	1,642	942	1,478	1,144	1,719	1,696	1,500	1,382	1,773	3,052	2,264
	Snoqualmie River	1,111	496	600	2,248	561	108	660	1,821	1,419	1,048	1,127	2,817	2,280
Lake Washington	Natural Spawners:	787	661	790	245	888	930	336	294	697	778	347	1,269	637
	Cedar River [1,2]	469	508	525	156	452	681	303	227	432	241	120	810	369
	Sammamish River [3]	318	153	265	89	436	249	33	67	265	537	227	459	268
Green River	Natural Spawners:													
	Duwamish-Green River	7,035	10,548	5,267	2,476	4,078	7,939	6,026	9,967	7,300 [6]	9,100 [6]	6,170	7,975	13,950
White River	Natural Spawners:													
	White River	275	194	406	409	392	605	628	402	316	553	1,523	2,002	803
Puyallup	Natural Spawners:													
	Puyallup River [4]	3,515	1,702	3,034	1,999	1,328	2,344	2,111	1,110	1,711	1,988	1,193	1,915	1,590
	S. Prairie Creek Index Area [4]	-	-		-	798	1,408	1,268	667	1,028	1,430	695	1,154	840
Nisqually	Natural Spawners:													
	Nisqually River	994	953	106	1,655	1,730	817	606	340	834	1,399	1,253	1,079	1,542
Skokomish	Natural Spawners:													
	Skokomish River	642	1,719	825	960	657	1,398	995	452	1,177 [6]	1,692 [6]	926 [6]	1,913 [6]	1,479
Mid-Hood Canal	Natural Spawners													
	Mid-Hood Canal Tributaries:	-	86	96	112	384	103	-	-	287	762	438	322	95
Dungeness	Natural Spawners:													
	Dungeness River	310	163	158	43	65	163	183	50	110	75	218	453	633
Elwha	Natural Spawners:													
	Elwha River [6]	2,956	3,361	1,222	1,562	1,216	1,150	1,608	2,517	2,358	1,602	1,851	2,208	2,376
ESU Total		39,964	29,240	26,284	19,457	20,887	25,610	27,773	26,380	36,238	27,326	36,087	43,341	52,744

[1] The majority are natural-origin spawner.

[2] The escapement estimates for the Cedar River are based on an expansion of a live count of fish. However, Cedar River redd counts suggests that this expansion of the live count may be a conservative estimate of the total escapement (P. Hage, Muckleshoot Tribe, e-mail to S. Bishop, NMFS, February 10, 2004).

[3] Does not include escapement into the Upper Cottage Lake Creek, which has been surveyed since 1998. Surveys of the Upper Cottage Lake Creek have exceeded 100 fish (S.

Foley, WDFW, pers. com., to K. Schultz, NMFS, February 19, 2004). Escapement counts also do not include spawners in Issaquah Creek, which are believed to be primarily Issaquah Hatchery returns (N. Sands, NMFS, e-mail to S. Bishop, NMFS, February 26, 2004). Therefore, escapement information presented is a conservative estimate of the total Sammamish River population's escapement.

[4] The area surveyed for the South Prairie Creek index increased from 1.5 to 12.5 stream miles in 1994.

[5] Escapement is considered in-river gross escapement plus hatchery voluntary escapement minus pre-spawning mortality.

A conservation-based supplementation program was initiated on the North Fork in 1986 using indigenous broodstock to help rebuild the North Fork Nooksack spring chinook population. Hatchery fish from the supplementation program were included in the ESA listing because they were considered essential for recovery. Between 1992 and 2002, hatchery-origin adults accounted for an estimated 67 percent of naturally-spawning chinook in the North Fork (PSTRT 2003a). There is no comparable supplementation program on the South Fork Nooksack.

The **Whidbey/Main Basin Region** includes the Skagit, Stillaguamish and Snohomish river systems (Figure 1, Table 3). The three basins contain 10 chinook populations (PSTRT 2004a) which are all watershed Category 1 populations. These watersheds are hydrologically diverse, differ in the magnitude of hatchery production, and support populations with different life history strategies, including three of Puget Sound's seven spring chinook runs and three of its five summer-run populations.

The Skagit River system contains six of the ten populations in the region including three spring, two summer; and a fall-timed population (PSTRT 2004a). Escapements generally declined steadily from the 1970s to the mid-1990s. However, the most recent 5-year period has shown increasing trends in escapement for all six populations. The populations vary significantly in abundance and productivity. Escapement for the Lower Skagit fall, Lower Sauk summer and Upper Skagit summer populations averaged 2,944, 721, and 10,144, respectively, from 1999 through 2002 which exceeded their viable thresholds of 2,182, 681 and 7,454. The three Skagit spring chinook populations are smaller, but compareable to each other in terms of abundance. Escapement for the Upper Cascade, Upper Sauk, and Suiattle spring populations averaged 330, 364, and 380, respectively, from 1999 through 2002 compared with viable thresholds of 330 and 400 for the Upper Sauk and Suiattle populations[4], respectively. Average productivity[5] for the 1990-97 brood years ranged from 1.6 to 3.9 for the six Skagit chinook populations (PSTRT 2003b; PSTRT 2003c).

The Skagit chinook populations are relatively unaffected by hatchery production. There is a small production facility on the Cascade River that serves primarily as an indicator stock for the coded-wire tag program to monitor survival rates, exploitation rates and harvest distribution. The contribution of hatchery-origin fish to natural spawning has been estimated at less than 2 percent (PSTRT 2003b; PSTRT 2003c).

The Stillaguamish River includes two populations. Escapements to the North Fork Stillaquamish declined from 1974 through 1991. Since then, there has been an increasing trend. The estimated average annual escapement from 1999 through 2002 was 697 natural origin spawners (1,151 natural spawners) in the North Fork compared to critical and viable abundance thresholds of 300 and 552. There has been no significant trend in escapement in the South Fork Stillaguamish

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[4]Data was unavailable to derive a viable threshold for the Upper Cascade population.

[5]The number of adult recruits produced per parent spawner.

River which has averaged 283 spawners since 1999 compared to critical and viable abundance thresholds of 200 and 300, respectively (Table 4).

A conservation-based supplementation program was initiated on the North Fork Stillaguamish in 1986 using indigenous broodstock to help rebuild the population. Hatchery fish from the supplementation program were included in the ESA listing because they were considered essential for recovery. Hatchery-origin adults comprised 33 percent of natural spawners in the North Fork from 1990 through 2002. (PSTRT 2003d) There is no comparable program on the South Fork Stillaguamish. Straying of hatchery fish in the South Fork has not been quantified.

Two populations have been identified in the Snohomish River system including those on the Skykomish and Snoqualmie rivers. The Skykomish population includes both summer and fall-timed fish (PSTRT 2004a). Spawning escapement to the Skykomish River showed a marked declining trend from the late 1970s until 1993, and a substantial increasing trend since then. The average escapement from 1999 through 2002 was 2,028 natural-origin adults (4,226 total naturally spawning adults) compared to critical and viable abundance thresholds of 1,650 and 3,500 (Table 3). The trend in escapement for the Snoqualmie River population was relatively flat from the late 1970s to the mid-1990s. From 1999 through 2002, the average annual escapement was 1,660 natural origin adults (2,113 total natural) compared to a critical abundance threshold of 400 (Table 3). A viable abundance threshold has not been identified. Productivity has averaged 1.5 and 2.5 for the Skykomish and Snoqualmie populations, respectively for the 1994-1997 brood years (1996-2002 return years)(PSTRT 2003e; PSTRT 2004b).

The primary objective of the hatchery program on the Snohomish system is fishery augmentation although it does rely on local-origin broodstock. From 1990 through 2002, an estimated 42 percent of naturally-spawning chinook in the Skykomish River and 23 percent of naturally-spawning chinook in the Snoqualmie River were of hatchery origin (PSTRT 2003e; PSTRT 2004b).

The **Southern Basin region** contains four major chinook-bearing watersheds including Lake Washington, and the Duwamish-Green, Puyallup and Nisqually rivers (Figure 1, Table 3). The PSTRT identified six populations in the region (PSTRT 2004a). Three of the populations are designated watershed Category 1 and three Category 2. The lower reaches of all these system flow through lowland areas that have been developed for agricultural, residential, urban or industrial use. 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.

Long and short term trends in escapement for populations in the South Basin region have generally been positive. However, the magnitude of hatchery fish on the spawning grounds is likely masking the true level of natural production (Myers *et al.* 1998; PSIT/WDFW 2003). Except for the Cedar and Sammamish chinook populations, escapements in the other areas have exceeded their viable escapement thresholds in recent years (Table 4).The range of escapements in the former two populations include years in which escapements have come close to or have fallen below their critical escapement thresholds. However, in the case of the Cedar River population, recent comparisons of escapement estimation methods indicate more spawners may be present than previously thought. In the case of the Sammamish population, escapement estimates do not include escapement into some of the tributary areas. Therefore, a direct comparison of escapements with the VSP generic guidance of a critical threshold of 200 fish should be considered conservative, as the total escapements are likely greater.

Numerous hatcheries in this area account for the majority of chinook salmon produced in Puget Sound (PSMFC 2002). With the exception of the White River program, hatchery production in the region is primarily for fishery augmentation. Until recently inter-basin hatchery transfers were common and extensive with the Green River serving as the primary source for broodstock. Because of the magnitude and duration of these programs and the low natural production of these systems, particularly in the Nisqually and Puyallup, there is no detectable genetic difference between the fish originating from the hatchery and those spawned in the wild (PSIT/WDFW 2003; WDF *et al.* 1993 as cited in PSTRT 2004a). Under a policy adopted by the co-managers in 1991, all Puget Sound hatchery programs established using Green River stock were required to become self-sustaining, and transports of Green River-origin broodstock between watersheds were prohibited. Although stray rates have not been quantified for most areas, hatchery fish are believed to contribute heavily to the naturally spawning populations. For example, stray rates in the Green River averaged 72 percent for 1990-2002 (PSTRT 2003f). However, because the hatchery program on the Green River has not received out-of-basin stock transfers, the integrated Green River natural/hatchery-origin stock likely retains most of is genetic characteristics (Marshall *unpublished*) and is thus classified as a Category 1 population. The White River supports the only spring chinook population in the South Sound Region and is also classified as Category 1. Because of chronically low abundance, a conservation-based hatchery program was initiated in the mid-1980s to help rebuild White River spring chinook. NMFS has included the program in the ESA listing because it is considered essential for recovery.

Table 6. Recent year escapement for populations in the South Basin Region

Population	1999-2002 Average Escapement (range)	Thresholds		Average Exploitation Rates	
		Critical	Viable	1983-1988	1999-2003
Sammamish	373 (227-537)	200	1,250	78%[1]	29%
Cedar	385 (120 - 810)	200	1,250	78%[1]	29%
Duwamish-Green	9,299 (6,170 - 13,950)	835	5,500	79%[2]	44%
Puyallup	1,672 (1,193 - 1,988)	200	1,200	75%[1]	59%
White	1,220 (553 - 2,002)	200	1,000	77%[2]	39%
Nisqually	1,318 (1,079 - 1,542)	200	1,100	90%[2]	77%

Data source: [1]FRAM 2003
[2]CTC 2003. Data is through 2000. Data for years for years 2001-2003 are not yet available.

The **Hood Canal Region** has two fall chinook salmon populations, one in the Skokomish River, and a second that is comprised of three Hood Canal tributaries (Dosewallips, Duckabush and Hamma Hamma Rivers)(PSTRT 2004a). Both the Skokomish and mid-Hood Canal Rivers populations are considered watershed Category 2 populations and thus are a composite of natural- and hatchery-origin fish that are genetically indistinguishable. Historically, the Skokomish River supported the largest natural chinook run in Hood Canal. Natural production in the North Fork Skokomish has been limited as a result of impacts associated with a hydroelectric dam that blocks anadromous passage at RM 21 and greatly limited in-stream flow due to an out of basin diversion. Natural production in the South Fork is further limited by the effects of intensive logging activity (WDF *et al.* 1993). Natural escapements to the Skokomish have increased from a pre-listing average (1990-1998) of 981 to a 1999-2002 average escapement of 1,503 total natural spawners. This is compared to critical and viable escapement thresholds of 200 and 1,200, respectively (Table 4).

The PSTRT has designated the Hood Canal Tributaries chinook salmon as the other independent chinook population within Hood Canal (PSTRT 2004a). A great deal of uncertainty remains about the relationship among the chinook in the three rivers because of the lack of information about the populations prior to significant habitat alteration and use of hatchery supplementation in these rivers. Prior to 1986, all escapement estimates for these rivers were made by extrapolation based on observations from the Skokomish River (PSIT/WDFW 2003). Aggregate escapement to the three mid-Hood Canal rivers has averaged 404 since 1999 (Table 4), compared with VSP critical and viable abundance thresholds of 200 and 1,250, respectively. The spatial structure of the Mid-Hood Canal population is unique in that it includes three sub-populations (Hamma Hamma, Dosewallips and Duckabush rivers) separated by salt water. The 1999-2002 average escapements into these individual sub-populations range from 43 to 304 spawning adults.

The primary purpose of the hatchery program in the Skokomish River is fishery augmentation. The brood source is of mixed origin, with significant influence from historical transplants from South Puget Sound facilities. The contribution of hatchery straying to natural spawning is unknown but believed to be substantial (PSIT/WDFW 2004; PSTRT 2004a). A chinook supplementation program contributes to escapement on the Hamma Hamma River and straying from outside programs presumably occurs.

The **Strait of Juan de Fuca Region** has two watershed Category 1 populations including a native, spring-timed population on the Dungeness, and a native, fall-timed population on the Elwha (PSTRT 2004a). Both populations are considered critical due to chronically low spawning escapement levels (WDF *et al.* 1993).

The Dungeness River is located in the rain shadow of the Olympic Mountains and, as a result, receives relatively little rainfall (less than 20 inches per year). The Dungeness is therefore particularly dependent on annual precipitation and snow pack, and is susceptible to habitat degradations that exacerbate low flow conditions. Agricultural water withdrawals remove as much as 60 percent of the natural flow during the critical low flow period which coincides with spawning. Other land use practices have also substantially degraded the system.

Much of the Elwha drainage is still pristine and protected in the Olympic National Forest. However, two dams at river miles 4.9 and 13.4 block passage to over 70 miles of potential habitat. The remaining habitat below the first dam is degraded by the loss of natural gravel, large woody debris, and the adverse effects of high water temperatures. The high temperatures exacerbate problems with the parasite *Dermocystidium* with resulting pre-spawning mortality is sometimes as high as 70 percent. Recovery of the Elwha population depends on restoring access to high quality habitat in the upper Elwha basin. The Elwha Dams are scheduled for removal in the near future thus greatly enhancing the prospects for eventually recovery.

Dungeness escapement has remained mostly below 250 spawners since 1986. The trend in escapement from 1986 to the present has been relatively flat, although there has been a marked increase in escapement since 2000 (Table 5). Escapements averaged 345 from 1999 through 2002 (Table 4) compared with critical and viable escapement thresholds of 200 and 925. Elwha escapements have averaged 2,009 from 1999 through 2002 (Table 4) compared with critical and viable escapement thresholds of 200 and 2,900. Although the long term trend has been downward, escapement levels have been stable since 1992.

Because of the limitations on natural production and low abundance, hatchery supplementation programs were initiated on both the Elwha and Dungeness using endemic broodstocks. Hatchery fish from the supplementation programs were included in the ESA listing because they were considered essential for recovery. Considering the current level of degradation in habitat quality and quantity, the populations would likely have gone extinct without the continued contribution of the hatchery programs. The contribution of hatchery straying to natural spawning is unknown but believed to be substantial (PSMFC 2002; PSTRT 2004a; NMFS 2000c).

3.2.1.3 Lower Columbia River chinook

The Lower Columbia River chinook salmon ESU is characterized by numerous short- and medium-length rivers that drain the coast ranges and the west slope of the Cascade Mountains. This ESU includes all native populations from the mouth of the Columbia River to the crest of the Cascade Range, excluding populations above Willamette Falls. The former location of Celilo Falls (drowned by The Dalles reservoir in 1960) is the eastern boundary for this ESU (Figure 4). The Cowlitz, Kalama, Lewis, Washougal, and Wind Rivers constitute the major systems in Washington; the lower Willamette, Clackamas, Hood and Sandy Rivers are the major systems in Oregon. The ESU does not include spring chinook salmon populations in the Clackamas River or the introduced Carson spring chinook salmon stock. Tule fall chinook salmon in the Wind and White Salmon Rivers are included in this ESU, but not the introduced upriver bright fall chinook salmon populations in the Wind and White Salmon Rivers and those spawning naturally below Bonneville Dam (Myers *et al.* 1998). Of the fourteen hatchery stocks included in the ESU, one was considered essential for recovery (Cowlitz River spring chinook) but was not listed (64 FR 14308). WDF *et al.* (1993) identified 20 stocks within the ESU, but surveyed only Washington stocks which did not include the Sandy spring or Sandy late fall bright spawning aggregations in Oregon. The Willamette/Lower Columbia River Technical Recovery Team has preliminarily identified 31 historical demographically independent populations including the spring and late fall bright populations in Oregon (WLCRTRT 2002).

There are three different runs of chinook salmon in the Lower Columbia River ESU: spring-run, late fall brights, and early fall tules. Spring-run chinook salmon in the lower Columbia River, have a stream-type juvenile life history and enter freshwater as adults in March and April, well in advance of spawning in August and September. Historically, fish migrations were synchronized with periods of high rainfall or snow melt to provide access to upper reaches of most tributaries where spring stocks would hold until spawning (Fulton 1968; Olsen *et al.* 1992; WDF *et al.* 1993). The tule and bright fall chinook exhibit an ocean-type live history and northerly ocean migration patterns, with bright fish tending to travel father north than the tule stocks. Tule fall chinook begin entering the Columbia River in August, rapidly moving into the lower Columbia River tributaries to begin spawning in September and October. Bright fall chinook enter the Columbia River over a longer period of time beginning in August and do not begin spawning until October with spawning observed into the following March in some locations. All lower Columbia River chinook mature from two to six years of age, primarily returning as three and four year old adults (Myers *et al.* 1998).

Estimated overall abundance of chinook salmon in this ESU is not cause for immediate concern.

Long-term trends in fall run escapement are mixed, with most larger stocks positive, while the spring run trends are positive or stable (Table 7). Short-term trends (1999-2003) for both runs are also stable or positive (Table 7). Apart from the relatively large and apparently healthy fall-run population in the Lewis River, production in this ESU appears to be predominantly hatchery-driven with few identifiable native, naturally reproducing populations. About half of the populations comprising this ESU are very small, increasing the likelihood that risks due to genetic and demographic processes in small populations will be important.

Spring chinook were present historically in the Sandy, Clackamas[6], Cowlitz, Kalama, Hood and Lewis Rivers. Spawning and juvenile rearing areas have been eliminated or greatly reduced by dam construction on all these rivers. The native Lewis River run became extinct soon after completion of Merwin Dam in 1932. The natural Hood River spring chinook population was extirpated in the 1960's after a flood caused by the natural breaching of a glacial dam resulted in extensive habitat damage in the West Fork production areas. Currently non-listed hatchery spring chinook from the Deschutes River are being released into the Hood River as part of a reintroduction program. The remaining spring chinook stocks in the Lower Columbia River ESU are found in the Sandy, Lewis, Cowlitz, and Kalama Rivers (Figure 4). Numbers of naturally spawning spring-run chinook salmon are very low, and have historically had or continue to have substantial contributions of hatchery fish. Recent escapements (1998-2003) above Marmot Dam on the Sandy River averaged 5,500 and have been increasing (personal communication with C. LeFleur, Washington Department of Fish and Wildlife, Fisheries Biologist, April 1, 2004). Hatchery-origin spring chinook are no longer released above Marmot Dam; the proportion of first generation hatchery fish in the escapement is relatively low, on the order of 10-20 percent in recent years. The recent five year geometric mean escapements of naturally spawning spring chinook adults in the Cowlitz, Kalama, and Lewis Rivers are 463, 313, and 490, respectively (personal communication with C. LeFleur, Washington Department of Fish and Wildlife, Fisheries Biologist, April 1, 2004). The amount of natural production resulting from these escapements is unknown, but is presumably small since the remaining habitat in the lower rivers is not the preferred habitat for spring chinook (ODFW 1998). Hatchery escapement goals have been consistently met in the Cowlitz and Lewis Rivers. In the past, when necessary, brood stock from the Lewis was used to meet production goals in the Kalama. Although the status of hatchery stocks are not always a concern or priority from an ESA perspective, in situations where the historic spawning habitat is no longer accessible, hatchery stocks provide a reservoir for the genetic legacy of the populations. In this context, the status of the hatchery stocks is therefore pertinent.

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[6] Clackamas River spring chinook are considered part of the listed Upper Willamette River chinook ESU.

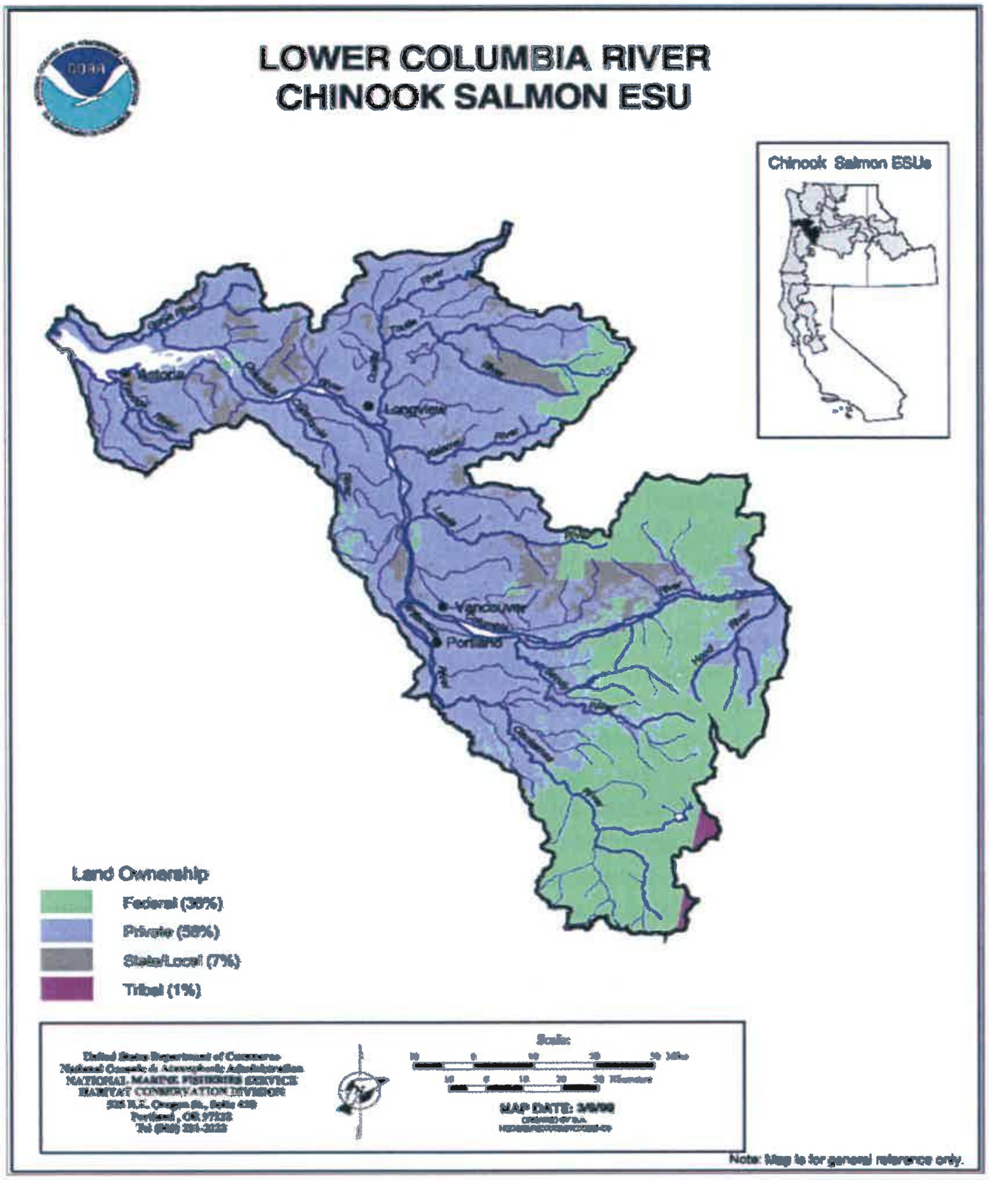

Figure 4. Description of Lower Columbia Chinook Salmon ESU.

Table 7. Estimated Lower Columbia River spring chinook tributary returns, 1991-2003 (nearest 100). 2003 is preliminary (PFMC 2004)

Year	Sandy R.	Cowlitz R.	Lewis R.	Kalama R.	Total Returns Excluding the Willamette System
1991	3,700	8,900	8,300	2,600	23,500
1992	9,200	10,400	5,600	2,400	27,600
1993	6,400	9,500	6,600	2,900	25,400
1994	3,500	3,100	3,000	1,300	10,900
1995	2,500	2,200	3,700	700	9,100
1996	4,100	1,800	1,700	600	8,200
1997	5,200	1,900	2,200	600	9,900
1998	4,200	1,100	1,600	400	7,300
1999	3,300	2,100	1,800	1,000	8,200
2000	3,800	1,900	2,200	1,400	9,300
2001	5,600	1,600	2,200	1,700	11,100
2002	7,000	3,700	2,000	2,800	16,900
2003	*6,400*	*13,400*	*5,100*	*4,200*	

The long term trend for most fall chinook populations in the Lower Columbia River is declining (WCSBRT 2003). However, beginning in 1999, escapements began to increase with escapements in 2001 to 2003 among the highest in the last 12 years (Table 8). The tule component of the fall chinook populations spawn in the Coweeman and East Fork Lewis Rivers (Figure 4). Escapements for these populations have ranged from less than a hundred to 2,000 per year (personal communication with R. Ehlke, Washington Department of Fish and Wildlife, Fisheries Biologist, April 12, 2004). Some natural spawning of tule fall chinook occurs in other areas but is thought to result primarily from hatchery-origin strays. Tule fall chinook are produced at the Elochoman, Cowlitz, Toutle, Kalama, Spring Creek and Washougal hatcheries in Washington and Big Creek hatchery in Oregon. The bright component of Lower Columbia River fall chinook spawn in the North Fork Lewis, East Fork Lewis and Sandy Rivers. Lower Columbia River bright stocks are among the few healthy natural chinook stocks in the Columbia River Basin. Escapement to the North Fork Lewis River has exceeded its escapement goal of 5,700 by a substantial margin every year since 1980, except 1999, with a recent five year average escapement of 11,990 (Table 8). Escapements of the two smaller populations of brights in the

Sandy and East Fork Lewis River have been relatively stable, although variable, for the last 10-12 years (Table 8). All three populations are largely unaffected by hatchery fish (ODFW 1998; NMFS 2001c).

Freshwater habitat is in poor condition in many basins, with problems related to forestry practices, urbanization, and agriculture. Dam construction on the Cowlitz, Lewis, White Salmon, and Sandy Rivers has eliminated access to a substantial portion of the spring-run spawning habitat, with a lesser impact on fall-run habitat (Myers *et al.* 1998).

The large numbers of hatchery fish in this ESU make it difficult to determine the proportion of naturally produced fish. In spite of the heavy impact of hatcheries, genetic and life-history characteristics of populations in this ESU still differ from those in other ESUs. However, the potential loss of fitness and diversity resulting from the introgression of hatchery fish within the ESU is an important concern. In response to concerns about straying into tributaries of the Lower Columbia (Myers *et al.* 1998), the release locations for non-ESU Rogue River bright fall-run fish in Youngs Bay were changed and as a result, stray rates have declined markedly (R. Turner, NMFS, to S. Bishop, NMFS, pers. comm., February 19, 2002).

In 2002-2003, status reviews were conducted by the West Coast Biological Review Team (BRT) (WCSBRT 2003). The BRT, based on a synthesis of the updated information provided in their report plus the information contained in previous Lower Columbia River status reviews, tentatively identified the number of historical and currently viable populations. The summary indicated that the ESU is substantially modified from historical population structure. Most tule fall chinook populations are potentially at risk of extinction and no populations of the spring run life-history type are currently considered self-sustaining. The Lewis River late fall bright population has the highest likelihood of being self-sustaining under current conditions. The BRT concluded that the ESU remains "likely to become endangered in the foreseeable future."

Table 8. Estimated Lower Columbia River fall chinook escapements, 1991-2003 (nearest 10)(personal communication with R. Ehlke, Washington Department of Fish and Wildlife, Fisheries Biologist, April 12, 2004)

	Tule populations		Bright populations		
Year	Coweeman	E. Fork Lewis R.	N. Fork Lewis	E. Fork Lewis R.	Sandy R.
1993	330	80	7,025	80	1,720
1994	530	200	9,936	100	980
1995	770	100	9,718	100	1,100
1996	2,150	170	13,971	170	660
1997	1,330	180	8,670	120	2,220
1998	140	50	5,935	50	880
1999	90	110	3,184	110	640
2000	130	150	9,820	150	80
2001	630	310	13,886	220	910
2002	890	740	16,371	560	1,380
2003	*1,082*	*360*	*19,280*	*350*	*770*

3.2.2 Critical Habitat

Critical habitat was designated and described in detail, for the Lower Columbia River and Puget Sound Chinook Salmon ESUs on February 16, 2000 (65 FR 7764). On April 30, 2002, the U.S. District Court for the District of Columbia approved a NMFS consent decree withdrawing the February 2000 critical habitat designation for these ESUs, along with several others. However, it is useful to note that (1) when the critical habitat designation was in place, it did not include the offshore marine areas that are under the jurisdiction of the PFMC (65 FR 7764); and (2) previous biological opinions (NMFS 2003a; NMFS 2000c) concluded that the types of fishing gear used in the areas in which Fraser Panel fisheries are conducted were not likely to adversely affect critical habitat. Currently, critical habitat is not designated for either the Puget Sound or Lower Columbia River Chinook Salmon ESUs.

3.3 Environmental Baseline

The environmental baseline is an analysis of the effects of past and present human and natural factors leading to the current status of the species or its habitat and ecosystem within the action area. The action area is defined as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR 402.02).

The environmental baseline for this Opinion includes the effects of several activities that affect the survival and recovery of threatened and endangered species in the action area. The activities having the greatest impact on the environmental baseline generally fall into five categories: hydro-power system impacts on juvenile outmigration and adult return migration; habitat degradation effects on water quality and availability of adequate incubation and rearing locations; artificial propagation; harvest impacts and fluctuations in natural conditions. The relative effect of each H to the ESUs, and to each stock within an ESU, differs. Habitat restoration actions are expected to improve productivity by restoring habitat to proper function (NMFS 1996a). However, in most cases, it will be a decade or more before the effects are demonstrable. The harvest standards discussed in this opinion were developed under assumptions of current habitat productivity and capacity. The following discussion reviews recent developments in each of the sectors, and outlines their anticipated impacts on natural conditions and the future performance of the listed ESUs.

3.3.1 Hydro-Power System

Columbia River basin anadromous salmonids, especially those above Bonneville Dam, have been dramatically affected by the development and operation of the Federal Columbia River Power System (FCRPS). Storage dams have eliminated spawning and rearing habitat and have altered the natural hydrograph of the Snake and Columbia rivers, decreasing spring and summer flows and increasing fall and winter flows. Power operations cause fluctuation inflow levels and river elevations, affecting fish movement through reservoirs and riparian ecology and stranding fish in shallow areas. The eight dams in the migration corridor of the Snake and Columbia rivers alter smolt and adult migrations. Smolts experience a high level of mortality passing through the dams. The dams also have converted the once-swift river into a series of slow-moving reservoirs, slowing the smolts' journey to the ocean and creating habitat for predators. Water velocities throughout the migration corridor are now far more dependent on volume runoff than before development of the mainstem reservoirs. These factors not only affect populations above Bonneville Dam but also those populations below the Federal Dams when they use the mainstem Columbia River as a migration corridor.

Although not as severe as those experienced by upriver salmon populations, there are hydro-power system impacts that also affect Lower Columbia River ESUs. One impact is the loss of habitat from irrigation and hydro-power dams that has substantially reduced the available spawning and rearing habitat for the listed species. For example, current available habitat for Lower Columbia River chinook is only 63 percent of the potential habitat that was historically available (WCSBRT 2003). For many historic spring chinook populations habitat has been reduced to zero (Cispus River, Tilton River, Big White Salmon River and Upper Cowlitz River) or has been severely reduced as in the Lewis River.

The effects of FCRPS hydropower projects on 12 listed Columbia River Basin salmonid species have been evaluated by NMFS in a recent biological opinion (NMFS 2000d). Although NMFS concluded that the proposed operation and configuration of the FCRPS and the BOR projects were likely to jeopardize the continued existence of 8 listed ESUs and to adversely modify their designated critical habitat (opinion was crafted before the rescission of critical habitat designation), the actions were determined as not likely to jeopardize the Lower Columbia River chinook ESU.

There have been numerous changes in the operation and configuration of the FCRPS as a result of ESA consultations between the hydrosystem Action Agencies (BPA, COE, BOR) and the Services (NMFS and USFWS). These have resulted in survival improvements for listed fish migrating through the Snake and Columbia rivers. Increased spill at all of the FCRPS dams allows smolts to avoid both turbine intakes and bypass systems. Increased flow in the mainstem Snake and Columbia rivers provides better inriver conditions for smolts.

While not as overriding an effect on the Puget Sound ESU as a whole when compared with other factors, dams constructed for hydropower generation, irrigation or flood control have substantially affected chinook populations in several river systems. The construction and operation of dams have blocked access to spawning and rearing habitat, changed flow patterns, resulted in elevated temperatures and stranding of juvenile migrants and degraded downstream spawning and rearing habitat by reducing recruitment of spawning gravel to downstream areas. For example, hydromodification in the Skagit system has resulted in a loss of 64 percent of its distributary sloughs and 45 percent of side channel sloughs.

3.3.2 Habitat

Water quality in streams throughout Puget Sound and the Lower Columbia River basin have been degraded by human activities such as dams and diversion structures, water withdrawals, farming and grazing, road construction, timber harvest, mining, and urbanization. In the Columbia River Basin, over 2,500 streams and river segments and lakes do not meet Federally approved, state and Tribal water quality standards and are now listed as water quality limited under Section 303(d) of the Clean Water Act (CWA). Tributary water quality problems contribute to poor water quality where sediment and contaminants from the tributaries settle in mainstem reaches and the estuary.

Highway culverts that are not designed for fish passage can block upstream migration. Migrating fish are also diverted into unscreened or inadequately screened water conveyances or turbines, resulting in unnecessary mortality. Whereas many fish-passage improvements have been made in recent years, manmade structures continue to block migrations or kill fish throughout the basin.

Land ownership has played a part in habitat and land use changes. While there is substantial habitat degradation across all ownerships, in general, habitat in many Federally managed headwater stream sections is in better condition than in the largely non-Federal lower portions of tributaries (Doppelt *et al.* 1993; Frissell 1993; Henjum *et al.* 1994; Quigley and Arbelbide 1997). In the past, valley bottoms were among the most productive fish habitats in (ISG 1996; Spence *et al.* 1996; Stanford and Ward 1992). Today, agricultural and urban land development and water withdrawals have critically altered the habitat for fish and wildlife. Streams in these areas typically have high water temperatures, sedimentation problems, low flows, simplified stream channels, and reduced riparian vegetation (Bishop and Morgan 1996; PSSRG 1997).

In the Columbia River, the Basinwide Recovery Strategy (NMFS 2000b) outlines a broad range of habitat programs. Because some of the anadromous fish spawning habitat is in Federal ownership, Federal land management programs are of primary importance. Current management on Federal land is governed by an ecosystem-based aquatic habitat and riparian-area management strategy known as PACFISH and associated biological opinions. This interim strategy covers the majority of the basin accessible to anadromous fish and includes specific prescriptions designed to halt habitat degradation. The Basinwide Recovery Strategy also outlines a large number of non-Federal habitat programs. Because non-Federal habitat is managed predominantly for private rather than public purposes, however, expectations for non-Federal habitat are harder to assess. Degradation of habitat for listed fish from activities on non-Federal lands is likely to continue to some degree over the next 10 years, although at a reduced rate due to state, Tribal, and local recovery plans.

Federal, tribal, state and local governments and community organizations are currently collaborating in the development of a recovery plan for listed salmon species in Puget Sound, including the Puget Sound chinook ESU. This effort is collectively called the Shared Strategy forum. The Shared Strategy plan will include conservation goals for listed Puget Sound salmon; and the habitat, hatchery, and harvest actions that will need to be taken to achieve these goals for each watershed in Puget Sound and the Strait of Juan de Fuca. When complete, the Shared Strategy will provide its plan to NMFS for assessment as to whether the plan would suffice as the recovery plan for Puget Sound salmon listed under the ESA.

3.3.3 Artificial Propagation

Puget Sound currently includes over 100 and the Columbia River Basin over 70 hatchery programs and associated satellite facilities, some of which were initiated more than 100 years ago, and well before the salmon and steelhead were listed pursuant to the ESA (NMFS 1999a). Hatcheries in the Pacific Northwest have been used to mitigate for declines in salmon and steelhead abundance. Today, hatchery fish contribute to varying degrees to naturally spawning salmon populations in Puget Sound and the lower Columbia River (see Status discussion above).

Hatchery programs have generally been put in place to mitigate for declines in fish runs due to habitat destruction from hydropower construction, human development, resource extraction, and overfishing. Much of the hatchery production is for fishery augmentation, but hatcheries are increasingly important for conserving natural populations in areas where the habitat can no longer support natural production or where the numbers of returning adults are so low that intervention is required to reduce the immediate risk of extinction. Over the last decade, there has been a greater focus on the use of hatcheries to restore, maintain and conserve natural populations of anadromous salmonids as well (Fast and Craig 1997; NPPC 1994; RASP 1992).

Hatchery programs producing non-listed salmonid species are being used to benefit the fisheries that are under review in this opinion. Many of the artificial propagation programs are designed to provide surplus fish for harvest in commercial, tribal, and recreational fisheries. These non-listed fish production programs are also used to meet international harvest objectives set forth under the Pacific Salmon Treaty agreement, and to mitigate for natural salmonid production losses due to habitat blockage and degradation.

Potential negative effects of artificial propagation on naturally produced populations include effects on the genetic and ecological health of natural populations, effects of fisheries management and the potential to mask the status of naturally producing stocks which effects public policy and decision making. NMFS' status reviews of the listed ESUs (Busby *et al.* 1996; Myers *et al.* 1998; Johnson *et al.* 1997; Weitkamp *et al.* 1995) and the recent BRT report (WSCBRT 2003) have identified hatchery effects as potential factors for the decline in these ESUs. In response to ESA listings and regional hatchery reform initiatives, hatchery programs and the associated fishery plans have changed, and state and tribal co-managers have begun to implement mitigation provisions as part of conservation initiatives (WDFW/PNPTT 2000). The intent of hatchery reform is to strive to reduce negative effects of artificial propagation on natural populations while retaining its proven production and potential conservation benefits. For example, hatchery programs are in the process of phasing out use of improper broodstocks, such as out-of-basin or out-of-ESU stocks, replacing them with fish derived from, or more compatible with, locally adapted populations. The basic thrust of many of these reforms has been to produce fish that pose less risk to natural populations, either by minimizing interactions with natural populations or by making hatchery fish more compatible with them. These improvements are needed not only to address artificial propagation's potential negative effects on listed fish but also to improve the overall success of artificial propagation programs.

In addition, fisheries that target hatchery fish may over harvest less productive wild populations. For populations with a substantial hatchery component, fisheries are now managed to provide primary protection to the naturally spawning chinook while shaping fisheries to maximize access to surplus hatchery production. The majority of Puget Sound and Columbia River chinook salmon are now mass marked to assess the contribution of hatchery-origin adults on the spawning grounds, improve broodstock management, and allow for selective harvest opportunity where appropriate. Hatcheries in Puget Sound are currently the subject of an ESA review designed to address the adverse effects of ongoing hatchery programs.

Scientific knowledge regarding the benefits and risks of artificial propagation is incomplete, but improving. Artificial propagation measures have proven effective in many cases at alleviating near-term extinction risks, yet the potential long-term benefits of artificial propagation as a recovery tool are unclear. Scientific uncertainty remains about whether and to what extent hatcheries, as they are currently operated, pose a continuing risk to natural populations. The hatchery operators conduct monitoring and evaluation activities to address these issues and to evaluate the success of artificial propagation programs and the reforms.

3.3.4 Harvest

Puget Sound and Lower Columbia River chinook salmon are harvested throughout their migratory range from Alaska to Oregon both in fisheries intended to harvest salmon and in fisheries directed on other species. Until recently the exploitation rates on the chinook ESUs being considered here have been too high for many of the component stocks and have contributed to their decline particularly because of what we now know about the cycles in ocean productivity (Section 3.3.5).

Salmon are taken incidentally in the Bering Sea/Aleutiàn Islands, and the Gulf of Alaska groundfish fisheries off of the coast of Alaska. NMFS has conducted section 7 consultations on the impacts of fishing conducted under the Bering Sea and Aleutian Islands and Gulf of Alaska Fishery Management Plans of the North Pacific Fisheries Management Council on ESA listed species and concluded that impacts were not likely to jeopardize the Puget Sound or Lower Columbia River chinook ESUs (NMFS 1994, NMFS 1995, NMFS 1998b, NMFS 1999e, NMFS 2000g). The bycatch in the Canadian groundfish fisheries has been considered in previous consultations on U.S. groundfish and salmon fisheries (NMFS 1992, NMFS 1999d). The conclusion was that the bycatch of listed species was not likely to be a substantial additional impact to that of the U.S., assuming that the total annual salmon bycatch in Canadian groundfish fisheries was approximately 28,000 fish per year[7] (NMFS 1999d).

Salmon are taken incidentally in the groundfish fishery off Washington, Oregon, and California. NMFS conducted section 7 consultations under the ESA pertaining to the effects of the groundfish fishery conducted under the Pacific Coast Groundfish Fishery Management Plan (PCGFMP) on listed chinook, coho, chum, sockeye salmon and steelhead and concluded that impacts on species listed at that time were low and not likely to jeopardize the listed species (NMFS 1990; NMFS 1991; NMFS 1992; NMFS 1993; NMFS 1996b; NMFS 1999d; NMFS 2002b). During the 2000 Pacific whiting season, the whiting fisheries exceeded the chinook bycatch amount specified in the Pacific whiting fishery Biological Opinion's (December 15, 1999) incidental take statement estimate of 11,000 fish by approximately 500 fish. After reviewing the data from the 2000 and 2001 whiting fisheries (including industry bycatch minimization measures), the status of the affected listed chinook, environmental baseline information, and the incidental take statement from the 1999 whiting biological opinion, NMFS determined that re-initiation of the 1999 whiting biological opinion was not required (NMFS 2002b). The 11,000 fish threshold was not exceeded in 2002 or 2003. NMFS concluded that implementation of the PCGFMP did not pose jeopardy to

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[7] Assumes bycatch in other gears is similar to that of whiting which is estimated to be approximately 14,000.

the listed ESUs, or result in the destruction or adverse modification of critical habitat.

Salmon fisheries off the coast of Southeast Alaska (SEAK) and British Columbia also impact the listed salmon ESUs considered in this opinion. Historical impacts on the listed ESUs and their component stocks in these fisheries have been discussed in the status section above and are summarized in Tables 9-17 below. Historically SEAK and British Columbian fisheries have accounted for a substantial proportion (up to 82%) of the fishery-related mortality of populations in both ESUs depending on the population. Chinook fisheries off the coasts of SEAK and British Columbia will be managed under the terms of the most recent agreement under the Pacific Salmon Treaty. NMFS' assessment of the current PST agreement (Treaty) as it applied to the SEAK and British Columbia fisheries concluded that it did not pose jeopardy to the listed ESUs (NMFS 1999c). The terms of the agreement will be effective through 2008 (2010 for Fraser Panel fisheries). The Treaty includes a general obligation for each country to reduce exploitation rates in specific fisheries on certain stocks if they are not meeting escapement goals.

Salmon have been harvested in the waters of Puget Sound, the Columbia basin and in ocean coastal areas as long as there have been people here. For thousands of years, native Americans have fished on salmon and other species in these areas for ceremonial and subsistence use and for barter. Salmon were possibly the most important single component of the native American diet, and were eaten fresh, smoked, or dried (Craig and Hacker 1940; Drucker 1965; NMFS 2004). Commercial fishing developed rapidly with the arrival of European settlers and the advent of canning technologies in the late 1800s. Development of non-Indian fisheries began in about 1830; by 1861, commercial fishing was an important economic activity. The early commercial fishery used gill nets, seines hauled from shore, traps, and fish wheels. Later, purse seines and troll (using hook and line) fisheries were developed. Recreational (sport) fishing began in the late 1800s, occurring primarily in tributary locations (PSIT/WDFW 2004; ODFW/WDFW 1998).

Eventually the combined ocean and freshwater harvest rates exceeded 80 percent and sometimes 90 percent of the run, contributing to the species' decline (Ricker 1959). As a result of better management tools and information by which to define harvest objectives, and declining abundances, harvest rates on Puget Sound and the Lower Columbia River chinook salmon ESUs have declined considerably since the 1980s. Tables 9-17 show the magnitude and distribution of exploitation rates for individual populations within the ESUs over the last twenty years. The tables show the total adult equivalent exploitation rates by brood year as well as how that exploitation was distributed across the major fisheries. The estimates are based on coded wire tag (CWT) recoveries which provide the most direct estimates of exploitation rates. The adult equivalent calculation is a procedure that discounts catch for expected future natural mortality which would occur prior to spawning. The estimates are reported by brood year. For example, the exploitation rate of the 1992 brood year accounts for harvest mortality that occurred on age 2-5 fish in years 1994-97. The data are complete through the 1997 brood and 2002 fishery. The 1998 brood year is reported, but is incomplete in that the five year old recoveries from the 2003 fishery are not yet available. Five year old adults are a small proportion of the return each year in Puget Sound and a larger proportion of the return of Columbia River stocks (Myers *et al.* 1998). There is generally a year-long time lag in updating the coast-wide CWT data base necessary to provide these estimates. The averages in the following tables correspond to key shifts in fishing regimes: (1) pre- Pacific Salmon Treaty (PST) implementation (1975-1984), (2) post-PST implementation but prior to the implementation of fishery restrictions seen in recent years (1985-1990); (3) recent years when fisheries have been heavily constrained (1991-1998).

Exploitation rates can also be calculated using harvest management models by catch year. These models use the same CWT data to model exploitation rates that occurred in past years. However, once the models are calibrated, they can also be used for management planning purposes to estimate exploitation rates that would be associated with a given fishery structure in a particular year. Because the models are projections, they can be used to characterize exploitation rates that are not available when using the more direct brood year, CWT estimates, or for management units that are not directly represented by CWT data. These exploitation rates are provided for Puget Sound chinook stocks that are not CWT indicator stocks in Table 18 below. For comparative purposes, exploitation rates for other Puget Sound stocks are also provided. Because these rates are annual rates and not brood year rates, and because they are based on adjustments to a base set of CWT data rather than by individual years, the rates are different than those in Tables 11-17. However, although the absolute rates are different the trends in exploitation rates are generally similar. Table 18 should be used for comparative purposes with rates in the analysis of effects discussion for Puget Sound chinook populations because the same harvest management model is used to estimate the effects of the proposed action.

The three components of the Lower Columbia River chinook salmon ESU (spring, tule, brights) have different distributions and are subject to different rates of harvest. The time series of exploitation rate for the spring component is not currently available, but the model base period (1979-82) exploitation rate for Cowlitz spring chinook in PFMC fisheries was 12 percent. U.S. Fraser Panel fisheries occur July through August, well after the entry of spring chinook into the river in March and April and would therefore not impact returning adults from the spring component.

The total brood year exploitation rates on tule stocks have also declined since 1976, averaging 70 percent from 1977-1984, and 55 percent from 1985 through 1990 (Table 9). Total exploitation rates for the 1991-1998 broods averaged 36 percent (Table 9). The distribution of the tule stocks is more southerly with the ocean harvest concentrated in Canadian and PFMC fisheries. Exploitation rates in the PFMC fishery averaged 22 percent in the 1985 through 1990 time period and 15 percent for the 1991-1998 brood years (42% of total exploitation)(Table 9). The 1985-1990 exploitation rate in the river fisheries averaged 10 percent compared with the 1991-1998 brood year average of 6 percent (Table 9). Tules are caught in U.S. Fraser Panel fisheries, but it is a rare occurrence (personal communication with D. Simmons, NMFS, April 1, 2004).

North Fork Lewis River fall chinook are the primary representative of the bright component of the Lower Columbia River ESU. As noted in the Status discussion, this is one of the few healthy wild stocks in the Lower Columbia River. Total exploitation rates averaged 55 percent from 1977 through 1984, 43 percent from 1985 through 1990 and 30 percent from 1991 through 1998 brood years (Table 10). This is a far-north migrating stock so the ocean harvest occurs primarily in Alaskan and Canadian fisheries (Table 10). Exploitation rates in the PFMC fishery have averaged 4 percent since the 1985 brood year (14% of total exploitation). In-river exploitation rates have averaged 23 percent from 1977 through 1984, 21 percent from, 1985-1995, and 9 percent in recent years (Table 10). Encounters of North Fork Lewis fall chinook in Puget Sound and other terminal marine area fisheries are a rare occurrence.

In December 2003, NMFS approved two Fisheries Management and Evaluation Plans (FMEP) for fisheries in the tributaries to the Columbia River downstream of and including the Wind River in Washington and the Hood River in Oregon, excluding fisheries in the Willamette River above Willamette Falls. The new selective fisheries in the FMEPs for spring chinook salmon are expected to reduce natural spring chinook salmon harvest rates to less than 10 percent and will generally average closer to 5 percent. Under selective fishing regulations, fisheries impacts on naturally produced spring chinook in the Sandy River are expected to be approximately 8.6 percent per year (ODFW 2003). In the future, if adult returns increase, fishery impacts on naturally produced adults are expected to remain the same as selective fisheries will remain in place. This long term management goal is expected to ensure that natural escapement goals are achieved for tributaries in Washington and Oregon.

Under the FMEPS, for fall tules, fisheries will be managed to not exceed the Rebuilding Exploitation Rate (RER) of 49 percent based on the Coweeman population. As described in Subsection 3.4.1.1 below, the RER for a given population is the highest exploitation rate that will achieve a high probability of rebuilding and survival as measured over a 25 year period and against a baseline of zero harvest. WDFW fall chinook salmon tributary harvest rates are usually less than 10 percent. Tributary fisheries for the Coast Range, Cascade, and Columbia Gorge tule management units will be managed so as to not exceed the RERs in place for that run year. In the future, as more RERs are developed for other populations and refined, the FMEPs will adopt those RERs into the management of the tributary fisheries. The new and modified RERs are expected to reflect changes and approaches developed in recovery planning processes.

The Puget Sound chinook salmon ESU includes both spring and summer/fall components. Tables 11 through 17 contain brood year exploitation rates for stocks within the ESU for which CWT data are available. Exploitation rates among the Nooksack early, Skagit and White River spring chinook stocks have been very similar. Most of the harvest occurs in Canadian and Puget Sound fisheries. The long-term exploitation rates averaged 61 percent or greater (Tables 11-13). Total exploitation rates have declined for the most recent broods (1991-1998), averaging 41, 42, and 52 percent, respectively (Tables 11-13). This represents a decline of 23 to 48 percent in exploitation rate. The 1991-1998 brood exploitation rates in Puget Sound have averaged 12, 21 and 49 percent, respectively. The rate in U.S. Fraser Panel fisheries by themselves has averaged 4 percent or less from 1985-1990 and 1 percent or less in recent years. The higher exploitation rate on White River springs in Puget Sound may be the result of a delayed rearing strategy as part of the rebuilding program that generally results in high degree of residualization in Puget Sound waters. The Puget

Sound spring chinook stocks are subject to little harvest in PFMC fisheries. The long term average exploitation rate ranges from 1-4 percent. The estimated exploitation rate for the most recent brood years is 1 percent or less (Tables 11-13). Together, PFMC and U.S. Fraser Panel fisheries have accounted for 1-5 percent of the mortality on Puget Sound spring chinook salmon populations since the 1991 brood year (personal communication with D. Simmons, NMFS, April 1, 2004).

The distribution of Puget Sound summer/fall stocks is generally similar to spring stocks although their timing is such that they are subject to somewhat higher exploitation rates. Harvest of Puget Sound summer and fall chinook again occurs primarily in Canada and Puget Sound. The long-term average exploitation rate has ranged from 68 to 89 percent for a subset of the summer and fall stocks (Tables 14-17). The most recent brood years have been subject to average exploitation rates ranging from 39-67 percent (Table 14-17), or a decrease of 26-49 percent in total exploitation rate. The long-term average exploitation rate in Puget Sound fisheries (including U.S. Fraser Panel fisheries) ranged from 28 to 53 percent, and 13 to 55 percent for the most recent brood years. The rate in U.S. Fraser Panel fisheries by themselves has averaged 3 percent or less from 1985-1990 and 1 percent or less in recent years. The long-term average exploitation rates in PFMC fisheries ranged from 7-13 percent. For the 1991-1998 brood years, exploitation rates in PFMC fisheries have been 4 percent or less (Tables 14-17). Together, PFMC and U.S. Fraser Panel fisheries have accounted for 1-8 percent of the mortality on Puget Sound summer and fall chinook salmon populations since the 1991 brood year (personal communication with D. Simmons, NMFS, April 1, 2004).

There are two spring chinook populations in the **Strait of Georgia Region** including the North Fork Nooksack and the South Fork Nooksack. Both are watershed Category 1 populations. Nooksack spring chinook tend to migrate northward. As a result, the majority of harvest mortality occurs in British Columbia, which accounted for approximately 68 percent of fishery mortality from brood years 1991 through 1998 (approximately return years 1993-2002)(personal communication with D. Simmons, NMFS, April 1, 2004). On average, Alaskan fisheries accounted for 0 percent, Puget Sound commercial net and recreational fisheries for 30 percent, and PFMC fisheries for 2 percent (personal communication with D. Simmons, NMFS, April 1, 2004). The total exploitation rate on both populations has declined by 45 percent since the 1980's, averaging 74 percent from 1981 through 1984, and 41 percent from 1991 through 1998 brood years (personal communication with D. Simmons, NMFS, April 1, 2004).

The **Whidbey/Main Basin Region** includes the Skagit, Stillaguamish and Snohomish river systems (Figure 1, Table 3). The three basins contain 10 Category 1 chinook populations (PSTRT 2004a). As with the Nooksack spring populations, a large proportion of the harvest related mortality occurs to the north, outside of the jurisdiction of the state and Tribes. Based on yearling coded wire tag recoveries, Canadian fisheries accounted for 68 percent or more of mortality for Skagit spring, summer and fall chinook on average from 1993 through 1998 brood years (personal communication with D. Simmons, NMFS, April 1, 2004). Exploitation rates for summer and fall populations fell 55 percent from levels in excess of 60 percent during 1985-88, to an average in recent years of 27 percent (FRAM 2003). Over the same period, exploitation rates for spring chinook fell 48 percent, from an average of 81 percent during 1981-84 brood years to a recent average of 42 percent (personal communication with D. Simmons, NMFS, April 1, 2004).

A slightly higher proportion of the total harvest of the Stillaguamish Management Unit occurs in Canada than in Puget Sound (Table 14). In recent years, approximately 16 percent of Stillaguamish fishing-related mortality occurred in Alaska, 51 percent in Canada, 32 percent in Puget Sound commercial and recreational fisheries, and less than 1 percent in PFMC fisheries (personal communication with D. Simmons, NMFS, April 1, 2004). Exploitation rates have fallen 43 percent since the mid-1980's from rates averaging 68 percent to approximately 39 percent in recent years (personal communication with D. Simmons, NMFS, April 1, 2004)(Table 14).

Approximately 25 percent of fishing-related mortality on the Skykomish and Snoqualmie populations occurred in Alaska and Canada, 6 percent in PFMC, and 69 percent in Puget Sound net and recreational fisheries (PSC 2002). Exploitation rates have declined by 56 percent from rates of 62 percent in the early 1980's to an average of 27 percent in recent years (FRAM 2003).

The **Southern Basin region** contains four major chinook-bearing watersheds including Lake Washington, and the Duwamish-Green, Puyallup and Nisqually rivers (Figure 1, Table 3). The PSTRT identified six populations in the region (PSTRT 2004a). Three of the populations are designated watershed Category 1 and three Category 2. All three systems have been managed for hatchery harvest rates for decades. Data collection has begun to try to assess system productivities and to quantify the contribution of hatchery strays to escapements, but it will be several years before sufficient data are available for analysis. Beginning in 2000, management transitioned in the Nisqually and Puyallup systems from a focus on hatchery management to management objectives based on naturally spawning adults. In South Puget Sound, past strategies to maximize harvest of hatchery stocks resulted in exploitation rates 80 percent or more. Exploitation rates in recent years have been reduced 67 percent on average.

Unlike the populations in the Strait of Georgia and Whidbey/Main Basin regions, the majority of fishing-related mortality on Southern Basin populations has historically occurred in Puget Sound fisheries. For the 1991 through 1998 brood years, Canadian fisheries accounted for approximately 4-39 percent of fishing-related mortality, Puget Sound commercial and recreational fisheries 50-95 percent, PFMC fisheries 1-9 percent, and Alaska fisheries 2 percent or less (CTC 2003). Total exploitation rates have declined by 14 to 63 percent since the early 1980s averaging 75-92 percent in the 1980s for most populations, to 29 to 77 percent in recent years (Table 6)(FRAM 2003).

The **Hood Canal Region** has two fall chinook populations, one in the Skokomish River, and a second that is comprised of three Hood Canal tributaries (Dosewallips, Duckabush and Hamma Hamma Rivers)(PSTRT 2004a). Both the Skokomish and mid-Hood Canal Rivers populations are considered watershed Category 2 populations and thus are a composite of natural- and hatchery-origin fish that are genetically indistinguishable.

Coded-wire tag recoveries indicate Canadian fisheries accounted for 39 percent of harvest mortality, Alaskan fisheries 2 percent, Puget Sound commercial and sport fisheries 50 percent, and PFMC fisheries 9 percent from 1991 through 1998 brood years[8] (Table 17). The overall exploitation rate for Hood Canal summer-fall chinook salmon declined by 49 percent since the early 1990s, averaging 87 percent from 1985 through 1990 brood years, and 44 percent from 1991 through 1998 brood years (personal communication with D. Simmons, NMFS, April 1, 2004).

The **Strait of Juan de Fuca Region** has two watershed Category 1 populations including a native, spring-timed population on the Dungeness, and a native, fall-timed population on the Elwha (PSTRT 2004a). Both populations are considered critical due to chronically low spawning escapement levels (PSIT/WDFW 2004; and WDF *et al.* 1993) and rely on artificial propagation programs to sustain them.

Coded-wire tag data from 1991 through 1996, indicate British Columbia accounted for 54 percent of harvest mortality, Alaska 10 percent, Washington recreational fisheries 21 percent, Washington troll fisheries 5 percent, and Puget Sound net fisheries 9 percent (PSC data cited in NMFS 2000c). Exploitation rates have declined by 52 percent on average, from 76 percent in the 1980s to 37 percent in recent years (FRAM 2003).

There are no other tribal, local, private, or federal harvest actions unrelated to the actions considered in this opinion that substantially affect the environment of listed chinook in the action area. Harvest mortality that occurs in State waters of the action area are explicitly included in the assessment of harvest mortality associated with PFMC and Puget Sound fisheries so do not need to be considered separately here.

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[8] Managers assume marine harvest distribution of Mid-Hood Canal chinook similar to that of chinook from George Adams Hatchery; however, the terminal-area exploitation rate is lower because chinook fisheries are confined to southern Hood Canal and the Skokomish River.

Table 9. Summary of total adult equivalent exploitation rates for tule stocks from the Lower Columbia River chinook ESU (D. Simmons, NMFS, pers. comm. to S. Bishop, NMFS, April 1, 2004).

	Columbia River Tule (Cowlitz fall chinook)					
Brood Year	Total	SEAK	Canada	PFMC	Columbia R.	Other
1977	0.79	0.05	0.36	0.25	0.13	0.01
1978	0.71	0.05	0.28	0.30	0.07	0.01
1979	0.73	0.06	0.26	0.30	0.09	0.02
1980	0.63	0.04	0.33	0.13	0.12	0.01
1981	0.56	0.05	0.33	0.06	0.11	0.01
1982	0.71	0.06	0.27	0.14	0.25	0.00
1983	0.74	0.03	0.17	0.18	0.36	0.01
1984	0.71	0.03	0.18	0.19	0.29	0.00
1985	0.74	0.04	0.18	0.29	0.21	0.00
1986	0.51	0.05	0.18	0.17	0.09	0.03
1987	0.45	0.09	0.08	0.19	0.05	0.04
1988	0.50	0.05	0.30	0.10	0.03	0.01
1989	0.69	0.04	0.18	0.41	0.06	0.00
1990	0.41	0.03	0.07	0.13	0.17	0.00
1991	0.14	0.05	0.04	0.02	0.03	0.00
1992	0.18	0.04	0.04	0.08	0.00	0.01
1993	0.31	0.10	0.11	0.05	0.05	0.00
1994	0.49	0.07	0.10	0.27	0.05	0.00
1995	0.32	0.08	0.05	0.08	0.10	0.00
1996	0.59	0.04	0.22	0.19	0.15	0.00
1997	0.34	0.02	0.08	0.21	0.02	0.00
1998	0.52	0.06	0.08	0.33	0.05	0.00
1977-1984	0.70	0.05	0.27	0.20	0.18	0.01
1985-1990	0.55	0.05	0.17	0.22	0.10	0.01
1991-1998	0.36	0.06	0.09	0.15	0.06	0.00
Distribution of Fishing-Related Mortality						
1977-1984		6.6%	39.9%	28.0%	25.4%	1.2%
1985-1990		9.2%	30.4%	39.3%	18.7%	2.4%
1991-1998		16.5%	24.9%	42.7%	15.7%	0.3%

Table 10. Summary of total adult equivalent exploitation rates for the North Fork Lewis River bright stock from the Lower Columbia River chinook ESU (D. Simmons, NMFS, pers. comm. to S. Bishop, NMFS, April 1, 2004).

	Bright (Lewis River)					
Brood Year	Total	SEAK	Canada	PFMC	Columbia R.	Other
1977	0.52	0.08	0.20	0.06	0.16	0.02
1978	0.57	0.14	0.15	0.09	0.17	0.02
1979	0.51	0.09	0.17	0.07	0.17	0.01
1980						
1981						
1982	0.59	0.08	0.17	0.02	0.31	0.00
1983	0.68	0.06	0.20	0.05	0.35	0.01
1984	0.46	0.04	0.16	0.03	0.23	0.00
1985	0.45	0.06	0.12	0.07	0.18	0.02
1986	0.42	0.04	0.16	0.05	0.16	0.00
1987	0.38	0.04	0.14	0.05	0.14	0.01
1988	0.47	0.05	0.17	0.04	0.21	0.01
1989	0.42	0.00	0.07	0.05	0.31	0.00
1990	0.43	0.06	0.09	0.01	0.27	0.00
1991	0.31	0.11	0.07	0.02	0.11	0.00
1992	0.25	0.12	0.03	0.01	0.09	0.00
1993	0.28	0.08	0.05	0.00	0.15	0.00
1994	0.19	0.12	0.03	0.00	0.04	0.00
1995						
1996	0.14	0.06	0.00	0.03	0.05	0.00
1997	0.36	0.15	0.12	0.04	0.06	0.00
1998	0.54	0.09	0.12	0.21	0.13	0.00
1977-1984	0.55	0.08	0.17	0.06	0.23	0.01
1985-1990	0.43	0.04	0.12	0.04	0.21	0.01
1991-1998	0.30	0.11	0.06	0.04	0.09	0.00
Distribution of Fishing-Related Mortality						
1977-1984		14.7%	31.4%	10.0%	42.2%	1.7%
1985-1990		10.3%	28.8%	10.4%	49.0%	1.5%
1991-1998		35.5%	19.6%	14.5%	30.4%	0.0%

Table 11. **Summary of total adult equivalent exploitation rates for the Nooksack early stock (yearling component) from the Puget Sound chinook ESU** (D. Simmons, NMFS, pers. comm. to S. Bishop, NMFS, April 1, 2004**).**

	Nooksack Early (Yearling)					
Brood Year	Total	SEAK	Canada	PFMC	Puget Sound	Other
1977						
1978						
1979						
1980						
1981	0.80	0.03	0.57	0.00	0.20	0.00
1982	0.75	0.00	0.75	0.00	0.00	0.00
1983						
1984	0.66	0.00	0.52	0.01	0.14	0.00
1985						
1986	0.86	0.00	0.18	0.00	0.68	0.00
1987	0.54	0.00	0.30	0.02	0.22	0.00
1988	0.58	0.00	0.47	0.01	0.10	0.00
1989	0.56	0.03	0.41	0.02	0.11	0.00
1990	0.55	0.01	0.39	0.00	0.15	0.00
1991						
1992	0.37	0.00	0.26	0.00	0.11	0.00
1993	0.42	0.00	0.23	0.01	0.18	0.00
1994	0.39	0.00	0.24	0.00	0.16	0.00
1995	0.39	0.00	0.32	0.03	0.04	0.00
1996	0.48	0.00	0.35	0.01	0.12	0.00
1997						
1998						
1977-1984	0.74	0.01	0.61	0.00	0.11	0.00
1985-1990	0.62	0.01	0.35	0.01	0.25	0.00
1991-1996	0.41	0.00	0.28	0.01	0.12	0.00
Distribution of Fishing-Related Mortality						
1977-1984		1.3%	83.1%	0.3%	15.2%	0.0%
1985-1990		1.2%	56.8%	1.5%	40.6%	0.0%
1991-1996		0.0%	68.2%	2.3%	29.5%	0.0%

Table 12. Summary of total adult equivalent exploitation rates for the Skagit Spring stock (yearling component) from the Puget Sound chinook ESU (D. Simmons, NMFS, pers. comm. to S. Bishop, NMFS, April 1, 2004).

	Skagit Springs (Yearling)					
Brood Year	Total	SEAK	Canada	PFMC	Puget Sound	Other
1977						
1978						
1979						
1980						
1981	0.72	0.02	0.50	0.00	0.20	0.00
1982	0.83	0.00	0.66	0.01	0.17	0.00
1983	0.91	0.00	0.46	0.00	0.46	0.00
1984	0.78	0.01	0.34	0.00	0.37	0.00
1985	0.71	0.00	0.33	0.03	0.24	0.00
1986	0.73	0.01	0.37	0.04	0.30	0.00
1987	0.72	0.00	0.29	0.06	0.36	0.00
1988						
1989						
1990	0.57	0.00	0.37	0.02	0.16	0.00
1991						
1992						
1993	0.51	0.00	0.23	0.00	0.27	0.00
1994	0.41	0.02	0.22	0.00	0.17	0.00
1995	0.40	0.00	0.20	0.00	0.19	0.00
1996	0.25	0.00	0.12	0.00	0.13	0.00
1997	0.52	0.01	0.23	0.02	0.25	0.00
1998	0.41	0.00	0.17	0.00	0.23	0.00
1977-1984	0.81	0.01	0.49	0.00	0.30	0.00
1985-1990	0.68	0.00	0.34	0.04	0.27	0.00
1991-1998	0.42	0.00	0.19	0.00	0.21	0.00
Distribution of Fishing-Related Mortality						
1977-1984		1.3%	83.1%	0.3%	15.2%	0.0%
1985-1990		1.2%	56.8%	1.5%	40.6%	0.0%
1991-1998		0.0%	68.2%	2.3%	29.5%	0.0%

Table 13. **Summary of total adult equivalent exploitation rates for the White Spring stock from the Puget Sound chinook ESU (D. Simmons, NMFS, pers. comm. to S. Bishop, NMFS, April 1, 2004).**

	White River Spring					
Brood Year	Total	SEAK	Canada	PFMC	Puget Snd	Other
1977						
1978						
1979	0.90	0.00	0.01	0.05	0.84	0.00
1980	0.78	0.00	0.16	0.00	0.62	0.00
1981	0.51	0.00	0.00	0.00	0.51	0.00
1982	0.73	0.00	0.05	0.00	0.68	0.00
1983	0.78	0.00	0.04	0.02	0.72	0.00
1984	0.71	0.00	0.13	0.03	0.55	0.00
1985	0.70	0.00	0.03	0.03	0.64	0.00
1986	0.75	0.00	0.03	0.03	0.68	0.00
1987	0.68	0.00	0.03	0.03	0.61	0.00
1988	0.63	0.00	0.10	0.06	0.48	0.00
1989	0.63	0.00	0.03	0.02	0.58	0.00
1990	0.74	0.00	0.04	0.00	0.70	0.00
1991	0.55	0.00	0.01	0.00	0.54	0.00
1992	0.50	0.00	0.01	0.00	0.49	0.00
1993	0.46	0.00	0.01	0.00	0.45	0.00
1994	0.45	0.00	0.01	0.01	0.43	0.00
1995	0.39	0.00	0.01	0.00	0.38	0.00
1996	0.54	0.00	0.10	0.00	0.44	0.00
1997	0.74	0.00	0.00	0.01	0.72	0.00
1998						
1977-1984	0.68	0.00	0.05	0.01	0.62	0.00
1985-1990	0.69	0.00	0.04	0.03	0.62	0.00
1991-1997	0.52	0.00	0.01	0.00	0.49	0.00
Distribution of Fishing-Related Mortality						
1977-1984		0.0%	7.9%	1.8%	90.2%	0.0%
1985-1990		0.0%	6.4%	4.3%	89.3%	0.0%
1991-1997		0.0%	3.9%	0.8%	95.3%	0.0%

Table 14. **Summary of total adult equivalent exploitation rates for the Stillaguamish summer stock from the Puget Sound chinook ESU (D. Simmons, NMFS, pers. comm. to S. Bishop, NMFS, April 1, 2004).**

	Stillaguamish Fall					
Brood Year	Total	SEAK	Canada	PFMC	Puget Snd	Other
1977						
1978						
1979						
1980						
1981						
1982						
1983						
1984						
1985						
1986	0.66	0.00	0.32	0.05	0.28	0.00
1987	0.50	0.01	0.30	0.04	0.16	0.00
1988	0.70	0.00	0.26	0.12	0.32	0.00
1989	0.89	0.00	0.46	0.10	0.33	0.00
1990	0.66	0.01	0.28	0.03	0.34	0.00
1991	0.55	0.06	0.30	0.01	0.18	0.00
1992	0.40	0.01	0.25	0.01	0.13	0.00
1993	0.49	0.05	0.22	0.00	0.22	0.00
1994	0.44	0.11	0.18	0.00	0.16	0.00
1995	0.35	0.09	0.14	0.00	0.11	0.00
1996	0.30	0.07	0.17	0.00	0.06	0.00
1997	0.30	0.08	0.14	0.00	0.08	0.00
1998	0.28	0.01	0.18	0.00	0.09	0.00
1977-1984						
1985-1990	0.68	0.00	0.32	0.07	0.28	0.00
1991-1998	0.39	0.06	0.20	0.00	0.13	0.00
Distribution of Fishing-Related Mortality						
1977-1984						
1985-1990		0.4%	47.8%	10.1%	41.8%	0.0%
1991-1998		15.6%	50.9%	0.8%	32.7%	0.0%

Table 15. Summary of total adult equivalent exploitation rates for the Green River fall stock from the Puget Sound chinook ESU (D. Simmons, NMFS, pers. comm. to S. Bishop, NMFS, April 1, 2004).

	Green River fall (Green/Grovers Creek)					
Brood Year	Total	SEAK	Canada	PFMC	Puget Sound	Other
1978						
1979						
1980						
1981						
1982						
1983						
1984						
1985						
1986	0.81	0.00	0.27	0.10	0.44	0.00
1987	0.79	0.05	0.28	0.08	0.37	0.00
1988	0.84	0.00	0.29	0.11	0.44	0.00
1989	0.76	0.00	0.27	0.09	0.40	0.00
1990	0.75	0.00	0.30	0.02	0.42	0.00
1991	0.58	0.00	0.12	0.01	0.46	0.00
1992	0.58	0.01	0.12	0.04	0.41	0.00
1993	0.53	0.01	0.14	0.02	0.36	0.00
1994	0.47	0.01	0.15	0.02	0.29	0.00
1995	0.44	0.03	0.05	0.05	0.31	0.00
1996	0.60	0.01	0.19	0.03	0.37	0.00
1997	0.70	0.00	0.21	0.05	0.44	0.00
1998	0.73	0.01	0.20	0.04	0.48	0.00
1977-1984						
1985-1990	0.78	0.01	0.28	0.08	0.41	0.00
1991-1998	0.58	0.01	0.15	0.03	0.39	0.00
Distribution of Fishing-Related Mortality						
1977-1984						
1985-1990		1.4%	35.6%	10.3%	52.7%	0.0%
1991-1998		1.7%	25.5%	5.4%	67.4%	0.0%

Table 16. **Summary of total adult equivalent exploitation rates for the Nisqually fall (Kalama) stock from the Puget Sound chinook ESU (D. Simmons, NMFS, pers. comm. to S. Bishop, NMFS, April 1, 2004).**

	Nisqually fall					
Brood Year	Total	SEAK	Canada	PFMC	Puget Sound	Other
1977						
1978						
1979	0.98	0.00	0.39	0.06	0.53	0.00
1980	0.99	0.00	0.39	0.00	0.60	0.00
1981	0.97	0.00	0.25	0.01	0.71	0.00
1982	0.86	0.00	0.29	0.03	0.54	0.00
1983	0.92	0.00	0.32	0.01	0.59	0.00
1984	0.96	0.00	0.41	0.07	0.38	0.10
1985	0.83	0.00	0.23	0.08	0.51	0.00
1986	0.91	0.00	0.27	0.13	0.51	0.00
1987	0.87	0.00	0.08	0.20	0.57	0.01
1988	0.83	0.00	0.28	0.16	0.39	0.00
1989	0.84	0.00	0.25	0.11	0.48	0.00
1990	0.73	0.00	0.20	0.03	0.50	0.00
1991	0.57	0.00	0.10	0.02	0.44	0.00
1992	0.73	0.00	0.10	0.02	0.61	0.00
1993	0.66	0.00	0.11	0.01	0.54	0.00
1994	0.75	0.00	0.08	0.03	0.65	0.00
1995	0.57	0.00	0.07	0.00	0.50	0.00
1996	0.72	0.00	0.09	0.02	0.61	0.00
1997	0.65	0.00	0.12	0.02	0.51	0.00
1998	0.72	0.00	0.10	0.06	0.56	0.00
1977-1984	0.93	0.00	0.32	0.03	0.56	0.02
1985-1990	0.83	0.00	0.22	0.12	0.49	0.00
1991-1998	0.67	0.00	0.10	0.02	0.55	0.00
Distribution of Fishing-Related Mortality						
1977-1984		0.0%	34.0%	3.5%	59.9%	2.6%
1985-1990		0.0%	26.2%	14.2%	59.2%	0.5%
1991-1998		0.2%	14.2%	3.5%	82.1%	0.0%

Table 17. Summary of total adult equivalent exploitation rates for the Skokomish (George Adams) fall stock from the Puget Sound chinook ESU (D. Simmons, NMFS, pers. comm. to S. Bishop, NMFS, April 1, 2004).

	Skokomish fall (George Adams)					
Brood Year	Total	SEAK	Canada	PFMC	Puget Sound	Other
1977						
1978						
1979						
1980						
1981						
1982						
1983						
1984						
1985	0.91	0.00	0.20	0.12	0.58	0.00
1986	0.93	0.00	0.27	0.16	0.51	0.00
1987	0.87	0.01	0.29	0.12	0.45	0.00
1988	0.69	0.00	0.19	0.12	0.38	0.00
1989	0.87	0.00	0.45	0.15	0.27	0.00
1990	0.69	0.00	0.19	0.12	0.38	0.00
1991	0.51	0.00	0.23	0.01	0.27	0.00
1992	0.46	0.00	0.17	0.06	0.23	0.00
1993	0.45	0.02	0.09	0.01	0.16	0.00
1994	0.25	0.00	0.04	0.00	0.20	0.00
1995	0.29	0.02	0.09	0.01	0.16	0.00
1996	0.46	0.00	0.22	0.05	0.19	0.00
1997	0.59	0.01	0.25	0.07	0.25	0.00
1998	0.53	0.01	0.20	0.06	0.25	0.00
1977-1984						
1985-1990	0.87	0.00	0.27	0.13	0.46	0.00
1991-1998	0.44	0.01	0.17	0.04	0.22	0.00
Distribution of Fishing-Related Mortality						
1977-1984						
1985-1990		0.4%	30.9%	15.4%	53.2%	0.0%
1991-1998		1.9%	39.1%	8.6%	50.4%	0.0%

Table 18. **Summary of total adult equivalent exploitation rates for Puget Sound chinook populations based on the Fishery Regulation and Assessment harvest management model (FRAM)(FRAM 2003).**

Return Year	Skagit summer/fall	Snohomish	Dungeness/ Elwha	Lake Washington	Puyallup	Nooksack early	Skagit spring	White	Stillaguamish	Skokomish	Duwamish-Green	Nisqually
1983	0.78	0.73	0.77	0.82	0.82	0.48	0.74	0.55	0.69	0.79	0.86	
1984	0.72	0.63	0.62	0.75	0.75	0.43	0.62	0.35	0.58	0.67	0.57	0.91
1985	0.65	0.54	0.78	0.77	0.77	0.42	0.54	0.95	0.40	0.69	0.73	0.84
1986	0.59	0.60	0.88	0.68	0.68	0.41	0.54	0.41	0.58	0.80	0.57	0.89
1987	0.60	0.47	0.78	0.78	0.78	0.40	0.59	0.32	0.44	0.81	0.51	
1988	0.58	0.65	0.67	0.86	0.86	0.49	0.57	0.33	0.54	0.74	0.62	0.83
1989	0.71	0.51	0.68	0.75	0.75	0.36	0.73	0.33	0.44	0.76	0.59	0.90
1990	0.50	0.49	0.76	0.69	0.69	0.30	0.48	0.31	0.44	0.70	0.71	0.85
1991	0.54	0.51	0.75	0.81	0.81	0.34	0.63	0.44	0.36	0.68	0.64	0.78
1992	0.63	0.60	0.58	0.80	0.80	0.34	0.56	0.30	0.41	0.77	0.74	0.85
1993	0.65	0.60	0.54	0.61	0.61	0.30	0.46	0.22	0.27	0.61	0.74	0.82
1994	0.57	0.47	0.64	0.37	0.37	0.27	0.50	0.43	0.27	0.65	0.68	0.96
1995	0.60	0.62	0.48	0.31	0.31	0.23	0.46	0.31	0.40	0.35	0.37	0.89
1996	0.32	0.42	0.42	0.27	0.27	0.18	0.44	0.31	0.34	0.30	0.41	0.87
1997	0.38	0.29	0.34	0.29	0.29	0.21	0.41	0.20	0.29	0.37	0.31	0.76
1998	0.24	0.23	0.2	0.15	0.15	0.15	0.28	0.19	0.14	0.17	0.30	0.79
1999	0.33	0.3	0.45	0.19	0.19	0.16	0.21	0.25	0.19	0.45	0.28	0.80
2000	0.24	0.25	0.49	0.42	0.42	0.16	0.30	0.17	0.25	0.47	0.50	0.67
2001	0.40	0.23	0.18	0.27	0.27	0.18	0.21	0.17	0.17	0.26	0.49	0.57
2002	0.26	0.19	0.19	0.27	0.27	0.14	0.23	0.17	0.14	0.25	0.55	0.71
2003	0.48	0.19	0.22	0.31	0.31	0.20	0.23	0.18	0.17	0.26	0.50	0.76

NMFS is currently evaluating implementation of a resource management plan for Puget Sound chinook (RMP), jointly developed by the Washington Department of Fish and Wildlife, and the Puget Sound treaty tribes, under Limit 6 of the Endangered Species Act (ESA) 4(d) Rule. The proposed RMP would regulate commercial, recreational, ceremonial, and subsistence salmon fisheries potentially affecting the listed Puget Sound chinook salmon ESU within the marine and freshwater areas of Puget Sound. Harvest objectives specified in the RMP account for fisheries-related mortality of Puget Sound chinook throughout the migratory range of this species – from Oregon and Washington to Southeast Alaska, including salmon fisheries within the action area within the jurisdiction of the PFMC and U.S. Fraser Panel. The RMP also includes implementation, monitoring, and evaluation procedures designed to ensure fisheries are consistent with the RMP's objectives for conservation and use. Fisheries within the action area will be managed together with impacts in Puget Sound salmon fisheries after taking into account the mortality that has already occurred in SEAK and British Columbian fisheries, to meet the RERs, escapement goals and other harvest objectives detailed in the RMP (PSIT/WDFW 2004).

Recreational fisheries targeting on non-salmonid species have the potential to take chinook salmon. (Commercial fisheries on non-salmonid species have been discussed in the Environmental Baseline section of this opinion). Within the action area these are primarily fisheries for groundfish species. In general these species occupy different habitats and strata in the water column. The greatest potential for interaction occurs in a limited number of areas where chinook and the target species exist at similar depths. Chinook may also encounter groundfish gear as it is deployed. At this time the extent of these impacts are unquantified. However, an assessment of these impacts will be included in a Fishery Management and Evaluation Plan currently under development by WDFW.

3.3.5 Natural Factors Causing Variability in Population Abundance

Changes in the abundance of salmonid populations are substantially affected by changes in freshwater, estuarine and marine environments. For example, large scale climatic regimes, such as El Niño, cause changes in ocean productivity. Much of the Pacific coast was subject to a series of very dry years during the first part of the 1990s. In more recent years, severe flooding has adversely affected some stocks. For example, the low return of Lewis River bright fall chinook salmon in 1999 is attributed to flood events during 1995 and 1996.

Salmon and steelhead are exposed to high rates of natural predation, particularly during freshwater rearing and migration stages. Ocean predation may also contribute to natural mortality, although the levels of predation are largely unknown. In general, salmonids are prey for pelagic fishes, birds, and marine mammals, including harbor seals, sea lions, and killer whales. There have been recent concerns that rebounding seal and sea lion populations, following their protection under the Marine Mammal Protection Act of 1972, have resulted in substantial mortality for salmonids.

Recent evidence suggests that marine survival of salmon species fluctuates in response to 20-30 year long periods of either above or below average survival that is driven by long-term cycles of climatic conditions and ocean productivity (Beamish and Bouillon 1993; Beamish *et al.* 1999;

Cramer *et al.* 1999; Hare *et al.* 1999). This phenomenon has been referred to as the Pacific Decadal Oscillation (PDO) (Mantua *et al.* 1997). Poor ocean conditions that affect the productivity of Northwest salmonid populations appear to have been an important contributor to the decline of many populations prior to listing. The mechanism whereby stocks are affected is not well understood. The pattern of response to these changing ocean conditions has differed among stocks, presumably due to differences in their ocean timing and distribution. It is presumed that survival is driven largely by events occurring between ocean entry and recruitment to a sub-adult life stage. One indicator of early ocean survival can be computed as a ratio of coded-wire tag (CWT) recoveries of subadults relative to the number of CWTs released from that brood year. Time series of survival rate information for Lewis River fall chinook and Skagit fall chinook salmon show highly variable or declining trends in early ocean survival, with very low survival rates in recent brood years (personal communication with D. Simmons, NMFS, 2003). Ocean conditions may be improving which may have contributed to the increase in abundance observed in recent years for some populations, especially in the Columbia River. However, NMFS does not have data to corroborate an improved marine survival trend for Puget Sound chinook populations at this time. The survival and recovery of these species will depend on their ability to persist through periods of low ocean survival when stocks may depend on better quality freshwater habitat and lower relative harvest rates.

In this opinion, NMFS focuses on harvest, in the context of the environmental baseline and the current status of the species. Although harvest can be reduced in response to the species' depressed status and the reduced productivity that results from the degradations related to other human activities, the recovery of the listed species depends on improving the productivity of the natural populations in the wild. These improvements can only be made by addressing the factors of decline related to all of the H's that will be the subject of future opinions and recovery planning efforts.

Figure 5. Early ocean survival rate index for Green River chinook (Puget Sound chinook ESU)

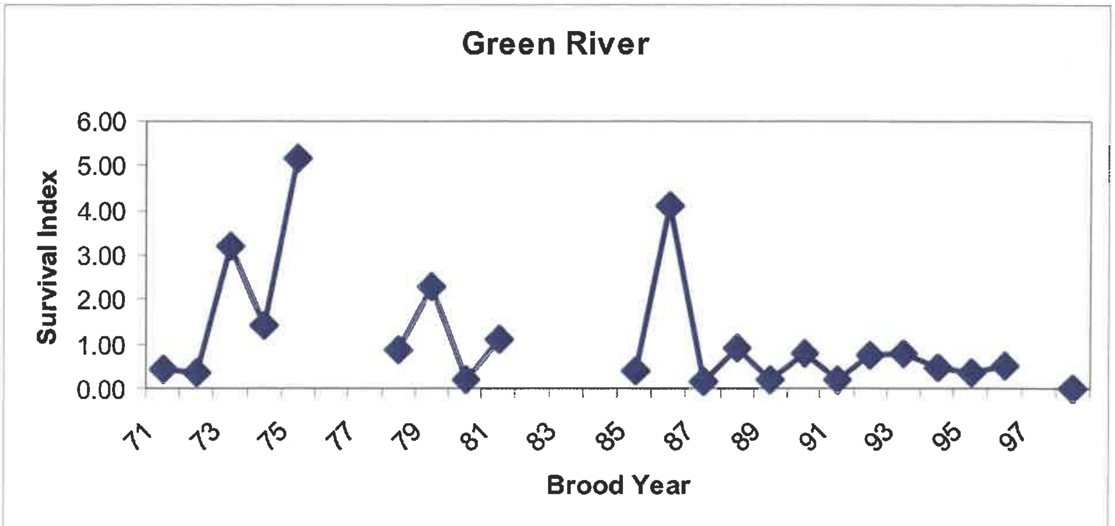
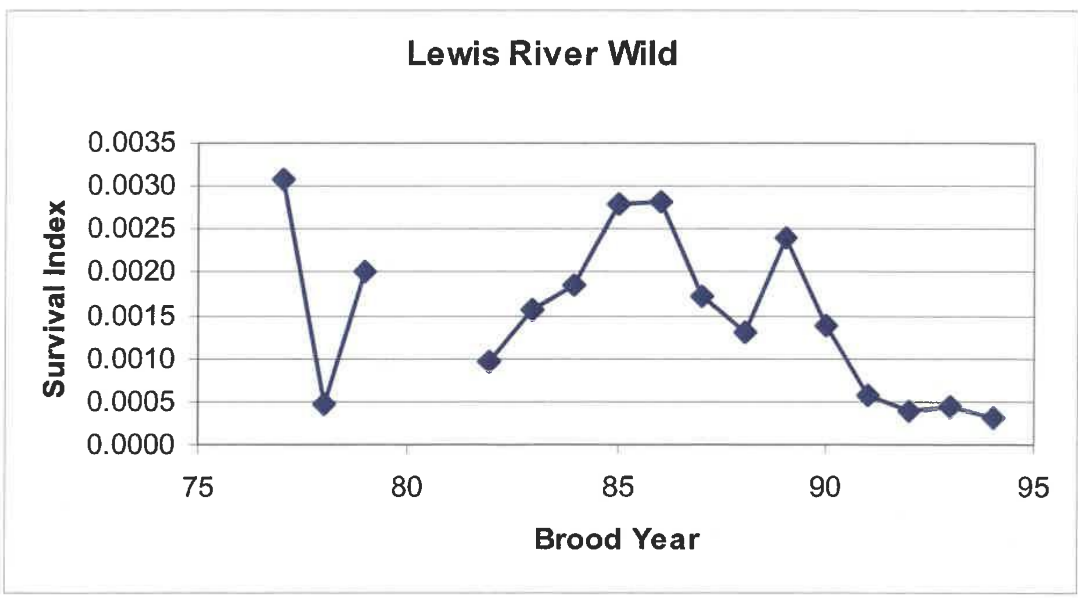


Figure 6. Early ocean survival rate index for Lewis River wild chinook (Lower Columbia River chinook ESU)



3.4 Analysis of Effects

3.4.1 Effects of the Proposed Actions on Species and on Critical Habitat

The standards for determining jeopardy are set forth in section 7(a)(2) of the ESA as defined at 50 CFR §402.02. This section of the Biological Opinion applies those standards in determining whether the proposed fisheries are likely to jeopardize the continued existence of one or more of the threatened or endangered salmon species (ESUs) that may be adversely affected by the fisheries, or adversely impact critical habitat. This analysis considers the direct, indirect, interrelated and interdependent effects of the proposed fisheries and compares them against the environmental baseline to determine if the proposed fisheries will appreciably reduce the likelihood of survival and recovery of these ESUs. Fishing activities may also result in non-lethal take associated with the operation of certain gear types or fishing methods, e.g., effects on fish behaviour. However, these effects are unknown and unquantifiable at this time.

3.4.1.1 Assessment Approach

Analysis of effects were based on quantitative assessments where possible and more qualitative considerations where necessary. Different methods and different types of information were used for the various ESUs and populations within ESUs, reflecting what was available or could be developed as part of this consultation. NMFS expects that more quantitative and holistic analyses and risk assessments will become available in time, and that standards may change as new information becomes available.

The method used to quantitatively assess the effects of fishing activities was developed with three objectives. First, NMFS sought to evaluate the proposed fisheries using biologically-based measures of the total exploitation rate that occurred across the entire migratory range of the species. Second, NMFS sought to use an approach that was consistent with the concepts developed by the Northwest Fisheries Science Center for the purpose of defining the conservation status of populations and ESUs, i.e.,Viable Salmonid Populations (VSP) (McElhany *et al.* 2000). Finally, NMFS sought to develop an approach for defining target exploitation rates that could be related directly to the regulatory definition of jeopardy. The product of this approach is a Rebuilding Exploitation Rate (RER) for representative populations within each ESU (NMFS 2000f). NMFS can then evaluate the proposed fisheries, in part, by comparing the RERs to population-specific exploitation rates that can be anticipated as a result of the expected fishing-related mortality from the implementation of the PFMC or U.S. Fraser Panel regulations, recognizing that the jeopardy determination must be made with respect to the overall ESU. To date, RERs have been developed for a limited set of populations in the Puget Sound chinook ESU and for the Coweeman population in the Lower Columbia River chinook ESU. NMFS has used RERs as part of its assessment of proposed harvest actions in several biological opinions and application of take limits under the ESA 4(d) Rule since 1999 (NMFS 1999c, NMFS 2000c, NMFS 2001a, NMFS 2003a).

Where available, exploitation rates and escapement are compared to population-specific conservation standards established by NMFS to ascertain whether fisheries will appreciably reduce survival and recovery of the ESU. Conservation standards are represented by RERs, critical escapement thresholds (CET) and viable escapement thresholds (VETs).

Rebuilding Exploitation Rates (RER): the highest rate of harvest that will achieve the following ESA conservation criteria. Over the long term (25 years), harvest at the RER level will achieve: 1a) a high (80%) probability of rebuilding or 1b) no more than a 10 percentage point reduction in the probability of rebuilding, and 2) a very low (5%) probability of the population falling to the critical threshold compared with a zero harvest baseline. Fishing regimes that exert harvest rates below the RER level, by definition, do not pose jeopardy to the ESU. Fishing regimes above the RERs may also not pose jeopardy to the ESU depending on the status and distribution of the chinook salmon populations throughout the ESU.

Critical escapement threshold (CET): a point of biological instability, below which the risk of extinction increases substantially, due to declining spawning success, depensatory mortality, or risk of loss of genetic integrity. This point is not precisely known for any population, but may be estimated by risk assessment if the current productivity of a population can be estimated. Based on theoretical assessment of ecological and genetic risk (McElhany *et al.* 2000; NMFS 2000f; NMFS 2001a) a generic critical threshold of 200 adults has been used for populations for which population-specific data is unavailable or insufficient to estimate productivity.

Viable escapement threshold (VET): (in the context of this analysis) is a level of spawning escapement associated with rebuilding populations to recovery, consistent with current environmental conditions. For most populations these thresholds are well below the escapement levels associated with full recovery, but achieving these goals under current conditions is a necessary step to eventual recovery when habitat and other conditions are more favorable. Where data are available, viable escapement thresholds have been defined consistent with the current productivity and capacity of spawning habitat. Where such information is not available, the generic viable threshold (1,250 adults) defined by NMFS for Viable Salmonid Populations (McElhany *et al.* 2000; NMFS 2000f; NMFS 2001a) is used as a reference point. By definition these generic thresholds offer only general guidance as to what generally represents points of stability or instability. Some populations may be fairly robust at very low abundances, while chinook salmon populations in large river systems may become unstable at higher abundances depending on resource location and spawner density. However, without population-specific information, these generic guidelines offer the best available information.

The RERs, viable and critical thresholds against which they were derived and the projected near term total exploitation rates are summarized in Table 19.

Table 19. RERs assuming low survival rates (average rates for Coweeman), and the critical and viable escapement thresholds used in the Risk Assessment Procedure. RERs are expressed as both CWT rates and equivalent rates compatible with the Fisheries Regulation Assessment Model (FRAM) used for domestic harvest management planning.

ESU	Management Unit	Population	Recovery Exploitation Rates		Escapement Threshold	
			CWT	FRAM	Critical	Viable
Puget Sound	Nooksack early	NF Nooksack SF Nooksack	0.21	0.12	400	500
	Skagit spring	Suiattle/SP	0.50	0.41	170	400
		Upper Sauk/SP	0.46	0.38	130	330
	Skagit summer/ fall	Upper Skagit/S	0.54	0.60	967	7,454
		Lower Skagit/F	0.33	0.49	251	2,182
		Lower Sauk/S	0.36	0.51	200	681
	Stillaguamish summer/fall	NF Stillaguamish/S	0.45	0.32	300	552
		SF Stillaguamish/F	0.28	0.24	200	300
	Snohomish summer/fall	Skykomish	0.24	0.18	1,650	3,500
	Duwamish-Green	Duwamish-Green River S/F	0.62	0.53	835	5,523
L. Col. River		Coweeman (Tule)	0.49	NA	200	330

/1 PSC model calibration 2004

Because RER objectives are expressed in terms of a total exploitation rate and some of the associated impacts occur in Canadian and Alaskan fisheries, it is necessary to make assumptions about anticipated impacts in the northern fisheries. In general, Alaskan fisheries will be managed up to the limits allowed under the PST agreement, and Canadian fisheries will be managed up to the PST limit for most fisheries. Assumptions about fishing levels in these northern fisheries were incorporated into the modeling analysis of impacts in previous opinions and 4(d) determinations (NMFS 1999c, NMFS 2001c, NMFS 2003a) and a Draft Environmental Impact Statement which evaluates the implementation of a proposed fishing plan for Puget Sound chinook salmon under the ESA 4(d) Rule currently under public review (NMFS 2004).

Estimated impacts from the fisheries authorized by the proposed Federal actions vary by population, consistent with population-specific management objectives. Through the pre-season harvest management planning process, the impacts to Puget Sound and Lower Columbia River chinook populations from various fishery harvest regimes are evaluated by a fishery model (Fishery Regulation Assessment Modeling or FRAM). The Puget Sound and the PFMC fisheries are considered in concert during this pre-season planning process to develop the various harvest regime model inputs.

For the 2004 fishing season, FRAM model run 1604 (dated April 14, 2004) is the final product of this pre-season PFMC planning process. Anticipated exploitation rates for the PFMC southern U.S. (SUS), non-PFMC SUS, and the combined Canadian and Alaska fisheries, along with the projected natural escapement of Puget Sound chinook salmon by management unit are depicted in Table 20. Initial regulations enacted for the 2004 fishing season will implement the harvest regime used to produce FRAM model run 1604. Regulations for the Puget Sound salmon fisheries may be modified in-season by the co-managers based on abundance, timing, and fishery monitoring information. Any modification to the regulations in-season must be consistent with the management objectives described during preseason planning. Although NMFS has not yet made its determination under the 4(d) Rule, the co-managers have indicated their intent to manage the 2004 fisheries under the terms of the 2004-2009 Puget Sound chinook harvest resource management plan.

NMFS is also preparing an Environmental Impact Statement (EIS) associated with its evaluation of a six year RMP for Puget Sound chinook salmon under the 4(d) Rule. As part of the analysis, NMFS assessed the range of escapements and exploitation rates that might occur for Puget Sound chinook populations under implementation of the proposed RMP over its six year duration. The modeling is similarly being conducted using the FRAM model. This information is being used to assess the likely impacts of the proposed actions in the near term, i.e., through the 2009 fishing year.

Table 20. **Total projected 2004 FRAM adult equivalent exploitation rates on Puget Sound and Lower Columbia River populations in various fisheries compared with their RER and a reasonable range of near term expected exploitation rates (%) (FRAM 2004, NMFS 2004).**

ESU	Management Unit	SE Alaska (all gear)	Canada (all gear)	PFMC (troll and sport)	Total ocean	U.S. Fraser Panel	Puget Sound Total	Columbia River	Total	Expected near term expl. rates	RER
Puget Sound	Nooksack Early	2	19	1	22	<1	5	0	27	20-26	12
	Skagit Spring	<1	16	1	18	1	16	0	33	23-28	38
RER Stocks	Skagit Summer/Fall	4	28	<1	33	<1	6	0	38	48-56	49
	Stillaguamish	<1	13	1	15	<1	8	0	23	17-20	24
	Snohomish	1	15	1	17	<1	12	0	29	19-23	18
	Duwamish-Green	1	24	3	28	<1	34	0	62	49-63	53
Non RER Stocks	Dungeness/Elwha	3	17	1	21	<1	4	0	24	22-29	
	Lake Washington	1	24	3	28	<1	15	0	43	31-38	
	White River	0	1	1	2	0	17	0	19	20	
	Puyallup	1	24	3	28	<1	23	0	50	49-50	
	Nisqually	1	13	3	17	<1	59	0	76	64-76	
	mid-Hood Canal	0	19	3	22	<1	8	0	31	26-34	
	Skokomish	0	19	3	22	<1	30	0	52	45-63	
Lower Columbia R.	Coweeman	7	13	16	36	0	0	10	46		49
	L. Columbia spring	2	3	7	12	0	0	4	16		
	N. Fork Lewis	12	6	5	23	0	0	15	38		

3.4.1.2 Puget Sound Chinook

As presented in sections 3.2 (Status) and 3.3 (Environmental Baseline), the Puget Sound chinook salmon ESU is composed of spring, summer and fall run stocks. All Puget Sound chinook populations are impacted by ocean fisheries off Alaska, Canada, and the southern U.S. They are subject to substantial recreational and commercial fisheries inside Puget Sound. Exploitation rates in PFMC and U.S. Fraser Panel fisheries on Puget Sound spring chinook historically have been low, averaging 0 to 8 percent. In recent years, as catches have been reduced to protect weak stocks, estimated exploitation rates in PFMC and U.S. Fraser Panel fisheries have been 0 to 2 percent for Puget Sound spring stocks (Tables 11-13). The 2004 model estimates are for a PFMC exploitation rate of 1 percent and an ocean fishery exploitation rate of 2 to 22 percent depending on the population (Table 20). Exploitation rates in U.S. Fraser Panel fisheries are expected to be 1.2 percent or less. This suggests that rates in the PFMC and U.S. Fraser Panel fisheries will continue to remain low. Exploitation rates in southern U.S. fisheries, including those in PFMC and U.S. Fraser Panel waters, are expected to range from 7 to 19 percent (NMFS 2004). Total exploitation rates on Puget Sound spring chinook populations over the next several years are expected to range from 19 to 33 percent (FRAM 2004; NMFS 2004)(Table 20).

For spring-type populations, to date, RERs have been developed for the Skagit spring chinook populations and the Nooksack early chinook salmon management unit. The anticipated exploitation rate in PFMC and U.S. Fraser Panel fisheries and the total ocean exploitation rates (including Alaskan and Canadian fisheries) are anticipated to be well below the RERs for the Skagit spring populations (Table 20). Total projected exploitation rates both in 2004 and in the near term are also expected to fall below the RERs for the Skagit spring populations (Table 20). The exploitation rates for the PFMC and U.S. Fraser Panel fisheries are well below the RER for the Nooksack early management unit, but the total ocean exploitation rate is expected to exceed the RER (Table 20). The RER for the Nooksack early management unit is not expected to be met in 2004 or in the near term, even with total closure of all southern U.S. fisheries.

In general, in the near term escapements for Puget Sound spring chinook salmon populations are expected to remain stable or continue to increase when compared with recent year average escapement (Table 21). Both the Skagit and White River populations are expected to exceed their viable escapement thresholds. Escapements for the Dungeness and Nooksack chinook populations in 2004 are expected to exceed the post-listing average, and in the case of the Nooksack, exceed the current optimum escapement under existing habitat conditions. Since so much of the harvest occurs within Canadian fisheries and escapements have been variable in recent years, escapements in the longer term are less certain. Depending on these two parameters, escapements may approach or fall below the critical escapement thresholds or may be well above their critical thresholds. Both these populations depend heavily on their associated hatchery conservation programs which are listed as essential to recovery of the ESU.

Exploitation rates in combined PFMC and U.S. Fraser Panel fisheries on Puget Sound summer and fall chinook populations historically have been low, averaging 2 to16 percent (Tables 14-17).

In recent years, as ocean catches have been reduced to protect weak stocks, estimated exploitation rates in combined PFMC and U.S. Fraser Panel fisheries have declined, averaging 0 to 5 percent (Tables 14-17). The 2004 model estimates are for a PFMC exploitation rate on Puget Sound summer/fall chinook salmon populations of 1 to 3 percent and a total ocean exploitation rate of 15 to 33 percent. Exploitation rates in U.S. Fraser Panel fisheries are expected to be 1.2 percent or less. This suggests that impacts on listed chinook in the PFMC and U.S. Fraser Panel fisheries will remain low. Exploitation rates in southern U.S. fisheries, including those in PFMC and U.S. Fraser Panel waters are expected to range from 5 to 59 percent (FRAM 2004; NMFS 2004)(Table 20). Total exploitation rates on Puget Sound summer and fall chinook populations over the next several years are expected to range from 17 to 76 percent (FRAM 2004; NMFS 2004).

For Puget Sound summer and fall-type populations, to date, RERs have been developed for populations in the Skagit, Snohomish, Stillaguamish, and Duwamish-Green River chinook salmon management units. The anticipated exploitation rate in PFMC and U.S. Fraser Panel fisheries and the total ocean exploitation rates (including Alaskan and Canadian fisheries) are anticipated to be well below the RERs for the Skagit, Stillaguamish and Green River chinook populations (Table 20). The exploitation rate in PFMC and U.S. Fraser Panel fisheries is well below the RER for the Snohomish populations (<2%), but when added to the mortality that is projected to occur in Alaskan and Canadian fisheries (16%) in 2004, it is just below the Snohomish RER of 18 percent (Table 20). Total projected exploitation rates over the next several years are expected to fall below the RERs for the Stillaguamish populations (Table 20). Total projected exploitation rates in 2004 and possibly through 2009 are expected to exceed the RER for the Duwamish-Green chinook population in some years, but escapements are expected to remain above the co-manager escapement goal of 5,800 and the viable escapement threshold of 5,500. The 2004 total exploitation rate for the Skagit summer-fall chinook management unit is anticipated to be below its RER of 49 percent (Table 20), the most constraining of the three Skagit summer-fall RERs (Table 19). Although the total exploitation rate in the near term (through 2009) may exceed the RER, the modeling on which these estimates were based assumed abundance and age composition similar to that anticipated in 2003. Anomalous age structure observed in the 2003 return make the estimates of near term exploitation rates a likely overestimate of the projected exploitation rates. Even with the addition of pink fisheries in odd years, exploitation rates for Skagit summer-fall chinook are likely to resemble exploitation rates seen in recent years of 24-40 percent (Table 18), below the RERs for all three populations.

In the near term, escapements for Puget Sound summer and fall chinook salmon populations are expected to remain stable or continue to increase when compared with recent year average escapement (Table 21). In addition, chinook populations in five of the ten (Skagit, Puyallup, Nisqually and Skokomish and Duwamish-Green) management units are expected to exceed their viable escapement thresholds (Table 21). Escapements for the Stillaguamish chinook populations in 2004 are expected to exceed the post-listing average, and approach or exceed current optimum escapement under existing habitat conditions. Escapements for the Skykomish and Elwha chinook populations are anticipated to be well above their critical thresholds and of similar magnitude to the 1999-2002 average in the near term (NMFS 2004). The 2004 escapement for the Skykomish population is projected to be well above both recent years' average escapement and its viable escapement threshold (personal communication with K. Rawson, Tulalip Tribe, April 13, 2004).

Escapements to the Cedar River in Lake Washington and the mid-Hood Canal tributaries are anticipated to remain above their critical escapement thresholds but generally below recent year averages (Table 21). Total escapement estimates for the Cedar River population are based on an expansion of a live count of fish. However, Cedar River redd counts suggests that this expansion of the live count may be an underestimate of the total escapement (personal communication with P. Hage, Muckleshoot Tribe, February 10, 2004). Therefore, a direct comparison of Cedar River escapements, based on an expansion of a live count, with the VSP generic guidance for a critical threshold of 200 fish should be considered conservative, as the total escapements are likely greater.

Although, the Mid-Hood Canal Management Unit has exhibited an increasing escapement trend since listing, escapement trends in the individual rivers comprising the Mid-Hood Canal tributaries population have not varied uniformly. In recent years, the spawning aggregation in the Hamma Hamma River has generally comprised the majority of the Mid-Hood Canal tributaries population. In comparison, the Dosewallips River has seen a decrease in escapement during this same time period. Spawning levels below 40 fish have been observed in recent years in the Duckabush and Dosewallips Rivers. However, exchange among the three spawning aggregations within the Mid-Hood Canal Management Unit, and with other Hood Canal natural and hatchery populations is probable (personal communication with W. Beattie, Northwest Indian Fisheries Commission, January 31, 2004). The demographic risks to the Mid-Hood Canal tributaries population may be buffered by this straying at all abundance levels.

As mentioned in the Environmental Baseline section (3.3.4), NMFS is currently evaluating implementation of a resource management plan for Puget Sound chinook (RMP) under Limit 6 of the Endangered Species Act (ESA) 4(d) Rule. The proposed RMP would be in effect for the 2004-2009 fishing years and describes the implementation of commercial, recreational, ceremonial, and subsistence salmon fisheries potentially affecting the listed Puget Sound chinook salmon ESU within the marine and freshwater areas of Puget Sound. Fisheries within the action area for this biological opinion would be managed together with impacts in Puget Sound salmon fisheries, after taking into account the mortality that is expected to occur in SEAK and British Columbian fisheries, to meet the RERs, escapement goals and other harvest objectives detailed in the RMP (PSIT/WDFW 2004). NMFS' proposed evaluation and recommended determination of the RMP under the ESA is currently undergoing public comment. In that proposed evaluation, NMFS has tentatively concluded that the proposed RMP would not appreciably decrease the likelihood of survival and recovery of the Puget Sound chinook salmon ESU and therefore is proposing to approve the RMP under the 4(d) Rule (NMFS 2004). Although NMFS' determination on this particular RMP is only proposed, NMFS has evaluated two previous RMPs in 2001 and 2003 that were similar to the RMP currently under evaluation and approved them under the 4(d) Rule (NMFS 2001a; NMFS 2003a). Anticipated southern U.S. exploitation rates for all management units are within the range evaluated in NMFS' previous 4(d) determinations for Puget Sound chinook plans and escapements have increased since the implementation of the 2001 RMP. With the exception of the Lake Washington and Snohomish management units, total exploitation rates are also expected to be within the range previously analyzed. Anticipated 2004 and near term total exploitation rates for these management units are higher than those previously evaluated. However, escapements for the Snohomish are expected to remain near or above the recent year average, with the 2004 expected escapement being the highest in the database. Escapements for the Cedar River are expected to remain above the critical threshold but below the viable threshold.

Table 21. Projected 2004 escapements for Puget Sound chinook populations compared with recent average escapements and escapement objectives (FRAM 2004; personal communication with K. Rawson, Tulalip Tribe, April 13, 2004).

Management Unit	Population	Expected escapement 2004	Expected escapement near term (2005-2009)	1999-2002 average	Escapement thresholds Critical	Escapement thresholds Viable	Escapement thresholds Goal
Nooksack Early		570	252-388	429	400	500	
Skagit Spring		1,183	1,270-1,921	1,075			
	Suiattle	433		380	170	400	
	Upper Sauk	406		364	130	330	
	Upper Cascade	344		330	170		
Skagit Summer/Fall		19,929	7,551-11,633	13,810			
	Upper Skagit	16,182		10,144	967	7,454	
	Lower Skagit	2,870		2,944	200	2,182	
	Lower Sauk	877		721	251	681	
Stillaguamish		1,891	1,584-2,322	980			
	N. Fork Stillaguamish	1,537		697	300	552	
	S. Fork Stillaguamish	354		283	200	300	
Snohomish		9,341	3,399-5,073	3,936			
	Skykomish	4,351		2,118	1,650	3,500	
	Snoqualmie	4,990		1,818			
Duwamish-Green	Duwamish-Green	5,898	≥5,800	9,299	835	5,500	5,800
Dungeness	Dungeness	461	231-356	345	200	925	
Elwha	Elwha	2,310	1,395-2,125	2,009	200	2,900	
Lake Washington	Cedar River	414	428-610	767	200	1,250	
White River	White River	1,705	1,011-1,468	1,220	200	1,000	
Puyallup	Puyallup	2,149	1,798-2,419	1,672	200	1,200	
Nisqually	Nisqually	2,079	≥1,100	1,318	200	1,100	1,100
Mid-Hood Canal	Mid-Canal Tribs	298	344-531	404	200	1,250	
Skokomish	Skokomish	1,262	>1,200	1,483	200	1,250	1,200

3.4.1.3 Lower Columbia River Chinook

As discussed earlier, the Lower Columbia River chinook ESU is composed of spring run, and fall run tule and bright fall life history types. The population structure of the ESU is currently under review (WLCTRT 2002). Until that review is complete, it is reasonable to evaluate the spring, tule, and bright life history types separately with respect to their status and the effect of the proposed action. The effects analysis therefore treats each life history type independently and, where possible, also considers the status of and anticipated effect on individual stocks.

The remaining spring stocks within the ESU include those on the Cowlitz, Kalama, and Lewis rivers. These spring stocks have a wider ocean distribution than most stocks originating in the lower Columbia River, and are impacted by ocean fisheries off Alaska, Canada, and the southern U.S. They were also subject, in past years, to substantial recreational and commercial fisheries inside the Columbia. Exploitation in PFMC fisheries has been low. The chinook management model base period (1979-82) exploitation rate for the Cowlitz River spring chinook was 12 percent for the PFMC fisheries. The 2004 model estimates are for a PFMC exploitation rate of 7 percent and a total ocean fishery exploitation rate of 12 percent (Table 20). This suggests that rates in the PFMC fisheries will continue to remain low. Harvest in mainstem fisheries in the Lower Columbia River will also be low, on the order of 10 percent or less and probably closer to 5 percent on average based on the terms of the recently approved FMEPs (NMFS 2003b). The exploitation rate expected in 2004 in-river fisheries is 4 percent. Catch of Lower Columbia River spring stocks in U.S. Fraser Panel fisheries is a rare event.

Although some spring chinook spawn naturally in each of these rivers, the historic habitat for spring chinook is now largely inaccessible. For the time being, the remaining spring stocks depend on the associated hatchery production programs. The hatcheries have met their escapement objectives in recent years, thus insuring that what remains of the genetic legacy is preserved. Harvest constraints for other Columbia Basin stocks will provide additional protection for the hatchery programs until such time that a more comprehensive recovery plan is implemented. Natural escapements for the Sandy, Lewis and Kalama Rivers have increased in recent years. Cowlitz escapement has remained stable, although 2002 and 2003 escapements were significantly higher than those in previous years (Table 7).

Tule stocks in the ESU include those on the Coweeman, East Fork Lewis, and Clackamas rivers. The interim escapement goals on the Coweeman and East Fork Lewis are 1,000 and 300, respectively. Escapements have been below these goals in eight of the past eleven years for the both stocks. The 10 year average escapement for the Coweeman is 730, compared to a recent 5 year average of 560 (range= 90-1,082). In the East Fork Lewis, the 10 year average escapement is 220, compared to a recent 5 year average of 330 (range = 50-740).

Until recently tule hatchery production has been prioritized to support PFMC and Lower Columbia River fisheries, thus providing the potential for very high exploitation rates. The tule stocks are north migrating, but are most vulnerable to catch in fisheries off the Washington coast, in West Coast Vancouver Island (WCVI) fisheries, and in the lower river. In recent years, ESA and other unrelated conservation constraints have substantially limited these fisheries. A RER for the Coweeman stock was first derived in 2000 (65%) and updated in 2002 (49%). Fisheries since that time have been managed so that impacts on Lower Columbia River tule stocks do not exceed the RER. Exploitation rates in the PFMC fisheries averaged 21 percent through the 1990 brood year, but declined to 15 percent more recently (Table 9). The 2004 model estimates are for a PFMC exploitation rate of 16 percent and a total ocean fishery exploitation rate of 36 percent (Table 20). This suggests that rates in the PFMC fisheries will continue to remain at moderate levels, and less than what they were through the 1980s. As described in the FMEPs (NMFS 2003b), fisheries will be managed to not exceed an RER of 49 percent based on the Coweeman population. The expected total exploitation rate in 2004 for the Coweeman stock is 46 percent (Table 20), below the RER of 49 percent.

Three natural-origin bright stocks have also been identified. Exploitation rates on Columbia River bright stocks in PFMC and Puget Sound fisheries (including U.S. Fraser Panel fisheries) have been low even in years when fisheries were relatively unconstrained. Therefore, exploitation rates on Lower Columbia River brights in these fisheries are expected to remain low. The total brood year exploitation rate on bright stocks averaged 49 percent through 1990 with a rate of 5 percent in PFMC fisheries (Table 10). The average exploitation rate for the more recent broods was 30 percent with a rate of 4 percent in PFMC fisheries. The model estimates for the 2004 fisheries are for a total exploitation rate in ocean fisheries of 23 percent including 5 percent in PFMC fisheries (Table 20).

There is a relatively large and healthy stock on the North Fork Lewis River. The escapement goal for this system is 5,700. That goal has been met, and often exceeded by a substantial margin, every year since 1980, except for 1999 (Table 8). The Sandy and East Fork Lewis stocks are much smaller. Escapements to the Sandy have been stable and on the order of 600 to 1,000 fish per year in nine of the last 11 years (range = 80-2,220). Less is known about the East Fork stock, but it has been stable in abundance, on the order of 100 fish per year (range = 50-170), until the last three years, when escapements increased dramatically (220-560). Escapements in all three rivers have increased substantially since 2001 (Table 8).

3.4.2 Cumulative Effects

Cumulative effects are those effects defined in 50 CFR 402. Cumulative effects 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 action are not considered in this section because they require separate consultation pursuant to Section 7 of the ESA. Non-Federal actions that require authorization under other sections of the ESA, and not included here, will be considered in separate section 7 consultations. Non-Federal actions such as actions taken by tribal, state and local governments will likely to be in the form of legislation, administrative rules or policy initiatives. Government and private actions may include changes in land and water uses, including ownership and intensity, any of which could impact listed species or their habitat. Government actions are subject to political, legislative and fiscal uncertainties. These realities, added to the geographic scope of the action area that encompasses numerous government entities exercising various authorities and the many private landholdings, make any analysis of cumulative effects difficult and speculative.

Representative State Actions - The Washington state government is cooperating with other governments to increase environmental protection for listed ESUs, including developing and applying better habitat restoration, hatchery and harvest reforms, and water resource management. The following list of major efforts and programs, described in the Summer Chum Salmon Conservation Initiative (WDFW/PNPTC 2000) are directed at or are contributing to the recovery of Puget Sound chinook salmon:

- Washington Wildlife and Recreation Program
- Wild Stock Restoration Initiative
- Joint Wild Salmonid Policy
- 1994 - Hood Canal Coordinating Council
- Governor's Salmon Recovery Office
- Conservation Commission
- Salmon Recovery Lead Entities
- Salmon Recovery Funding Board Forest and Fish Report
- Growth Management Act

There are other proposals, rules, policies, initiatives, and government processes that help conserve marine resources in the Puget Sound, improve the habitat of listed species, and assist in recovery planning. As with the above state initiatives, these programs could benefit the listed species if implemented and sustained.

In the past, Washington State's economy was heavily dependent on natural resources, with intense resource extraction activity occurring. Changes have occurred in the last decade and are likely to continue with less large scale resource extraction, more targeted extraction methods, and substantial growth in other economic sectors. Growth in new businesses is creating urbanization pressures and has contributed to population growth and movement in the Puget Sound area, a trend likely to continue for the next few decades. Such trends will place greater demands in the action area for electricity, water and buildable land; will affect water quality directly and indirectly, and will increase the need for transportation, communication and other infrastructure development. These impacts will affect habitat features, such as water quality and quantity, that are important to the survival and recovery of the listed species. The overall effect is likely to be negative, unless carefully planned and mitigated for through the initiatives and measures listed above.

Local Actions: Local governments will be faced with similar but more direct pressures from population increases and attendant activities. There will be demands for intensified development in rural areas as well as increased demands for water, municipal infrastructure and other resources. The reaction of local governments to such pressures is difficult to assess at this time given the lack of certainty in policy and funding. In the past local governments in the action area generally accommodated additional growth in ways that adversely affected listed fish habitat, allowing for development to destroy wetlands, stream-banks, estuarine shorelines, and other areas critical to listed species. This situation still applies, although a broad and gradual change in attitude towards planning may be occurring.

Some local government programs, if submitted for consideration, may qualify for limitation in the application of take prohibitions under the NMFS' ESA section 4(d) rule, which is designed to conserve listed species. Local governments also may participate in regional watershed health programs, although political will and funding will determine participation and therefore the effect of such actions on listed species. Overall, without comprehensive and cohesive beneficial programs and the sustained application of such programs, it is likely that local actions will have few measurable positive effects on listed species and their habitat, and may even contribute to further degradation.

Tribal Actions: Tribal governments participate in cooperative efforts involving watershed and basin planning designed to improve fish habitat and are expected to continue to do so. The results from changes in tribal forest and agriculture practices, water resource allocations, and land uses are difficult to assess for the same reasons discussed under State and Local Actions. The earlier discussions related to growth impacts apply also to tribal government actions. Tribal governments will need to apply comprehensive and beneficial natural resource programs to areas under their jurisdiction to produce measurable positive effects for listed species and their habitat.

Private Actions: The effects of private actions on ESA-listed resources are the most uncertain. Private landowners may convert current use of their lands, or they may intensify or diminish current uses. Individual landowners may voluntarily initiate actions to improve environmental conditions, or they may abandon or resist any improvement efforts. Their actions may be compelled by new laws, or may result from growth and economic pressures. Changes in ownership patterns will have unknown impacts.

Summary: Non-federal actions on listed species are likely to continue affecting listed species. The cumulative effects in the action area are difficult to analyze considering the geographic landscape of this opinion, the uncertainties associated with government and private actions, and the wide array of potential responses to changing economies of the region. Whether these effects will increase or decrease is a matter of speculation; however, based on the trends identified in this section, the adverse cumulative effects are likely to increase. Although tribal, state, and local governments have developed plans and initiatives to benefit listed fish, they must be applied and sustained in a comprehensive way before NMFS can consider them "reasonably foreseeable" in its analysis of cumulative effects.

3.5 Integration and Synthesis of Effects

The jeopardy determinations in this opinion are based on the consideration of the proposed management actions taken to reduce the catch of listed fish, the magnitude of the remaining harvest, particularly in comparison to the period of decline, and in some cases estimates of target exploitation rates which were derived to be consistent with survival and recovery, i.e., RERs. NMFS has also paid particular attention to the population structure of each ESU by reviewing both the status and impacts on components that were considered representative or important to the ESU as a whole (Section 3.2). The jeopardy determinations are based on quantitative assessments where possible and more qualitative considerations where necessary. Different methods and different types of information have been used for the various ESUs and populations within ESUs, reflecting what was available or could be developed as part of this consultation. NMFS expects that more quantitative and holistic analyses and risk assessments will become available in time, and that standards may change as new information becomes available. In the meantime, NMFS must rely on the best available information in making its judgement about the risk of the proposed action to the listed species.

3.5.1 Puget Sound Chinook

The Puget Sound Chinook Salmon ESU includes spring, summer and fall populations distributed over five distinct geographic areas. Escapements have been stable or increasing in recent years for all populations in all regions. Exploitation rates in PFMC and U.S. Fraser Panel fisheries are anticipated to remain low and, when combined with impacts in Alaskan and Canadian fisheries are below the RERs for all Puget Sound populations for which they have been derived. Total exploitation rates have decreased 23 to 63 percent from rates in the 1980s. Based on these considerations, NMFS does not believe that PFMC or U.S. Fraser Panel fisheries pose a substantial risk to the listed Puget Sound chinook populations.

The geographical distribution of viable populations across the Puget Sound chinook salmon ESU is important for the ESU's recovery (PSTRT 2002). The PSTRT identified five geographic regions within the Puget Sound chinook salmon ESU and recommended that an ESU-wide recovery scenario should include at least two to four viable chinook salmon populations in each of five geographic regions within Puget Sound, depending on the historical biological characteristics and acceptable risk levels for populations within each region (PSTRT 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 (PSTRT 2002). While changes in harvest alone cannot recover the Puget Sound chinook salmon ESU, NMFS can use the preliminary PSTRT guidance to assist it in evaluating whether the proposed action, in combination with fishing mortality in other fisheries would impede recovery of the ESU.

Strait of Georgia Strait: Both Nookack spring chinook populations are Category 1 populations. Average escapement for both populations in this region has increased in recent years over pre-listing levels, although natural-origin escapement for both populations remains close to their critical thresholds. However, if naturally spawning hatchery-origin adults from the listed supplementation program are included, early chinook salmon escapement has averaged 3,400 in the North Fork Nooksack, a 1000 percent increase since listing. Over the same period, natural-origin spawning chinook adults have increased by only 11 percent. When compared to hatchery-origin returns, the lack of a similar dramatic increase in natural-origin fish, given the substantial decreased in harvest rates, suggests constraints on productivity due to limitations in marine, estuarine or freshwater habitat.

The total exploitation rate on both populations has declined by 45 percent since the 1980's, averaging 74 percent from 1981 through 1984, and 41 percent for 1991 through 1998 brood years (personal communication with D. Simmons, NMFS, April 1, 2004)(Table 11). The exploitation rates for the PFMC and U.S. Fraser Panel fisheries (1.1%) are well below the RER for the Nooksack early management unit, but the total ocean exploitation rate is expected to exceed the RER (Table 20). The RER for the Nooksack early management unit is not expected to be met in 2004 or in the near term, even with total closure of all southern U.S. fisheries. Natural origin escapement has increased since the ESU was listed and, in 2004, the Nooksack spring natural origin escapement is expected to exceed its viable escapement threshold. However, escapements in the longer term are less certain. Depending on abundance and harvest in Canadian fisheries, escapements might also approach or fall below critical escapement thresholds in the next few years (Table 21). However, given the very low anticipated exploitation rate in PFMC and U.S. Fraser Panel fisheries, adjustments in these fisheries would have negligible effect on the sustainability of populations in this region.

Whidbey/Main Basin: The ten chinook populations in this region are all Category 1 populations. Average escapements for eight of the ten populations in this region have increased above pre-listing levels and the other two are stable. Five of the ten populations in this region, including both spring and summer/fall life history types, are currently above their viable escapement thresholds, two are approaching their viable escapement threshold and one is below its viable threshold but well above its critical escapement threshold (Table 21). Data is not sufficient to derive viable thresholds for the Upper Cascade River in the Skagit spring management unit or the Snoqualmie River population in the Snohomish management unit. However, both populations are above their critical thresholds (Table 21).

Exploitation rates have fallen 43 to 56 percent from levels in excess of 60 percent during the mid-1980s, to an average in recent years of 27 to 42 percent depending on the population (FRAM 2003; personal communication with D. Simmons, NMFS, April 1, 2004)(Tables 12,14 and 18). Anticipated exploitation rates in PFMC and U.S. Fraser Panel fisheries and the total ocean exploitation rates (including Alaskan and Canadian fisheries) are anticipated to meet or fall below all eight RERs in this region (RERs have not been derived for the Upper Cascade or Snoqualmie populations)(Table 20). Total projected exploitation rates over the next several years are expected to fall below seven of the eight RERs (Table 20)[9]. The total exploitation rate for the Snohomish management unit is expected to exceed its RER for the next several years, primarily due to harvest in Canadian fisheries. However, natural-origin escapement in the Skykomish River is expected to remain near or above the viable escapement threshold. The expected escapement in 2004 is the highest in the database.

Southern Basin: In this region, the Cedar and Duwamish-Green River fall populations and White River spring chinook populations are Category 1 populations. The Sammamish, Puyallup and Nisqually River chinook are Category 2 populations. Average escapements for four (including spring and fall types) of the six populations in this region are above pre-listing levels and both long and short term trends in escapement have generally been positive. Escapements for four of the six populations in this region have exceeded viable escapement thresholds in recent years. Escapements for both the Cedar and Sammamish chinook populations have exceeded their critical thresholds since 1998, but are well below their viable thresholds (Table 21). Escapement to the Cedar is stable while escapement to the Sammamish is increasing. Given the variation of the escapements in the past and the small populations size (Tables 5 and 21), either or both populations could approach or fall below their critical thresholds in the near future. However, since the escapements are based on partial census of the populations, these estimates should be considered conservative, and the total escapements are likely greater.

The Puyallup and Nisqually systems were managed for hatchery harvest rates for decades. Beginning in 2000, management transitioned in the Nisqually and Puyallup systems from a focus on hatchery management to management objectives based on naturally spawning adults. Past strategies to maximize harvest of hatchery stocks resulted in exploitation rates 80 percent or more. Total exploitation rates have declined by 14 to 63 percent since the early 1980s, averaging 29 to 77 percent in recent years (FRAM 2003). The expected exploitation rate in PFMC and U.S. Fraser Panel fisheries and the total ocean exploitation rates (including Alaskan and Canadian fisheries) are anticipated to be well below the RER for the Green River chinook population. Although projected exploitation rates in are expected to exceed the RER in some years for the Duwamish-Green chinook population, escapements are expected to remain above the viable escapement threshold of 5,500.

Hood Canal: The Skokomish and Mid-Hood Canal Tributaries populations are both Category 2 type populations. Average recent years escapement for both populations have increased above pre-listing levels (Table 4). The Skokomish River escapement has been near or above its viable escapement threshold in four of the last five years (Tables 5) and is expected to exceed its viable

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[9]The 2004 total exploitation rate for the Skagit summer-fall chinook management unit is expected to be below its RER of 49 percent, the most constraining of the three Skagit summer-fall RERs. Although the total exploitation rate in the near term may exceed the RER, the modeling on which these estimates were based assumed abundance and age composition similar to that anticipated in 2003. Anomalous age structure observed in the 2003 return make the estimates of near term exploitation rates a likely overestimate of the projected exploitation rates. Even with the addition of pink fisheries in odd years, exploitation rates for Skagit summer-fall chinook are more likely to resemble exploitation rates seen in recent years of 24-40 percent, below the RERs for all three populations.

threshold in the near term (Table 21). There is some concern regarding the volatility of the escapement for the sub-aggregates (Dosewallips, Duckabush and Hamma Hamma Rivers) within the Mid-Hood Canal Tributaries population. Escapements below 40 fish have been observed in recent years in the Duckabush and Dosewallips Rivers. However, straying likely occurs between the subaggregates and the Skokomish River and the genetic and ecological traits share similar traits throughout the region.

The overall exploitation rate for Hood Canal summer-fall chinook salmon declined by 49 percent since the early 1990s, averaging 87 percent from 1985 through 1990 brood years, and 44 percent from 1991 through 1998 brood years (personal communication with D. Simmons, NMFS, April 1, 2004)(Table 17). The expected exploitation rate in PFMC and U.S. Fraser Panel fisheries is expected to be less than 4 percent with a total ocean exploitation rates (including Alaskan and Canadian fisheries) of 22 percent. Further decrease in the SUS fisheries-related impacts would have little practical effect on the persistence of the Mid-Hood Canal Tributaries population, resulting in an estimated additional 3 spawning adults to the Duckabush River and 2 to the Dosewallips River.

Strait of Juan de Fuca: There are two Category 1 populations within this region. The hatchery-origin production operating in the two watersheds within this region share the ecological and genetic traits of the natural-origin populations and is considered essential to recovery of the ESU. Considering the current level of degradation in habitat quality and quantity, the populations would likely have gone extinct without the continued contribution of the hatchery programs. Recent years average escapement for the Dungeness population is above pre-listing levels; above its critical escapement threshold although well below its viable escapement threshold. The Elwha chinook population is stable with a post-listing average escapement of 2,000 compared with a viable escapement threshold of 2,900 adults.

Exploitation rates have declined by 52 percent on average, from 76 percent in the 1980s to 37 percent in recent years (FRAM 2003). The expected exploitation rate in PFMC and U.S. Fraser Panel fisheries is expected to be less than 2 percent with a total ocean exploitation rates (including Alaskan and Canadian fisheries) of 21 percent. Anticipated SUS exploitation rates are low (4-6%) and further reductions would have little practical effect on the persistence of these two populations.

The PSTRT identified five geographic regions within the Puget Sound chinook salmon ESU and recommended that an ESU-wide recovery scenario should include at least two to four viable chinook salmon populations in each of five geographic regions within Puget Sound, depending on the historical biological characteristics and acceptable risk levels for populations within each region (PSTRT 2002). The information summarized above suggests that, as long as exploitation rates on Puget Sound chinook populations in PFMC and U.S. Fraser Panel fisheries remain at or below rates seen in recent years, conduct of these fisheries will have little to no effect on the achievement of viability criteria for at least two to four populations in each major Puget Sound geographic region, representing the range of life history types within that region.

Given the low anticipated exploitation rates in the PFMC and U.S. Fraser Panel fisheries, especially relative to the RERs for Puget Sound populations, the status of populations and life-history types within each of the major regions in the Puget Sound chinook ESU, the significant decline in exploitation rates in all Puget Sound regions combined with the apparent general positive response in escapements and NMFS' determinations on past RMPs similar to the one currently under consideration for Puget Sound salmon fisheries, NMFS concludes that the proposed PFMC and U.S. Fraser Panel fisheries in northern Puget Sound fisheries are not likely to jeopardize the continued existence of the Puget Sound chinook ESU in total.

3.5.2 Lower Columbia River Chinook

As described in section 3.2, the Lower Columbia River chinook ESU is a complex ESU comprised of several distinct life history types including spring, tule and bright fall-timed stocks. What remains of the spring component of the Lower Columbia River chinook ESU is now confined to the Sandy, Cowlitz, Lewis, and Kalama rivers. There are no natural-origin, self-sustaining populations of Lower Columbia River spring chinook as all are integrated with and largely dependent on the associated hatchery programs in each basin. Although some natural spawning occurs, most is likely the result of hatchery straying, and it is unlikely that any of the populations would persist given the current habitat conditions absent the existing hatchery programs. The population in the Sandy above Marmot Dam is increasing. Escapements in the Cowlitz, Lewis, and Kalama have increased in recent years, approaching levels observed in the early 1990's (Table 7). The expected return to the tributary areas in 2004 is 22,700 fish, well above escapement goals. Terminal fisheries are managed to meet hatchery escapement goals. Exploitation in PFMC and U.S. Fraser Panel fisheries continues to be low. The chinook management model base period (1979-82) exploitation rate for the Cowlitz River spring chinook, the harvest indicator for Lower Columbia River spring chinook, was 12 percent for the PFMC fisheries. The 2004 model estimates are for a PFMC exploitation rate of 7 percent and a total ocean fishery exploitation rate of 12 percent. The combined exploitation rate in Puget Sound and other terminal marine areas is expected to be less than 1 percent. Given the circumstances, the primary management objective is to ensure hatchery escapement goals are met in order to maintain options for future recovery efforts. The PFMC and U.S. Fraser Panel fisheries are consistent with meeting the escapement goals.

Lower Columbia River tule stocks have been subject to habitat degradation due to the familiar litany of factors related to resource exploitation and land use development. Hatchery programs have been pervasive throughout the Lower Columbia River, in particular, for over a hundred years. As a result, only two self-sustaining stocks of tule chinook in the lower Columbia River have been identified that are not substantially influenced by hatchery strays. Escapement in the East Fork Lewis River has been relatively stable. Escapement to the Coweeman has averaged over 870 in recent years. Both populations have experienced significant increases in escapement since 2001.

There is no shortage of hatchery fish including many that are part of the ESU (although not listed) that can be used for recovery efforts. Harvest mortality on tule stocks has been reduced substantially in recent years. Given the circumstances, it is unlikely that the anticipated harvest in PFMC or Puget Sound fisheries pose a significant risk to the tule component. In this case, the broader objective of the ESA, which requires survival and recovery of self-sustaining, naturally spawning populations, can best be achieved through focused recovery planning efforts that identify habitats that can be rehabilitated, coupled with harvest management programs that provide the necessary protections that will allow for rebuilding. Until then harvest of tule stocks needs to be sufficiently constrained to protect the few remaining naturally spawning populations. The fact that these populations have been relatively stable and that overall harvest mortality has declined in recent years suggests that the PFMC and U.S. Fraser Panel fisheries do not pose a substantial risk to those populations nor limit the potential for longer-term recovery efforts. The estimated RER for the Coweeman stock is 49 percent. Fisheries, including PFMC and U.S. Fraser Panel fisheries in northern Puget Sound, will continue to be managed to ensure that all fishing-related mortality is consistent with this objective.

The Lower Columbia River bright component is one of the few healthy wild stocks in the Columbia River Basin. The Lewis River bright stock has exceeded its escapement goal of 5,700 by a substantial margin every year since at least 1980, except 1999. Given the relative health of this stock and the pattern of low mortality in PFMC and U.S. Fraser Panel fisheries, NMFS does not believe that PFMC or U.S. Fraser Panel fisheries pose a substantial risk to the Lower Columbia River bright populations.

NMFS considered status and stock structure, as currently defined, of each life history component of the ESU and impacts from the proposed fisheries on each. Based on the above considerations, NMFS concludes that the proposed PFMC and U.S. Fraser Panel fisheries in northern Puget Sound fisheries are not likely to jeopardize the continued existence of the Lower Columbia River chinook ESU in total.

3.6 Conclusion

After reviewing the current status of the listed chinook salmon ESUs considered in this opinion, the environmental baseline for the action area, the effects of the proposed fisheries, and the cumulative effects, it is NMFS' biological opinion that the proposed PFMC and U.S. Fraser Panel fisheries are not likely to jeopardize the continued existence of the Puget Sound and Lower Columbia River Chinook Salmon ESUs.

4 INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. 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.

The measures described below are non-discretionary, and must be undertaken by NMFS. This agency has a continuing duty to regulate the activity covered by this incidental take statement in consultation with the affected states and tribes. If this agency fails to assume and implement the terms and conditions of this incidental take statement, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of take, NMFS must document the progress of the action and its impact on the species as specified in the incidental take statement. [50CFR §402.14(i)(3)]

4.1 Amount or Extent of Incidental Take

Brood year exploitation rates on Puget Sound spring and fall chinook salmon populations in future U.S. Fraser Panel fisheries must be no greater than 1 percent on average. The brood year exploitation rates on Puget Sound spring and fall chinook salmon populations in future PFMC fisheries must remain within the range observed in recent years, i.e., 5 percent or less on average.

Brood year exploitation rates on Lower Columbia River spring and bright fall chinook salmon in future U.S. Fraser Panel fisheries must be no greater than 1 percent on average. The brood year exploitation rates on Lower Columbia River spring and bright chinook salmon populations in future PFMC fisheries must remain within the range observed in recent years, i.e., on average, 15 percent or less for spring and tule stocks and 5 percent or less for bright fall chinook populations. PFMC and U.S. Fraser Panel fisheries must be managed such that the total brood year exploitation rate for the Coweeman stock, in all fisheries combined, does not exceed 49 percent.

4.2 Effect of the Take

In the accompanying biological opinion, NMFS determined that the level of anticipated take of the Puget Sound and Lower Columbia River Chinook Salmon ESUs in the proposed PFMC and U.S. Fraser Panel fisheries are not likely to jeopardize the continued existence of either listed species or result in destruction or adverse modification of critical habitat where designated.

4.3 Reasonable and Prudent Measures

There are two reasonable and prudent measures included in this incidental take statement for the ESUs considered in this opinion. These were also included in the March 8, 1996, biological opinion and hereby remain in effect for the ESUs covered in this biological opinion: 1) in-season management actions taken during the course of the fisheries shall be consistent with the take limits defined in Section 4.1 of the Incidental Take Statement above, and 2) harvest impacts of listed salmon stocks shall be monitored using best available measures.

4.4 Terms and Conditions

In order to be exempt from the prohibitions of sections 9 and 4(d) of the ESA, NMFS must continue to comply with all of the terms and conditions listed in the March 8, 1996, biological opinion, as amended by the February 18, 1997, opinion concerning Sacramento River winter chinook. In addition, NMFS must comply with the following terms and conditions to implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

1. NMFS shall confer with the affected states and tribes, the PFMC chair and the U.S. Fraser Panel, as appropriate, to ensure that in-season management actions taken during the course of the fisheries are consistent with the take specified in the effects section of the ITS above for each of the ESUs.

2a. NMFS shall confer with the affected states and tribes, and the PFMC chair prior to the start of fishing each year to produce a summary table showing that the harvest targets and fishing regimes adopted preseason are consistent with the take expectations specified in Section 4.1 of the Incidental Take Statement (ITS) above for each of the ESUs. The exploitation rates in the ITS define the limits of expected annual take.

2b. NMFS, in cooperation with the affected states and tribes, the PFMC chair, and the U.S. Fraser Panel, as appropriate, shall monitor the catch and implementation of other management measures, e.g., non-retention fisheries, at levels that are comparable to those used in recent years. The monitoring is to ensure full implementation of, and compliance with, management actions specified to control the various fisheries within the scope of the action.

2c. NMFS, in cooperation with the affected states and tribes, the PFMC chair, and the U.S. Fraser Panel, as appropriate, shall sample the fisheries for stock composition including the collection of CWTs in all fisheries and other biological information to allow for a thorough post-season analysis of fishery impacts on listed species.

2d. NMFS shall confer with the affected states and tribes, the PFMC chair, and the U.S. Fraser Panel, as appropriate, prior to the start of preseason planning to produce a summary table showing that the brood year exploitation rates for those Puget Sound and Lower Columbia River populations for which the data are available, as assessed post-season, are consistent with the take specified in Section 4.1 of the Incidental Take Statement above for each of the ESUs.

5 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, in addition to those included in the March 8, 1996, biological opinion, are consistent with these obligations, and therefore should be implemented by NMFS.

1. NMFS, in collaboration with the affected states and tribes should evaluate the ability of each listed ESU to survive and recover, given the totality of impacts affecting each ESU during all phases of the salmonid's life cycle, including freshwater, estuarine and ocean life stages. For this effort, NMFS should collaborate with the affected co-managers to evaluate available life cycle models or initiate the development of life cycle models where needed.

2. NMFS in collaboration with the affected states and tribes should evaluate where possible improvement in gear technologies and fishing techniques that reduces mortality of listed species.

3. NMFS in collaboration with the affected states and tribes should continue to evaluate the impacts of selective and non-retention fishing techniques in commercial and recreational fisheries on listed species

4. NMFS in collaboration with the affected states and tribes should continue to improve the quality of information gathered on ocean rearing and migration patterns to improve the understanding of the utilization and importance of these areas to listed ESUs.

5. 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.

6 REINITIATION OF CONSULTATION

This concludes formal consultation on the Pacific Salmon Plan as it relates to the Puget Sound and Lower Columbia River Chinook Salmon ESUs. 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 take 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 on listed species or critical habitat that was not considered in the biological opinion; (4) a new species is listed or critical habitat designated that may be affected by the identified action. In instances where the amount or extent of take is exceeded, NMFS must immediately reinitiate formal section 7 consultation on the proposed fisheries. In the case of populations for which RERs are derived, a change in the rate itself will not be considered grounds for re-initiation as long as the rate is consistent with the risk criteria described previously in this document.

7 MAGNUSON-STEVENS ACT ESSENTIAL FISH HABITAT CONSULTATION

"Essential fish habitat" (EFH) provisions of the Magnuson-Stevens Act (MSA) require heightened consideration of fish habitat in resource management decisions. EFH is defined in section 3 of the MSA as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." NMFS interprets EFH to include aquatic areas and their associated physical, chemical and biological properties used by fish that are necessary to support a sustainable fishery and the contribution of the managed species to a healthy ecosystem.

The MSA and its implementing regulations at 50 CFR 600.920(j) require that before a Federal agency may authorize, fund or carry out any action that may adversely effect EFH, it must consult with NMFS and, if requested, the appropriate Regional Fishery Management Council. The purpose of consultation is to develop a conservation recommendation that addresses all reasonably foreseeable adverse effects on EFH. Further, the action agency must provide a detailed response in writing to NMFS and the appropriate Council within 30 days after receiving an EFH conservation recommendation. The response must include measures proposed by the agency to avoid, minimize, mitigate, or offset the impact of the activity on EFH. If the response is inconsistent with conservation recommendations of NMFS, the agency must explain its reasons for not following the recommendations, including the scientific justification for any disagreements over the anticipated effects of the proposed action and the measures needed to avoid, minimize, or mitigate such effects.

This consultation requirement does not distinguish between actions which occur within EFH and actions outside EFH. Any reasonable attempt to encourage the conservation of EFH must take into account actions that occur outside EFH, such as upstream and up slope activities that may have an adverse effect on EFH. Therefore, EFH consultation with NMFS is required by Federal agencies undertaking permitting or funding activities that may adversely affect EFH, whatever its location.

The objective of this EFH consultation is to determine whether the adoption of the proposed fishery management activities by NMFS may adversely affect EFH for any of the species for which EFH has been identified. If the proposed action is determined to be likely to adversely affect EFH, conservation recommendations will be recommended to avoid, minimize, or otherwise offset potential adverse impacts on EFH resulting from the proposed activities discussed in the biological opinion above.

7.1 Identification of Essential Fish Habitat

The Pacific Fisheries Management Council (PFMC) is one of eight Regional Fishery Management Councils established under the MSA. The PFMC develops and carries out fisheries management plans for Pacific coast groundfish, coastal pelagic species and salmon off the coasts of Washington, Oregon and California, and recommends Pacific halibut harvest regulations to the International Pacific Halibut Commission.

Pursuant to the MSA, the PFMC has designated freshwater and marine EFH for chinook (*Oncorhynchus tshawytscha*) and coho salmon (*Oncorhynchus kisutch*) (PFMC 1999), EFH for five species of coastal pelagic species (PFMC 1998a), and a "composite" EFH for 62 species of groundfish (PFMC 1998b). The PFMC has not identified EFH for chum salmon (*Oncorhynchus keta*), but the areas used by chum for "spawning, breeding, feeding, or growth to maturity" overlap with those identified for coho and chinook salmon as encompassed by the actions considered in this consultation. For purposes of this consultation, marine EFH for chinook and coho in Washington and Oregon includes all estuarine, nearshore and marine waters within the western boundary of the U.S. Exclusive Economic Zone (EEZ), 200 miles offshore. EFH for coastal pelagic species and composite EFH for groundfish in Washington and Oregon includes all waters, substrates and associated biological communities from the mean higher high water line, the upriver extent of saltwater intrusion in river mouths, and along the coast extending westward to the boundary of the EEZ. A detailed description and identification of EFH for groundfish is found in the Final Environmental Assessment/Regulatory Impact Review for Amendment 11 to the Pacific Coast Groundfish Management Plan (PFMC 1998b) and the NMFS EFH for West Coast Groundfish Appendix (Casillas *et al.* 1998). A detailed description and identification of EFH for coastal pelagic species is found in Amendment 8 to the Coastal Pelagic Species Fishery Management Plan (PFMC 1998a). A description and identification of EFH for salmon is found in Appendix A to Amendment 14 to the Pacific Coast Salmon Plan (PFMC 1999).

7.2 Proposed Action

The proposed action area includes the U.S. marine waters of the Strait of Juan de Fuca and San Juan Islands region under the jurisdiction of the Pacific Salmon Commission Fraser Panel, as well as the estuaries and marine waters offshore of Washington and Oregon. The estuarine and offshore marine waters are designated EFH for various life stages of 62 species of groundfish and five coastal pelagic species. The proposed action area also encompasses the Council-designated EFH for chinook salmon and coho salmon.

7.3 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 purse seines, reef nets and gill nets. The use of these gears affects the water column and the shallower estuarine 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 also assessed the effects of fishing activities, including ghost fishing by gillnets, on EFH for groundfish and provided recommended conservation measures in the Final Environmental Assessment/Regulatory Impact Review for Amendment 11 to The Pacific Coast Groundfish Management Plan (PFMC 1998b) and the NMFS EFH for West Coast Groundfish Appendix (Casillas *et al.* 1998).

Of the three types of impact on EFH identified by the PFMC for fisheries in Council waters, the concern regarding gear-substrate interactions and removal of salmon carcasses are also potential concerns for the fisheries in U.S. Fraser Panel waters. The types of salmon fishing gear that are used in U.S. Fraser Panel fisheries – purse seine, reef net, and gillnet – actively avoid contact with the substrate because of the resultant interference with fishing and potential loss of gear. 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 overfishing. Both of these conservation measures are basic principles of Fraser Panel management (PST 1999; Puget Sound Management Plan 1985).

7.4 Conclusion

The PFMC concluded fishing activities of the type included in the proposed actions considered in this consultation are likely to adversely affect EFH and it provided recommended conservation measures (Casillas *et al.* 1998, PFMC 1998b, PFMC 1999). The PFMC adopted these conservation measures for fishing activities under its jurisdiction at the June 2000 Council meeting, and they were approved by the Secretary of Commerce as part of the package on Amendment 14 on September 27, 2000. These conservation measures remain in effect for the PFMC fisheries. The U.S. Fraser Panel fisheries are unlikely to adversely affect EFH. Therefore, NMFS concludes that EFH has been adequately addressed for the PFMC and U.S. Fraser Panel fisheries.

7.5 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 (1) conservation recommendations have been made and adopted for the PFMC fisheries and (2) the proposed U.S. Fraser Panel fisheries would not adversely affect the EFH. No additional conservation recommendations beyond those identified and already adopted are needed.

7.6 Statutory Response Requirement

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

7.7 Consultation Renewal

NMFS must re-initiate EFH consultation if plans for this action 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 §600.920(k)).

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