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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, Maryland 20910

DEC 15 1999

MEMORANDUM TO: Gary C. Matlock
Director, Office of Sustainable Fisheries

FROM: Donald R. Knowles
Director, Office of Protected Resources

SUBJECT: ESA Section 7 Consultation on Pacific Coast Groundfish Fishery Management Plan for the California, Oregon, and Washington Groundfish Fishery

The attached biological opinion addresses the potential effects of Pacific Coast groundfish Fishery Management Plan for the California, Oregon, and Washington groundfish fishery under the Magnuson-Stevens Fishery Conservation and Management Act on threatened and endangered species pursuant to section 7 of the Endangered Species Act of 1973, as amended (ESA). This opinion concludes that the proposed groundfish fishery is not likely to jeopardize the continued existence of threatened or endangered species or designated critical habitat. The biological opinion includes an Incidental Take Statement that provides the fishery with an exemption to the take prohibitions established in section 9 of the ESA.

The data available on the effects of the groundfish fishery on threatened and endangered species was limited. The Biological Opinion also states that if and when it becomes apparent, based on analyses by either NMFS or PFMC, that management measures cannot adequately reduce the bycatch rate to prescribed levels, the amount or extent of incidental take will have been exceeded and section 7 consultation must be reinitiated.

For further information, please contact Christopher Wright at (206) 526-4323 or Craig Johnson at (301) 713-1401.

Attachment

Endangered Species Act - Reinitiated Section 7 Consultation

BIOLOGICAL OPINION

Fishing Conducted under the Pacific Coast
Groundfish Fishery Management Plan
for the California, Oregon, and Washington
Groundfish Fishery

Agency: National Marine Fisheries Service,
Northwest and Southwest Regional
Sustainable Fisheries Divisions

Consultation Conducted by
National Marine Fisheries Service
Protected Resources Division

Date Issued: 12/15/99

Don Knowles

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INTRODUCTION

The National Marine Fisheries Service (NMFS) has reinitiated consultation under the Endangered Species Act (ESA) section 7(a)(2) on the fishing conducted under the Pacific Fishery Management Council's (PFMC) Pacific Coast Groundfish Fishery Management Plan (FMP) for the California, Oregon, and Washington groundfish fishery. Consultation was reinitiated to consider the effect of the FMP on 22 new Evolutionarily Significant Units (ESUs) of salmonids that have been added to the list of threatened and endangered species since the last consultation on May 14, 1996 (Table 1).

The groundfish fisheries in the Exclusive Economic Zone (EEZ) off Washington, Oregon, and California are managed under authority of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). Annual management recommendations are developed according the FMP of the PFMC. The PFMC provides its management recommendations to the Secretary of Commerce, who implements the measures in the EEZ if they are found to be consistent with the Magnuson-Stevens Act and other applicable law. Because the Secretary, acting through NMFS, has the ultimate authority for the FMP as modified by Amendment 11 and its implementation, NMFS is both the action agency and the consulting agency in this consultation.

A. Background

The Pacific coast groundfish fishery is a year-round, multi-species fishery that takes place off the coasts of Washington, Oregon, and California. Most of the Pacific coast non-tribal, commercial groundfish harvest is taken by the limited entry fleet. The groundfish limited entry program was established in 1994 for trawl, longline, and trap (or pot) gears. There are also several open access fisheries that take groundfish incidentally or in small amounts; participants in those fisheries may use, but are not limited to longline, vertical hook-and-line, pot, setnet, trammel net, shrimp and prawn trawl, California halibut trawl, and sea cucumber trawl. In addition to these non-tribal commercial fisheries, members of the Makah, Quileute, Hoh, and Quinault tribes participate in commercial, and ceremonial and subsistence fisheries for groundfish off the Washington coast. Participants in the tribal commercial fishery use similar gear to non-tribal fishers who operate off Washington. Groundfish caught in the tribal commercial fishery is sold through the same markets as non-tribal commercial groundfish catch.

One of the primary goals of the Pacific coast groundfish FMP is to keep the fishery open throughout the entire year. Harvest rates in the limited entry fishery are constrained by annual harvest guidelines, two-month cumulative period landings limits, individual trip limits, size limits, species-to-species ratio restrictions, and other measures, all designed to control effort so that the allowable catch is taken at a slow rate that will stretch the season out to a full year. The two-month cumulative landings limits approach allows each vessel to catch up to a specific amount of different groundfish species over a two-month period, with not more than 60 percent of the cumulative period total to be taken in either month of the period. Cumulative period catch limits are set by comparing current or previous landings rates with the year's total available catch.

Landing limits have been used to slow the pace of the fishery and stretch the fishing season out

Table 1. Summary of salmon species listed and proposed for listing under the ESA.

Species	Evolutionarily Significant Unit	Present Status	Federal Register Notice	
Chinook Salmon (*O. tshawytscha*)	Sacramento River Winter	Endangered	54 FR 32085	8/1/89
	Snake River Fall	Threatened	57 FR 14653	4/22/92
	Snake River Spring/Summer	Threatened	57 FR 14653	4/22/92
	Central Valley Spring	Threatened	64 FR 50394	9/16/99
	California Coastal	Threatened	64 FR 50394	9/16/99
	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	Endangered	64 FR 14308	3/24/99
Chum Salmon (*O. keta*)	Hood Canal Summer-Run	Threatened	64 FR 14508	3/25/99
	Columbia River	Threatened	64 FR 14508	3/25/99
Coho Salmon (*O. kisutch*)	Central California Coastal	Threatened	61 FR 56138	10/31/96
	S. Oregon/ N. California Coastal	Threatened	62 FR 24588	5/6/97
	Oregon Coastal	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	3/25/98
Steelhead (*O. mykiss*)	Southern California	Endangered	62 FR 43937	8/18/97
	South-Central California	Threatened	62 FR 43937	8/18/97
	Central California Coast	Threatened	62 FR 43937	8/18/97
	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
Cutthroat Trout (*O. clarki clarki*)	Umpqua River	Endangered	61 FR 41514	8/9/96
	Southwest Washington/Columbia	Proposed Threatened	64 FR 16397	

over as many months as possible, so that the overall harvest target is not reached until the end of the year. Open access fisheries that land groundfish are more commonly targeting non-groundfish species (e.g., shrimp, prawns, albacore, California halibut, sea cucumbers, etc.) with some incidental groundfish landings. Open access fishery limits are primarily set as monthly cumulative limits that may not exceed 50% of the 2-month limited entry limit for that same species.

There are about 500 vessels with Pacific coast groundfish limited entry permits, of which approximately 55% are trawl vessels, 40% are longline vessels, and 5% are trap vessels. Each permit is endorsed for a particular gear type and that gear endorsement cannot be changed, so the distribution of permits between gear types is fairly stable. The number of total permits will only change if multiple permits are combined to create a new permit with a longer length endorsement. Limited entry permits can be sold and leased out by their owners, so the distribution of permits between the three states often shifts. At the beginning of 1998, roughly 40% of the limited entry permits were assigned to vessels making landings in California, 35% to vessels making landings in Oregon, and 25% to vessels making landings in Washington.

Because open access groundfish landings vary according to which non-groundfish fisheries are landing groundfish as bycatch, the number of open access boats that land groundfish accordingly varies with the changes in those non-groundfish fisheries. In recent years, however, there have been approximately 2,000 vessels per year that have been making small groundfish landings against open access allocations. Of these vessels, about 1350 land their catch in California, about 500 land their catch in Oregon, and about 150 land their catch in Washington.

Limited entry fishers who use bottom trawl, longline, and pot gears target on many different species, with the largest landings by volume (other than Pacific whiting) from these species: Dover sole, sablefish, thornyheads, widow rockfish, and yellowtail rockfish. There are 55 rockfish species managed by the Pacific coast groundfish FMP and, taken as a whole, rockfish landings represent the highest volume of non-whiting landings in the Pacific coast commercial groundfish fishery (PFMC 1999a). This is a high technology, highly skilled fleet, and it is reasonable to expect that, except where ocean conditions and geologic formations make fishing impossible, commercial fishers have found ways to target concentrations of the target species.

In addition to these mixed-species fisheries, there is a distinct mid-water trawl fishery that targets Pacific whiting (*Merluccius productus*). Pacific whiting landings are significantly higher in volume than any other Pacific coast groundfish species. In 1998, whiting accounted for approximately 66% of all Pacific coast commercial groundfish landings by weight. The Pacific whiting fleet includes catcher boats that deliver to shore-based processing plants and to at-sea processor ships, as well as catcher-processor ships. Whiting is a high volume species, but it commands a relatively low price per pound, so it accounts for only about 21% of all Pacific coast commercial groundfish landings by value (PFMC 1999a).

With the exception of the portion of Pacific whiting catch that is processed at sea, all other Pacific coast groundfish catch is processed in shore-based processing plants along the Pacific coast. By weight, commercial groundfish landings are distributed amongst the three states as follows: Washington, 15%; Oregon, 66%; California, 19%. By value, commercial groundfish landings are distributed amongst the three states as follows: Washington, 17%; Oregon, 42%; California, 41%. The discrepancies between the Oregon and California portions of the landings are expected because Oregon processors handle a relatively high percent of the shore-based whiting landings, a high volume, low value fishery. Conversely, California fishers land more of the low volume, high value species as a proportion of the total state-wide catch than Oregon fishers.

Catcher vessel owners and captains employ a variety of strategies to fill out a year of fishing. Fishers from the northern ports may fish in waters off of Alaska, as well as in the West Coast groundfish fishery. Others may change their operations throughout the year, targeting on salmon, shrimp, crab, or albacore, in addition to various high-value groundfish species, so as to spend more time in waters close to their communities. Factory trawlers and motherships fishing for or processing Pacific whiting off of the West Coast usually also participate in the Alaska pollock seasons, allowing the vessels and crews to spend more time at sea. Commercial fisheries landings for species other than groundfish vary along the length of the coast. Dungeness crab landings are particularly high in Washington state, squid, anchovies, and other coastal pelagics figure heavily in California commercial landings, with salmon, shrimp, and highly migratory species like albacore more widely distributed, and varying from year to year.

Whiting has been processed into surimi, sold in headed and gutted form, filleted, and converted to meal and oil. Other, higher quality fish like Dover sole are dressed and rushed to fresh, local markets as quickly as possible, while most sablefish is frozen and sent to foreign markets. The quantity of groundfish caught off of the West Coast is just a small percent of the amount of groundfish caught in federal waters off Alaska, so West Coast groundfish moves through many of the same markets as Alaska groundfish, taking prices set by the northern fleet.

CONSULTATION HISTORY

NMFS has considered the impacts to salmon species listed under the ESA resulting from PFMC groundfish fisheries in several biological opinions (Table 2).

On August 10, 1990, NMFS issued a biological opinion that considered the effects that Amendment 4 of the Pacific Coast Groundfish Management Plan may have on threatened and endangered populations off California, Oregon, and Washington. The opinion reviewed impacts on marine mammals, sea turtles, and Sacramento River winter-run chinook salmon (SRWR), and concluded that the FMP, as amended, would not jeopardize the continued existence of any of the species considered.

A November 26, 1991, biological opinion considered the impact of the whiting fishery, a mid-water trawl gear, on SRWR chinook salmon in more detail than the 1990 opinion, and also briefly addressed the effects on Snake River sockeye salmon, which was newly listed (November 20, 1991) just as the opinion was being finalized.

An August 28, 1992, biological opinion considered the effects on Pacific salmon species listed under the ESA from fisheries conducted under the PFMC's Pacific Coast Groundfish FMP. The listed species considered in that biological opinion included SRWR chinook salmon, Snake River sockeye salmon, Snake River spring/summer chinook salmon, and Snake River fall (SRF) chinook salmon. The biological opinion concluded that impacts of fishing conducted under the groundfish FMP on SRWR chinook, Snake River sockeye, and Snake River spring/summer chinook salmon were negligible. This opinion further concluded that the estimated bycatch of SRF chinook salmon was low, most likely on the order of a few tens of fish per year. Based on the available information, NMFS concluded that operation of the fishery under the groundfish FMP was not likely to jeopardize the continued existence of these species.

Since the August 1992 biological opinion was issued, section 7 consultation was reinitiated twice: September 27, 1993, and May 14, 1996. The September 1993 reinitiation was caused by an unexpectedly high bycatch of pink salmon which, when incorporated into the aggregated bycatch, exceeded the incidental bycatch limit of 0.05 salmon/mt whiting specified in the opinion. Since the bycatch limits specified in the August 1992 opinion were designed to protect chinook salmon, the September 27, 1993 opinion was amended to clarify that the 0.05 salmon/mt of whiting bycatch rate limit would in the future be expressed in terms of chinook salmon with the expectation that the total bycatch of chinook in the whiting fishery would not exceed 11,000 "chinook" salmon per year or 0.05 "chinook" salmon/mt whiting. The May 1996 opinion was reinitiated because the bycatch in the 1995 fishery was estimated at the time to be 14,557 chinook salmon (0.08 chinook/mt whiting) and exceeded the limits designated in the August 1992 and September 1993 opinions. The May 1996 opinion concluded that, although the chinook limit was exceeded, it was not likely to jeopardize the continued existence of listed salmon species because impacts to listed species remained low and within the numerical range anticipated during the original analysis. Because critical habitat for these species did not include open ocean areas, the activities considered by NMFS in previous consultations determined that they were not likely to result in the destruction or adverse modification of critical habitat.

Table 2. NMFS biological opinions on PFMC groundfish fisheries implemented under the FMP.

Date	ESU covered
August 10, 1990	Sacramento River winter-run chinook salmon
November 26, 1991	Sacramento River winter-run chinook salmon and Snake River sockeye salmon
August 28, 1992	Sacramento River winter-run chinook salmon, Snake River sockeye salmon, Snake River spring/summer chinook salmon, and Snake River fall chinook salmon
September 27, 1993	Snake River fall chinook salmon
May 14, 1996	Snake River fall chinook salmon

BIOLOGICAL OPINION

I. Description of the Proposed Action

A. Proposed Action

Pursuant to the Magnuson-Stevens Act, the National Marine Fisheries Service proposes to continue and promulgate ocean groundfish fishing regulations developed in accordance with the Pacific Coast Groundfish Plan as amended by Amendment 11.

Amendment 11 was submitted by the PFMC to make the Pacific Coast Groundfish FMP consistent with the Magnuson-Stevens Act by: amending the FMP framework that defines "optimum yield" for setting annual groundfish harvest limits; setting framework control rules on defining rates of "overfishing" and levels at which managed stocks are considered "overfished";

defining Pacific Coast groundfish essential fish habitat; setting a bycatch management objective and a framework for bycatch reduction measures; establishing a management objective to take the importance of fisheries to fishing communities into account when setting groundfish management measures; providing authority within the FMP for the PFMC to require groundfish use permits for all groundfish users; authorizing the use of fish for compensation for private vessels conducting NMFS-approved resource surveys; removing jack mackerel from the fishery management unit; and updating FMP objectives, definitions and industry descriptions.

The Pacific Coast Groundfish FMP provides a framework for certain PFMC actions without requiring cumbersome amendment procedures for those actions. Portions of this amendment that are designed to meet several of the new Magnuson-Stevens Act requirements will change the way that the PFMC manages the groundfish fishery without changing the regulations that implement the FMP. A new definition of optimum yield, specific overfishing and overfished levels, and accounting for the needs of fishing communities in setting fishery management measures will become part of the guidelines the PFMC uses to set its annual specifications and management measures. Amendment 11 provides a framework to implement fishery management measures to protect groundfish essential fish habitat, which the PFMC will use to, among other things, investigate implementing marine research reserves.

The primary purpose of Amendment 11 was to incorporate the more conservative management requirements resulting from the Magnuson-Stevens Act into the existing FMP. Because of the more conservative nature of the Act, Amendment 11 will lead to less fishing than would have occurred under the previous FMP. This is immediately apparent from the preseason planning for the 2000 fisheries which were developed under provisions of Amendment 11. Several groundfish stocks were designated as overfished which led to greatly restricted fishing in 2000 and, likely, for the foreseeable future. After evaluating Amendment 11, NMFS concluded that the Amendment was not likely to adversely affect threatened or endangered species or designated critical habitat because the Amendment would have reduced the effects of the fishery on listed species to a level below the effects that supported NMFS' previous "no jeopardy" conclusion. Instead, this consultation focuses on the effect of Amendment 11 of the groundfish FMP on the ESUs that were listed since consultation was last completed in 1996 (NMFS 1996a).

The groundfish fishery off the west coast of Washington, Oregon, and California is prosecuted by three major gear types including trawl, pots, and hook-and-line gear with small amounts of additional catch taken by other miscellaneous gear types. The gear types that take the largest percentage of groundfish are trawls, principally mid-water, bottom, and shrimp trawls.

NMFS' August 28, 1992, biological opinion on the FMP concluded that shrimp trawls, pot gear, hook-and-line, and the other miscellaneous gear types in the groundfish fishery catch few if any salmonids. There have been no recent reports of salmon bycatch in these gears since the 1992 opinion, hence it is reasonable to conclude that they will continue to have a negligible impact on salmon. The two gear types that have a record of salmon bycatch are the mid-water and bottom trawls.

The Pacific whiting fishery is the only mid-water trawl groundfish fishery of significance in the

PFMC. The fishery is prosecuted by a combination of sectors including shore-based, and catcher processor and mothership operators (which includes tribal) occurring roughly during April through November period (Dorn *et al.* 1999). Dorn (1998) described the spatial distribution of the whiting fishery from the 1992 NMFS west coast acoustic survey as an area north to south of approximately 600 km, from Vancouver Island to Central California, and at widths ranging from 10-30 km running through the shelf break region at bottom depths ranging from 150-600 m. The highest whiting densities where in three areas, Heceta Bank off central Oregon, Willapa and Guide canyons off southwest Washington, and Juan de Fuca Canyon off Cape Flattery.

The bottom trawl fishery off the west coast harvests a mixture of species that include flatfishes, rockfishes, and roundfishes (Erickson and Pikitch1994). These fisheries operate at depths ranging from 10 m to 1,200 m with various seasons overlapping for the various species and stocks throughout the year. The chinook salmon that are encountered most frequently and in greatest numbers with this gear type are typically caught in the 100-482 m depths during winter, and in summer chinook are not frequently caught and are usually encountered at depths less than 220 m (Erickson and Pikitch1994). The areas where chinook are encountered most frequently appear to vary, but the data is quite limited.

B. Conservation Measures Included in the Proposed Action

As a result of the previous consultations, the whiting fishery is already subject to several conservation related constraints designed to minimize the bycatch of chinook salmon in particular. The targeted harvest of whiting inside of 100 fathoms in the Eureka catch area is prohibited. The start of the whiting fishery north of 42°00' north latitude is delayed annually until at least May 15. Finally, bycatch of chinook salmon in the whiting fishery is monitored in each sector of the fishery and limited to a bycatch rate of 0.05 chinook/mt whiting and a total bycatch of 11,000 chinook annually.

C. Action Area

NMFS establishes fishery management measures for ocean groundfish fisheries occurring in the EEZ (3-200 nautical miles off shore). Annual management recommendations are developed according the "Pacific Coast Groundfish Fishery Management Plan" of the PFMC. The PFMC provides its management recommendations to the Secretary of Commerce, who implements the measures in the EEZ if they are found to be consistent with the Magnuson-Stevens Act and other applicable law. 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 opinion, the action area is the EEZ, which is directly affected by the federal action, as well as the marine waters (other than internal) off the States of Washington, Oregon and California, which may be indirectly affected by the federal action.

II. Status of the Species and Critical Habitat

A. Analysis of Species Likely to be Affected

A preliminary analysis of the available data for the ongoing consultation indicates that the steelhead, sockeye, and cutthroat trout are rarely, if ever, encountered in the groundfish fishery. Coho and chum are caught in relatively low numbers in the whiting fishery with average catch per year coastwide on the order of tens to a few hundred fish (See IV.A. and Table 14), and in the bottom trawl fishery on the order of tens of fish per year (See IV.B. and NMFS 1992). NMFS therefore concludes that there is little or no affect to the steelhead, sockeye, cutthroat trout, coho, or chum salmon ESUs listed in Table 1 as a result of the groundfish FMP. Relevant information supporting this conclusion is reviewed briefly in section IV, but is not the focus of this opinion.

Substantial numbers of chinook salmon are caught in some of the whiting and bottom trawl fisheries. This opinion therefore focuses on the effect of the groundfish FMP on the newly listed chinook ESUs, and reconsiders conclusions related to SRF chinook and the other previously listed ESUs.

B. Species and Critical Habitat Description

Snake River Fall Chinook

The SRF chinook ESU includes all natural-origin populations of fall chinook in the mainstem Snake River and several tributaries including the Tucannon, Grande Ronde, Salmon, and Clearwater rivers. Fall chinook from the Lyons Ferry Hatchery are included in the ESU but are not listed.

Critical habitat was designated for SRF chinook salmon on December 28, 1993 (58 FR 68543). The essential features of the critical habitat include four components: (1) spawning and juvenile rearing areas, (2) juvenile migration corridors, (3) areas of growth and development to adulthood, and (4) adult migration corridors. Marine areas including those within the action area, are not included as part of the designated critical habitat.

Puget Sound (PS) Chinook

The PS chinook ESU 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. Chinook salmon in this area all exhibit an ocean-type life history although there are several populations with an adult spring run timing and ocean distribution. Although some spring-run chinook salmon populations in the PS 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. Several hatchery populations are also listed including spring run chinook from Kendall Creek, the North Fork Stillaguamish River, White River, and Dungeness River, and fall run fish from the Elwha River.

Lower Columbia River (LRC) Chinook

The LCR ESU includes all native populations from the mouth of the Columbia River to the crest of the Cascade Range, excluding populations above Willamette Falls. Celilo Falls, which corresponds to the edge of the drier Columbia Basin Ecosystem and historically may have presented a migrational barrier to chinook salmon at certain times of the year, is the eastern boundary for this ESU. Not included in this ESU are "stream-type" spring-run chinook salmon found in the Klickitat River (which are considered part of the Mid-Columbia River Spring-Run ESU) or the introduced Carson spring-chinook salmon strain. "Tule" fall chinook salmon in the Wind and Little White Salmon Rivers are included in this ESU, but not introduced "upriver bright" fall-chinook salmon populations in the Wind, White Salmon, and Klickitat Rivers. For this ESU, the Cowlitz, Kalama, Lewis, White Salmon, and Klickitat Rivers are the major river systems on the Washington side, and the Willamette and Sandy Rivers are foremost on the Oregon side. The majority of this ESU is represented by fall-run fish and includes both north migrating tule-type stocks and far-north migrating bright stocks. There are also several spring stocks that are considered part of the ESU. None of the hatchery populations in the Lower Columbia River are listed.

Upper Willamette River (UWR) Chinook

The UWR chinook ESU occupies the Willamette River and tributaries upstream of Willamette Falls. Historically, access above Willamette Falls was restricted to the spring when flows were high. In autumn low flows prevented fish from ascending past the falls. The Upper Willamette spring chinook are one of the most genetically distinct chinook groups in the Columbia River Basin. Fall chinook salmon spawn in the Upper Willamette but are not considered part of the ESU because they are not native. None of the hatchery populations in the Willamette River is listed, although the spring-run hatchery stocks were included in the ESU.

Upper Columbia River Spring (UCRS) Chinook

The UCRS chinook ESU includes stream-type chinook salmon spawning above Rock Island Dam including the Wenatchee, Entiat, and Methow River basins. All chinook in the Okanogan River are apparently ocean-type and are considered part of the Upper Columbia River Summer- and Fall-run ESU. The Wenatchee and Entiat rivers are in the Northern Cascades Physiographic Province and the Methow River is in the Okanogan Highlands Physiographic Province. Several hatchery populations are also listed including those from the Chiwawa, Methow, Twisp, Chewuch, and White rivers, and Nason Creek.

Central Valley Spring (CVS) Chinook

Central Valley spring chinook exhibit a characteristic run timing and other adaptive features which allow them to enter the upper reaches of river systems prior to the onset of the low flows and high water temperatures that inhibit access to these areas during the fall. The run appears in the Sacramento River and its tributaries from February to July and spawning occurs from late August through early October, with a peak in September. Their higher fat reserves, smaller body size and entry into fresh water with undeveloped gonads facilitate the accent to higher streams (up to 1,500 m elevation) (Yoshiyama et al. 1996). Spring chinook in the Sacramento River exhibit an ocean-type life history, emigrating as fry, sub-yearlings, and yearlings.

California Coastal (CC) Chinook

This ESU includes all naturally spawned coastal spring and fall chinook salmon spawning from the Eel River to the Russian River. Chinook salmon spawn in several small tributaries to San Francisco Bay, however it is uncertain whether these small populations are part of this ESU, or strays from Central Valley chinook salmon ESUs.

C. Life History

Chinook Salmon

Chinook salmon is the largest of the Pacific salmon. 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, 7 total ages with 3 possible freshwater ages. This level of complexity is roughly comparable to sockeye salmon, although sockeye salmon have a more extended freshwater residence period and utilize different freshwater habitats (Miller and Brannon 1982, Burgner 1991). 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. 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).

D. Population Dynamics and Distribution

Snake River Fall Chinook

The spawning grounds between Huntington (RM 328) and Auger Falls (RM 607) were historically the most important for this species. Only limited spawning activity was reported downstream from RM 273 (Waples, et al. 1991), about one mile upstream of Oxbow Dam. Since then, irrigation and hydropower projects on the mainstem Snake River have blocked access to or inundated much of this habitat—causing the fish to seek out less-preferable spawning grounds wherever they are available. Natural fall chinook salmon spawning now occurs primarily in the Snake River below Hells Canyon Dam and the lower reaches of the Clearwater, Grand Ronde, Salmon, and Tucannon Rivers.

Adult SRF chinook salmon enter the Columbia River in July and migrate into the Snake River from August through October. Fall chinook salmon generally spawn from October through November and fry emerge from March through April. Downstream migration generally begins within several weeks of emergence (Becker 1970, Allen and Meekin 1973), and juveniles rear in backwaters and shallow water areas through mid-summer prior to smolting and migrating to the ocean—thus they exhibit an "ocean" type juvenile history. Once in the ocean, they spend one to four years (though usually, three) before beginning their spawning migration. Fall returns in the Snake River system are typically dominated by four-year-old fish. For detailed information on the SRF chinook salmon, see NMFS (1991) and June 27, 1991, 56 FR 29542.

No reliable estimates of historical abundance are available, but because of their dependence on mainstem habitat for spawning, fall chinook have probably been impacted to a greater extent by the development of irrigation and hydroelectric projects than any other species of salmon. It has been estimated that the mean number of adult SRF chinook salmon declined from 72,000 in the 1930s and 1940s to 29,000 during the 1950s. In spite of this, the Snake River remained the most important natural production area for fall chinook in the entire Columbia River basin through the 1950s. The number of adults counted at the uppermost Snake River mainstem dams averaged 12,720 total spawners from 1964 to 1968, 3,416 spawners from 1969 to 1974, and 610 spawners from 1975 to 1980 (Waples, et al. 1991).

Counts of adult fish of natural-origin continued to decline through the 1980s reaching a low of 78 individuals in 1990 (Table 3). Since then the return of natural-origin fish to Lower Granite Dam (LGD) has been variable, but generally increasing reaching a recent year high of 797 in 1997. The 1998 return declined to 306. This was not anticipated and is of particular concern because it is close to the low threshold escapement level of 300 that is indicative of increased risk (BRWG 1994). It has been suggested that the low return in 1998 was due to severe flooding in 1995 that affected the primary contributing brood year. The expected return of natural-origin adults to LGD in 1999 given the anticipated ocean and in-river fisheries is 518.

Unlike many of the listed salmonid ESUs, SRF chinook is probably represented by only a single population that spawns in the parts of the mainstem that remain accessible and the lower reaches of the associated tributaries. The more complex population structure that likely existed historically was eliminated by the upstream dams.

The recovery standard identified in the 1995 Proposed Recovery Plan (NMFS 1995a) for SRF chinook was a population of at least 2,500 naturally produced spawners (to be calculated as an eight year geometric mean) in the lower Snake River and its tributaries. The LGD counts can not be compared directly to the natural spawner escapement objective since it is also necessary to account for adults which may fall back below the dam after counting and pre-spawning mortality. A preliminary estimate suggested that a LGD count of 4,300 would be necessary to meet the 2,500 fish escapement goal (NMFS 1995a). For comparison, the geometric mean of the LGD counts of natural-origin fall chinook over the last eight years is 481.

A further consideration regarding the status of SRF chinook is the existence of the Lyons Ferry Hatchery stock which is considered part of the ESU. There have been several hundred adults returning to the Lyons Ferry Hatchery in recent years (Table 3). More recently, supplementation efforts designed to accelerate rebuilding were initiated beginning with smolt outplants from the 1995 brood year. The existence of the Lyons Ferry program has been an important consideration in evaluating the status of the ESU since it reduces the short-term risk of extinction by providing a reserve of fish from the ESU. Without the hatchery program the risk of extinction would have to be considered high since the ESU would otherwise be comprised of a few hundred individuals from a single population, in marginal habitat, with a demonstrated record of low productivity. Although the supplementation program likely contributes future natural origin spawners, it does little to change the productivity of the system upon which a naturally spawning population must rely. Supplementation is, therefore, not a long-term substitute for recovery. [See NMFS (1999e) for further discussion on the SRF chinook supplementation program.]

Recent analyses conducted through the PATH process (Plan for Analyzing and Testing Hypotheses) considered the prospects for survival and recovery given several future management options for the hydro system and other mortality sectors (Marmorek et al. 1998, Peters et al. 1999). That analysis indicated that the prospects of survival for SRF chinook were good, but that full recovery was relatively unlikely except under a very limited range of assumptions, or unless draw down was implemented for at least the four lower Snake River dams operated by the U.S. Army Corps of Engineers. Consideration of the draw down options led to a high likelihood that both survival and recovery objectives could be achieved.

The Northwest Fisheries Science Center (NFSC) has recently considered the extinction risk for SRF chinook as part of their Cumulative Risk Initiative (CRI). The results indicate that the probability of extinction for SRF chinook over the next ten years is near zero while the risk of extinction over 100 years is between 6-17% (depending on whether 1980 is included in the baseline analysis).

Table 3. Escapement and Stock Composition of Fall Chinook at Lower Granite Dam[1]						
Year	L. Granite Count	Marked Fish to Lyons Ferry Hatch.	L. Granite Dam Escapement	Stock Comp. of L. Granite Escapement		
					Hatchery Origin	
				Wild	Snake R.	Non-Snake R.
1975	1000		1000	1000		
1976	470		470	470		
1977	600		600	600		
1978	640		640	640		
1979	500		500	500		
1980	450		450	450		
1981	340		340	340		
1982	720		720	720		
1983	540		540	428	112	
1984	640		640	324	310	6
1985	691		691	438	241	12
1986	784		784	449	325	10
1987	951		951	253	644	54
1988	627		627	368	201	58
1989	706		706	295	206	205
1990	385	50	335	78	174	83
1991	630	40	590	318	202	70
1992	855	187	668	549	100	19
1993	1170	218	952	742	43	167
1994	791	185	606	406	20	180
1995	1067	430	637	350	1	286
1996	1308	389	919	639	74	206
1997	1451	444	1007	797	20	190
1998	1909	947	962	306	479	177

[1]Information taken from Revised Tables for the Biological Assessment of Impacts of Anticipated 1996-1998 Fall Season Columbia River Mainstem and Tributary Fisheries on Snake River Salmon Species Listed Under the ESA, prepared by the U.S. v. Oregon Technical Advisory Committee.

Puget Sound Chinook

This ESU encompasses all runs of chinook salmon in the Puget Sound region from the North Fork Nooksack River in the east to the Elwha River on the Olympic Peninsula. Chinook salmon in this area all exhibit an ocean-type life history. Although some spring-run chinook salmon populations in the PS 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.

The peak recorded harvest landed in Puget Sound occurred in 1908, when 95,210 cases of canned chinook salmon were packed. This corresponds to a run-size of approximately 690,000 chinook salmon at a time when both ocean harvest and hatchery production were negligible. [This estimate, as with other historical estimates, needs to be viewed cautiously; Puget Sound cannery pack probably included a portion of fish landed at Puget Sound ports but originating in adjacent areas, and the estimates of exploitation rates (ER) used in run-size expansions are not based on precise data.] Recent mean spawning escapements totaling 71,000 correspond to a run entering Puget Sound of approximately 160,000 fish. Based on an exploitation rate of one-third in intercepting ocean fisheries, the recent average potential run-size would be 240,000 chinook salmon (Pacific Salmon Commission 1994).

The 5-year geometric mean of spawning escapement of natural chinook salmon runs in North Puget Sound for 1992-96 is approximately 13,000. Both long and short-term trends for these runs were negative, with few exceptions. In South Puget Sound, spawning escapement of the natural runs has averaged 11,000 spawners. In this area, both long and short-term trends are predominantly positive.

Puget Sound chinook are the largest and most complex ESU that is considered in detail in this opinion. WDF et al. (1993) identified 28 stocks that were distributed among five geographic regions and 12 management units or basins (Table 4). [The Hoko River stock was included in WDF's initial inventory, but was subsequently assigned to the neighboring ESU.] NMFS is currently engaged in delineating the population structure of PS chinook and other ESUs as an initial step in a formal recovery planning effort that is now underway. These determinations have not been finalized at this time, but it is clear that these 28 stocks represent the greatest level of potential stratification and that some further aggregation of these stocks is likely (Myers, J. NWFSC/NMFS, pers. com. P. Dygert, NMFS, Sept. 2, 1999). By considering the status of the stocks as described by WDF, NMFS can be reasonably certain that we are not overlooking population structures that may be important to the ESU.

Table 4. Distribution of stocks identified in WDF (1993) by recovery category. Stock timing designations are spring (SP), summer (S), fall (F), and summer/fall (SF).

Region of Origin	Management Unit	Stock/Timing	Recovery Category
Strait of Juan de Fuca	Strait of Juan de Fuca	Elwha/Morse Cr./SF Dungeness/SP	1* 1
Hood Canal	Hood Canal	Hood Canal/SF	2 & 3
North Sound	Nooksack/Samish	NF Nooksack/SP SF Nooksack/SP Nooksack/F	1 1 2
	Skagit Spring	Upper Sauk/SP Suiattle/SP Cascade/SP	1 1 1
	Skagit Summer/Fall	Upper Skagit/S Lower Skagit/F Lower Sauk/S	1 1 1
	Stillaguamish	Stillaguamish/S Stillaguamish/F	1 1
	Snohomish	Snohomish/S Wallace/SF Snohomish/F Bridal Veil Cr/F	1 1 1 1
Mid-Sound	Lake Washington	Issaquah/SF N Lake WA Tribs/SF Cedar/SF	2* 2 1
	Duwamish/Green	Duwamish/Green/SF Newaukum Cr/SF	1 1
South Sound	Puyallup	White River/SP White River/SF Puyallup River /SF	1 2* 2
	Nisqually	Nisqually River/SF	2
	South Sound Tribs	South Sound Tribs/SF	3

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 addition, the Puget Sound contains areas where indigenous local stocks persist and areas where local stocks are a composite of indigenous stocks and introduced hatchery fish that may or may not be of local origin. In some areas where natural production has been lost, hatchery production has been used to mitigate for lost natural production.

The status of each of the identified stocks is discussed in more detail in a recent biological opinion concerning the effects of the Pacific Salmon Treaty on listed salmonids (NMFS 1999f). That discussion is incorporated here by reference. However, the analysis in this opinion requires less detail and just focuses on the aggregates of spring and summer/fall type chinook stocks. The spring stocks as a group are the most depressed component of the ESU. The status of the fall stocks varies with some being at or near spawning escapement objectives and other being quite depressed.

Lower Columbia River Chinook

The LCR ESU includes spring stocks and fall tule and bright components. Spring-run chinook salmon on the lower Columbia River, like those from coastal stocks, enter freshwater in March and April well in advance of spawning in August and September. Historically, fish migrations were synchronized with periods of high rainfall or snowmelt 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).

Fall chinook predominate the Lower Columbia River salmon runs. Fall chinook return to the river in mid-August and spawn within a few weeks (WDF et al. 1993, Kostow 1995). The majority of fall-run chinook salmon emigrate to the marine environment as sub-yearlings (Reimers and Loeffel 1967, Howell et al. 1985, WDF et al. 1993). A portion of returning adults whose scales indicate a yearling smolt migration may be the result of extended hatchery-rearing programs rather than of natural, volitional yearling emigration. It is also possible that modifications in the river environment may have altered the duration of freshwater residence. Adults return to tributaries in the Lower Columbia River at 3 and 4 years of age for fall-run fish and 4 to 5 years of age for spring-run fish. This may be related to the predominance of yearling smolts among spring-run stocks. Marine coded-wire-tag recoveries for lower Columbia River stocks tend to occur off the British Columbia and Washington coasts, though a small proportion of the tags are recovered in Alaskan waters.

There are no reliable estimates of historic abundance for this ESU, but it is generally agreed that there have been vast reductions in natural production over the last century. Recent abundance of spawners includes a 5-year geometric mean natural spawning escapement of 29,000 natural spawners and 37,000 hatchery spawners (1991-95), but according to the accounting of PFMC (1996), approximately 68% of the natural spawners are first-generation hatchery strays.

All basins in the region are affected to varying degrees by habitat degradation. Major habitat problems are related primarily to blockages, forest practices, urbanization in the Portland and Vancouver areas, and agriculture in flood plains and low-gradient tributaries. Substantial chinook salmon spawning habitat has been blocked (or passage substantially impaired) in the Cowlitz (Mayfield Dam 1963, RKm 84), Lewis (Merwin Dam 1931, RKm 31), Clackamas (North Fork Dam 1958, RKm 50), Hood (Powerdale Dam 1929, RKm 7), and Sandy (Marmot Dam 1912, RKm 48; Bull Run River dams in the early 1900s) rivers (WDF et al. 1993, Kostow 1995).

Hatchery programs to enhance chinook salmon fisheries in the lower Columbia River began in the 1870s, expanded rapidly, and have continued throughout this century. Although the majority of the stocks have come from within this ESU, over 200 million fish from outside the ESU have been released since 1930. A particular concern noted at the time of listing related to the straying by Rogue River fall-run chinook salmon, which are released into the lower Columbia River to augment harvest opportunities. The release strategy has since been modified to minimize straying, but it is too early to assess the effect of the change. Available evidence indicates a pervasive influence of hatchery fish on most natural populations throughout this ESU, including both spring- and fall-run populations (Howell et al. 1985, Marshall et al. 1995). In addition, the exchange of eggs between hatcheries in this ESU has led to the extensive genetic homogenization of hatchery stocks (Utter et al. 1989).

The remaining spring chinook stocks in the LCR ESU are found in the Sandy on the Oregon side and Lewis, Cowlitz, and Kalama on the Washington side. Spring chinook in the Clackamas River are considered part of the UWR ESU. Naturally spawning spring chinook in the Sandy River are included in the LCR ESU despite substantial influence of Willamette hatchery fish from past years since they likely contain all that remains of the original genetic legacy for that system. Recent escapements above Marmot Dam on the Sandy River average 2,800 and have been increasing (ODFW 1998b). 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% in recent years.

On the Washington side spring chinook were present historically in the Cowlitz, Kalama, and Lewis rivers. Spawning areas were blocked by dam construction in the Cowlitz and Lewis. The native Lewis run became extinct soon after completion of Merwin Dam in 1932. Production in the Kalama was limited by the dams and by 1950 only a remnant population remained. Spring chinook in the Cowlitz, Kalama, and Lewis are currently all hatchery fish. There is some natural spawning in the three rivers, but these are believed to be primarily from hatchery strays (ODFW 1998b). The recent averages (1994-1998) for naturally spawning spring chinook in the Cowlitz, Kalama, and Lewis are 235, 224, and 372, respectively. 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. The Lewis and Kalama hatchery stocks have been mixed with out of basin stocks, but are nonetheless included in the ESU. The Cowlitz stock is largely free of introductions and is considered essential for recovery although not listed. The number of spring chinook returning to the Cowlitz, Kalama, and Lewis rivers have declined in recent years, but still number several hundred to a few thousand in each system (Table 5). Hatchery escapement goals have been consistently met in the Cowlitz and

Lewis Rivers. The goal has not been met in all years in the Kalama, but WDFW continues to use brood stock from the Lewis 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, the status of the hatchery stocks is pertinent.

Table 5. Estimated Lower Columbia River spring chinook tributary returns, 1992-1999. (Source: Pettit 1998, ODFW/WDFW 1998.)

Year	Sandy R.	Cowlitz R.	Lewis R.	Kalama R.	Total Returns Excluding the Willamette System
1992	8,600	10,400	5,600	2,400	27,200
1993	6,400	9,500	6,600	3,000	25,500
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	4,300	1,100	1,600	400	7,400
1999		1,600	1,900	600	

There are apparently three self-sustaining natural populations of tule chinook in the Lower Columbia River (Coweeman, East Fork Lewis, and Clackamas) that are not substantially influenced by hatchery strays. Returns to the East Fork and Coweeman have been stable and near interim escapement goals in recent years. Recent 5 and 10 year average escapements to the East Fork Lewis have been about 300 compared to an interim escapement goal of 300. Recent 5 and 10 year average escapements to the Coweeman are 900 and 700, respectively compared to an interim natural escapement goal of 1000 (pers. comm., from G. Norman, WDFW to P. Dygert NMFS, February 22, 1999). Natural escapement on the Clackamas has averaged about 350 in recent years. There have been no releases of hatchery fall chinook in the Clackamas since 1981 and there are apparently few hatchery strays. The population is considered depressed, but stable and self-sustaining (ODFW 1998b). There is some natural spawning of tule fall chinook in the Wind and Little White Salmon Rivers, tributaries above Bonneville Dam (the only component of the ESU that is affected by tribal fisheries). Although there may be some natural production in these systems, the spawning results primarily from hatchery-origin strays.

The LCR bright stocks are among the few healthy natural chinook stocks in the Columbia River Basin. Escapement to the North Fork Lewis River has exceed its escapement goal of 5,700 by a substantial margin every year since 1980 with a recent five year average escapement of 10,000. The forecast in 1999 is for an exceptionally low return of about 2,500 and if correct would obviously be under the escapement goal. The low return in 1999 has been attributed to severe flooding that occurred in 1995 and 1996. Despite this apparent aberration, this population is considered healthy.

There are two smaller populations of LCR brights in the Sandy and East Fork Lewis River. Run sizes in the Sandy have averaged about 1000 and been stable for the last 10-12 years. The fall chinook hatchery program in the Sandy was discontinued in 1977, which has certainly reduced the number of hatchery strays in the system. There is also a late spawning component in the East Fork Lewis that is comparable in timing to the other bright stocks. The escapement of these fish is less well documented, but it appears to be stable and largely unaffected by hatchery fish (ODFW 1998b).

Upper Willamette River Chinook

Upper Willamette River chinook are one of the most genetically distinct groups or chinook in the Columbia River Basin. This may be related in part to the narrow time window available for passage above Willamette Falls. Chinook populations in this ESU have a life history pattern that includes traits from both ocean- and stream-type life histories. Smolt emigrations occur as young of the year and as age-1 fish. Ocean distribution of chinook in this ESU is consistent with an ocean-type life history with the majority of chinook being caught off the coasts of British Columbia and Alaska. Spring chinook from the Willamette River have the earliest return timing of chinook stocks in the Columbia Basin with freshwater entry beginning in February. Historically, spawning occurred between mid-July and late October. However, the current spawn timing of hatchery and wild chinook in September and early October likely is due to hatchery fish introgression.

The abundance of naturally-produced spring chinook in the ESU has declined substantially from historic levels. Historic escapement levels may have been as high as 200,000 fish per year. The production capacity of the system has been reduced substantially by extensive dam construction and habitat degradation. From 1946-50, the geometric mean of Willamette Falls counts for spring chinook was 31,000 fish (Myers et al. 1998), which represented primarily naturally-produced fish. The most recent 5 year (1995-1999) geometric mean escapement above the falls was 27,800 fish, comprised predominantly of hatchery-produced fish (Table 6). Nicholas (1995) estimated 3,900 natural spawners in 1994 for the ESU, with approximately 1,300 of these spawners being naturally produced. There has been a gradual increase in naturally spawning fish in recent years, but it is believed that many of these are first generation hatchery fish. The long-term trend for total spring chinook abundance within the ESU has been approximately stable although there was a series of higher returns in the late-80s and early-90s that are associated with years of higher ocean survival. The great majority of fish returning to the Willamette River in recent years have been of hatchery-origin.

Historically, there were five major basins that produced spring chinook including the Clackamas, North and South Santiam Rivers, McKenzie, and the Middle Fork Willamette. However, between 1952-1968 dams were built on all of the major tributaries occupied by spring chinook, blocking over half the most important spawning and rearing habitat. Dam operations have also reduced habitat quality in downstream areas due to thermal and flow effects. Dams on the South Fork Santiam and Middle Fork Willamette eliminated wild spring chinook in those systems (ODFW 1997). Although there is still some natural spawning in these systems below the dams, habitat quality is such that there is probably little resulting production and the spawners are likely of hatchery origin. Populations in several smaller tributaries that also used to support spring chinook are believed to be extinct (Nicholas 1995).

The available habitat in the North Fork Santiam and McKenzie rivers was reduced to 1/4 and 2/3, respectively, of its original capacity. Spring chinook on the Clackamas were extirpated from the upper watershed after the fish ladder at Faraday Dam washed out in 1917, but recolonized the system after 1939 when the ladder was repaired. NMFS was unable to determine, based on available information whether this represents a historical affinity or a recent, human-mediated expansion into the Clackamas River. Regardless, NMFS included natural-origin spring chinook as part of the listed populations and considers Clackamas spring chinook as a potentially important genetic resource for recovery.

The McKenzie, Clackamas, and North Santiam are therefore the primarily basins that continue to support natural production. Of these the McKenzie is considered the most important. Prior to construction of major dams on Willamette tributaries, the McKenzie produced 40% of the spring chinook above Willamette Falls and it may now account for half the production potential in the Basin. Despite dam construction and other habitat degradations, the McKenzie still supports substantial production with most of the better quality habitat locate above Leaburg Dam. The interim escapement objective for the area above the Dam is 3,000-5,000 spawners (ODFW 1998a). Pristine production in that area may have been as high as 10,000, although substantial habitat improvements would be required to again achieve pristine production levels. Estimates of the number of natural-origin spring chinook returning to Leaburg Dam are available since 1994 when adults from releases of hatchery reared smolts above the dam were no longer present. The number of natural-origin fish at the Dam has increased steadily from 786 in 1994 to 1,458 in 1999 (Table 6). Additional spawning in areas below the Dam accounts for about 20% of the McKenzie return.

The Clackamas River currently accounts for about 20% of the production in the Willamette Basin. The production comes from one hatchery and natural production areas located primarily above the North Fork Dam. The interim escapement goal for the area above the Dam is 2,900 adults (ODFW 1998a). This system is heavily influenced by hatchery production so it is difficult to distinguish natural from hatchery-origin spawners. Most of the natural spawning occurs above the North Fork Dam with 1,000- 1,500 adults crossing the Dam in recent years. There were 380 redds counted above the dam in 1998 and similar counts in 1997 (Lindsay et. al. 1998). There is some spawning in the area below the Dam as well although the origin and productivity of these fish is again uncertain. There were 48 spring chinook redds counted below the North Fork Dam in 1998.

Over 70% of the production capacity of the North Santiam system was blocked by the Detroit Dam. There are no passage facilities at the Dam so all of the current natural production potential remains downstream. The remaining habitat is adversely affected by warm water and flow regulation. The system is again influenced substantially by hatchery production, although the original genetic resources have been maintained since Marion Forks Hatchery stock has been derived almost exclusively from North Santiam brood sources (ODFW 1998a). Despite these limitations there continues to be natural spawning in the lower river. There were 194 redds counted in the area below Minto Dam (the lower-most dam) in 1998, which was marginally higher than during the prior two years (Lindsay et. al. 1998). The origin of the spawning adults or their reproductive success has not been determined.

Mitigation hatcheries were built to offset the substantial habitat losses resulting from dam construction and, as a result, 85%-95% of the production in the basin is now hatchery origin fish. On the one hand these hatchery populations represent a risk to the ESU. The genetic diversity of the ESU has been largely homogenized due to the past practice of broodstock transfers within the basin. Domestication is also a risk given the predominance of hatchery fish. Nevertheless, the hatchery populations also represent a genetic resource. All five of the hatchery stocks were included in the ESU and therefore are available to support recovery efforts. Given the extensive network of dams in the basin and other pervasive habitat degradations, it is clear that most, if not all, of the remaining populations would have been eliminated had it not been for the hatchery programs.

NMFS is currently engaged in a consultation to consider the future operation of the hatchery facilities in the Willamette Basin. This will reduce future risks associated with hatchery operations. Substantial efforts have already been taken to remedy some of the past hatchery practices including limiting the proportion of hatchery spawners in some natural production areas and reincorporating local-origin wild fish into the hatchery broodstock (ODFW 1998a). All hatchery produced fish in the Basin are now externally marked. Once these fish are fully recruited, the mass marking will allow implementation of selective fisheries in terminal areas and thus provide harvest opportunity with limited impacts to natural origin fish. The marking program will also greatly improve the managers' ability to monitor and control hatchery straying and production. The fall chinook hatchery production program was also noted as a risk to the species since fall chinook were not historically present above Willamette Falls. The fall production program at Stayton Ponds has now been closed with the last release made in 1995. It is reasonable to expect that the return of fall chinook will diminish rapidly as a result.

Table 6. Run size of spring chinook at the mouth of the Willamette River and counts at Willamette Falls and Leaburg Dam on the McKenzie River (Nicholas 1995; ODFW and WDFW 1998). The Leaburg counts show wild and hatchery combined and wild only since 1994.

Return Year	Estimated number entering Willamette River	Willamette Falls Count	Leaburg Dam Count	
			Combined	Wild Only
1985	57,100	34,533	825	
1986	62,500	39,155	2,061	
1987	82,900	54,832	3,455	
1988	103,900	70,451	6,753	
1989	102,000	69,180	3,976	
1990	106,300	71,273	7,115	
1991	95,200	52,516	4,359	
1992	68,000	42,004	3,816	
1993	63,900	31,966	3,617	
1994	47,200	26,102	1,526	786
1995	42,600	20,592	1,622	894
1996	34,600	21,605	1,445	1,086
1997	35,000	26,885	1,176	981
1998	45,100	34,461	1,874	1,364
1999	58,000*	40,410	1,458	1,416

*preliminary

Upper Columbia River Spring Chinook

Upper Columbia River Spring chinook have a stream-type life history. Adults return to the Wenatchee River from late March to early May, and from late March to June in the Entiat and Methow Rivers. Most adults return after spending two years in the ocean, while 20%-40% return after three years at sea. Peak spawning for all three populations occurs from August to September. Smolts typically spend one year in freshwater before migrating downstream. This ESU has slight genetic differences from other ESUs containing stream-type fish, but more importantly it has ecological differences in spawning and rearing habitats that were used to define the ESU boundary (Myers et al. 1998). The Grand Coulee Fish Maintenance Project

(1939-1943) was also a major influence on this ESU because fish from multiple populations were mixed into one relatively homogenous group and redistributed into streams throughout the Upper Columbia Region.

The ocean distribution of this ESU is generally to the north and offshore. Upper Columbia River Spring chinook are similar to Snake River spring/summer chinook in that they are subject to very little ocean harvest which is confirmed again here in relation to the groundfish fisheries. The status of UCRS chinook is discussed in more detail in NMFS (1999f) which is incorporated here by reference.

Central Valley Spring Chinook

Historically, spring chinook were most abundant in the San Joaquin Basin and the dominant run in both the Sacramento and San Joaquin River systems (Clark 1929, Fry 1961). Native populations in the San Joaquin River have apparently all been extirpated (Campbell and Moyle, 1990). The ESU presently occupies the Sacramento River Basin, occurring consistently in Mill, Deer and Butte creeks, with intermittent populations in Antelope, Big Chico, and Beegum creeks. Some spawning may occur in the main stem Sacramento. The long term abundance trends for the Mill, Deer, and Butte creek populations are negative (Myers et al. 1998), however since 1991 these populations have been increasing. The mean adult replacement rates for the1991 - 1996 brood years have been 2.0, 1.9 and 3.0 for Mill, Deer and Butte creeks respectively. The Butte Creek population is genetically distinct from the Deer and Mill Creek populations, returning earlier and spawning at lower elevations.

"Deer Creek is currently believed to have sufficient habitat to support "sustainable populations" of 4,000 spring-run (CDFG 1993)." (Yoshiyama et al. 1996). The Deer Creek population has been increasing since 1993; 1,900 and 1,500 adults returned in 1998 and 1999 respectively.

Artificial Propagation Efforts to enhance runs of Sacramento River spring chinook salmon through artificial propagation date back over a century. Since 1967, artificial production has focused on the program at the Feather River Hatchery. The use of a fixed date to distinguish returning spring- and fall-run fish at the Feather River Hatchery, however, has likely resulted in considerable hybridization between the two runs. In half of the years between 1987 and 1994 substantial numbers (21-46%) of the progeny of fish spawned as fall run were subsequently spawned as spring run (CDFG 1998). Genetic analysis revealed that spring-run chinook salmon from the Feather River Hatchery are genetically intermediate between spring- and fall-run samples and most similar to the sample of Feather River Hatchery fall-run chinook salmon (Myers et al. 1999). The Dept of Fish and Game compared CWT recovery rates of Feather River Hatchery spring run and Central Valley fall run (CDFG 1998). While there were minimal differences in the spacial ocean distribution of fall- and spring-run fish, they reported that 68% of the total annual harvest of age-3 Feather River Hatchery spring-run occurred during the months of February through April, compared to 41% for the fall run. Because of the hybridization of the spring and fall runs at the Feather River Hatchery, CDFG questioned whether the Feather River Hatchery spring run was an appropriate surrogate for the evaluation of the effects of ocean harvest on wild populations of spring chinook.

California Coastal Chinook

Chinook salmon from coastal areas north of the Eel River, from the Central Valley and from Klamath River Basin upstream from the Trinity River confluence are genetically and ecologically distinguishable from those in this ESU. Chinook salmon in this ESU exhibit an ocean-type life-history. No information exists on ocean distribution (based on marine CWT recoveries). Life-history information on the ESU is extremely limited. Additionally, only anecdotal or incomplete information exists on abundance of several spring-run populations including Mad and Eel Rivers.

Allozyme data indicate that this ESU is genetically distinguishable from the Oregon Coast, Upper Klamath and Trinity River, and Central Valley ESUs. Life history differences also exist between spring- and fall-run fish in this ESU, but not to the same extent as is observed in larger inland basins. Ecologically, the majority of the river systems in this ESU are relatively small and heavily influenced by a maritime climate. Low summer flows and high temperatures in many rivers result in seasonal physical and thermal barrier bars that block movement by anadromous fish.

III. Environmental Baseline

Environmental baselines for biological opinions include the past and present impacts of all state, federal or private actions and other human activities in the action area, the anticipated impacts of all proposed federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR §402.02).

A. Status of the Species and Critical Habitat within the Action Area

The assessments of the size, variability and stability of chinook populations, described in the previous sections, are made in fresh water spawning and migratory environments and closely reflect the status of chinook populations in the marine environment.

Critical habitat has not been designated for any of the newly listed chinook ESUs considered in this opinion. Critical habitat has been designated for SRF chinook. Marine habitats (i.e., oceanic or near shore areas seaward of the mouth of coastal rivers) are clearly vital to the species, and ocean conditions are believed to have a major influence on chinook salmon survival and productivity (see review in Pearcy, 1992). To date NMFS has not included marine areas when designating critical habitat for other salmon ESUs because there has been no apparent need for special management action to protect offshore areas. NMFS has not included marine areas when designating critical habitat for SRF chinook, or other salmon ESUs. Inshore marine areas, such as those in Puget Sound, may be more critical to the species survival. In the event that marine areas are designated for newly listed chinook salmon, the effect of ocean fisheries on critical habitat will be reconsidered.

B. Factors Affecting Species Environment Within the Action Area .

Commercial and Recreational Salmon Fisheries off the Coasts of Washington, Oregon, and California of the Pacific Fishery Management Council

Since 1989, NMFS has listed 26 ESUs of salmon, steelhead and cutthroat trout (Table 1). As the listings have occurred, NMFS has initiated formal section 7 consultations and issued biological opinions (Table 7) which consider the impacts to listed salmonid species, and some proposed salmonid species, resulting from proposed implementation of the Pacific Coast Salmon Plan (Salmon FMP), or in some cases, from implementation of the annual management measures. NMFS has also reinitiated consultation on certain ESUs when new information has become available on the status of the stocks or on the impacts of the Salmon FMP on the stocks.

In the biological opinion dated March 8, 1996, NMFS considered the impacts to salmon species then listed under the ESA resulting from implementation of the Salmon FMP including spring/summer chinook, fall chinook, and sockeye salmon from the Snake River and SRWR chinook. Provisions of the March 8, 1996, opinion regarding SRWR chinook were revised in a reinitiated section 7 biological opinion dated February 18, 1997. Two subsequent biological opinions dated April 30, 1997 and April 29, 1998 considered the effects of PFMC fisheries on the growing catalogue of listed species (Table 1). However, these latter two opinions were specific to the annual regulations adopted pursuant to implementation of the Salmon FMP and therefore were limited in duration to the year in question. The biological opinion concerning PFMC salmon fisheries, dated April 28, 1999, considered the effect of implementing Amendment 13 to the Salmon FMP on three currently listed coho ESUs. Because this opinion was programmatic in that it considered the amendment itself rather than just the annual regulations, it provides long-term coverage for PFMC fisheries regarding the three listed coho ESUs. The most recent biological opinion concerning PFMC salmon fisheries, was dated April 30, 1999, and covered ocean salmon fisheries for the 1999-2000 season.

This consultation history provides a mix of long and short-term coverage for the various ESUs with respect to PFMC ocean salmon fisheries. The effects of implementing the FMP on the three Snake River ESUs, SRWR chinook, and the three coho ESUs are covered by outstanding and still applicable opinions. The effects of PFMC fisheries on Umpqua River cutthroat and several steelhead ESUs have been considered previously, but only in opinions with an annual duration. Nine additional ESUs of chinook, sockeye, and chum salmon and steelhead were listed on March 24, 1999 (Table 1). The effects of PFMC fisheries on these species had not been previously considered. This biological opinion therefore considered the effects of the 1999 PFMC fisheries on the nine newly listed ESUs and the previously listed cutthroat and steelhead ESUs not currently covered by an existing opinion.

The Salmon FMP is currently being revised and amended primarily to incorporate required changes resulting from the Magnuson-Stevens Act. This revision, known as Amendment 14, will also be subject to consultation. Amendment 14 to the Salmon FMP and its accompanying supplemental environmental impact statement (Amendment 14) represent a comprehensive updating of the Salmon FMP. NMFS is therefore conducting a consultation under section 7 of the ESA on the effects that Amendment 14, as submitted to NMFS, may have on listed salmon stocks. This consultation considers whether any of the provisions of Amendment 14 will modify the Salmon FMP in a manner that adversely affects any of the listed species or designated critical habitat. In general, Amendment 14 will result in more conservative management in response to the requirements of the Magnuson-Stevens Act.

Table 7. NMFS biological opinions on ocean salmon fisheries implemented under the PFMC Salmon FMP and duration of the proposed action covered by each opinion.

Date	ESU covered and effective period
March 1, 1991	Sacramento River winter-run chinook (now superseded)
March 8, 1996	Snake River chinook and sockeye (until reinitiated), Sacramento River winter-run chinook (5 years)
February 18, 1997	Sacramento River winter-run chinook (4 years)
April 30, 1997	SONCC coho, CCC coho, Umpqua River cutthroat trout, all steelhead ESUs proposed for listing (1 year) S. Oregon/ N. California Coastal coho, Central California Coastal coho, Umpqua River cutthroat trout, all steelhead ESUs proposed for listing (1 year)
April 29, 1998	S. Oregon/ N. California Coastal coho, Central California Coastal coho, Umpqua River cutthroat trout, seven listed steelhead ESUs (1 year)
April 28, 1999	Oregon Coastal coho, S. Oregon/ N. California Coastal coho, Central California Coastal coho (until reinitiated)
April 30, 1999	Upper Columbia River Spring chinook, Upper Willamette River chinook, Lower Columbia River chinook, Puget Sound chinook (1 year)

C. Factors Affecting Chinook Outside the Action Area

Salmon Fisheries Outside the Action Area - Fishing Activities

NMFS recently completed a series of consultation regarding salmon fisheries that affect the listed chinook ESUs of concern in this opinion. Consultation on the 1999 ocean salmon fisheries in Alaska was completed on June 30, 1999 (NMFS 1999a). Consultation regarding fall season fisheries in the Columbia River Basin was completed on July 30, 1999 (NMFS 1999e). On November 18, 1999, NMFS signed an opinion covering the recently completed Pacific Salmon Treaty (PST) agreement (NMFS 1999f). The PST opinion specifically covered salmon fisheries in Alaska and Canada that are subject to the agreement, but also analyzed and accounted for impacts that occurred in southern fisheries. This set of opinions provides the most recent review of harvest related impacts in salmon fisheries. Some of the information from those opinions is summarized here and is used indirectly in analyzing the species and stock-specific impacts to listed chinook resulting from the groundfish fisheries.

Until recently the exploitation rates on most of 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 long-term decline in ocean productivity (see following section). Upper Columbia River spring chinook is an exception. The timing and distribution of these stocks is such that ocean harvest mortality is near zero. Inriver harvest rates over the last 15 or 20 years have been 10% or less (ODFW and WDFW 1998). The current depressed status of UCRS chinook is therefore largely unrelated to harvest.

The following series of tables, which was first developed for use in the Alaska fishery opinion (NMFS 1999a), shows the magnitude and distribution of exploitation rates for the chinook ESUs or components of the ESUs. 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 provides the most direct estimates of exploitation rates. The adult equivalent calculation is a procedure that discounts catch for expect 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 accounts for harvest mortality that occurred on age 2-5 fish in years 1994-97. The data is complete through the 1992 brood and 1997 fishery. The 1993 brood is reported, but is incomplete in that the five year old recoveries from the 1998 fishery are not yet available. There is generally a year-long time lag in updating the coast-wide CWT data base necessary to provide these estimates.

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 particular year. Because the models are projections, they can be used to characterize exploitation rate trends from past years and how they compare to the most recent years - 1998 and 1999 in this case - that are not available when using the more direct brood year, CWT estimates. In some cases, the model estimates are reported as an index calculated as the ratio of current exploitation rate divided by the 1989-93 average exploitation rate. Model estimates of ER for the 1999 fisheries are also reported.

The PST opinion (NMFS 1999f) used a somewhat different approach, relying primarily on the a model developed by the Chinook Technical Committee of the Pacific Salmon Commission. These model-based estimates are not directly comparable to those derived from the CWT data in part because of assumptions made in the modeling process, and in part because different stock aggregates are analyzed. For example, the CWT summary uses an aggregate of PS spring stocks while the CTC model is specific to Nooksack spring chinook, one of the component stocks. The data summaries from the Alaska opinion are use in this analysis because they permit comparison of the catch and resulting exploitation rates in PFMC salmon fisheries and with catches in groundfish fisheries.

The total brood year exploitation rate of UWR chinook averaged 0.54 from 1975 through 1990.

The average exploitation rate for the more recent 1991-93 broods was 0.35. Upper Willamette River chinook are a far-north migrating stock (Table 8). The ocean harvest occurs primarily in the Alaskan and northern Canadian fisheries. Because of their northerly distribution and earlier return timing, the exploitation rate of UWR chinook in PFMC fisheries is low, averaging 0.01 both in the past and most recent years (Table 8). The exploitation rate in the river fishery is higher, averaging 0.35 through 1990. Harvest in the river fisheries has declined substantially in recent years because of concerns for Snake River spring/summer chinook and other upriver spring stocks. Commercial harvest in the mainstem have been largely eliminated since 1992. The lower river sport fishery has been closed since 1995. Sport fisheries in the Willamette River and the tributaries have been increasingly restrictive as the return of hatchery and wild fish has declined through the 1990s. The Oregon Department of Fish and Wildlife (ODFW) is now implementing a mass marking and selective fishery program that is expected to reduce inriver recreational harvest rates on natural fish by 80% relative to the 1980-96 average once fully implemented in 2002 (Kruzic 1999).

The Lower Columbia River chinook ESU has three components including spring stocks, tule stocks, and far-north migrating bright stocks. These components have different distributions and are subject to different rates of harvest. The time series of ER for the spring component is not currently available, but the model base period (1979-82) ER for Cowlitz spring chinook in PFMC fisheries is 12%.

The total brood year exploitation rates on tule stocks have averaged 0.75 through 1990 although there has been a pattern of decline over that time period (Table 9). Total exploitation rates from 1991-93 averaged 0.39. 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 0.25 through 1990 and 0.09 for the 1991-93 brood years. The long-term exploitation rate in the river fisheries averaged 0.18. The most recent 3 year average is 0.15.

North Fork Lewis River fall chinook are the primary representative of the bright component of the Lower Columbia River ESU. As noted above this is one of the few healthy wild stocks in the Lower Columbia River. Total exploitation rates have averaged 0.49 through 1990 and 0.29 between 1991-92. This is a far-north migrating stock so the ocean harvest occurs primarily in Alaska and Canada. The long term average exploitation rate in PFMC is 0.05. The more recent average ER is 0.01. Inriver ERs have averaged 0.22 through 1990 and 0.11 in recent years (Table 10).

The PS chinook ESU includes both spring and fall components. The long-term average ER on the spring component is 0.71, but averaged 0.52 for the 1991-93 broods (Table 11). Most of the harvest occurs in Canadian and Puget Sound fisheries. PS spring chinook stocks are subject to little harvest in PFMC fisheries. The long term average ER is 0.01. The estimated ER for the most recent brood years is 0.00.

The distribution of PS fall stocks is similar although their timing is such that they are subject to somewhat higher ERs. The long-term average ER is 0.83. The most recent brood years have been subject to an ER of 0.57. Harvest of PS fall chinook again occurs primarily in Canada and

Puget Sound. The ER in PFMC fisheries averaged 0.03 through 1990 and 0.01 from 1991-93 (Table 12).

A time series of model estimates of total exploitation rates are also available for the PS spring and fall chinook stocks. These are reported as an index relative to the 1989-93 average ER. The estimated total ER indices for spring and fall stocks in 1999 are 0.67 and 0.76, respectively. This is thus an indicator of the magnitude of ER reductions across all fisheries in 1999. Although the decline in ER is moderate relative to the 1989-93 base period, Figure 1 indicates that the ER has declined steadily and more substantially since 1983.

Figure 1. Total adult equivalent exploitation rate index for a composite of Puget Sound spring and fall chinook stocks relative to the 1989-93 average ER.

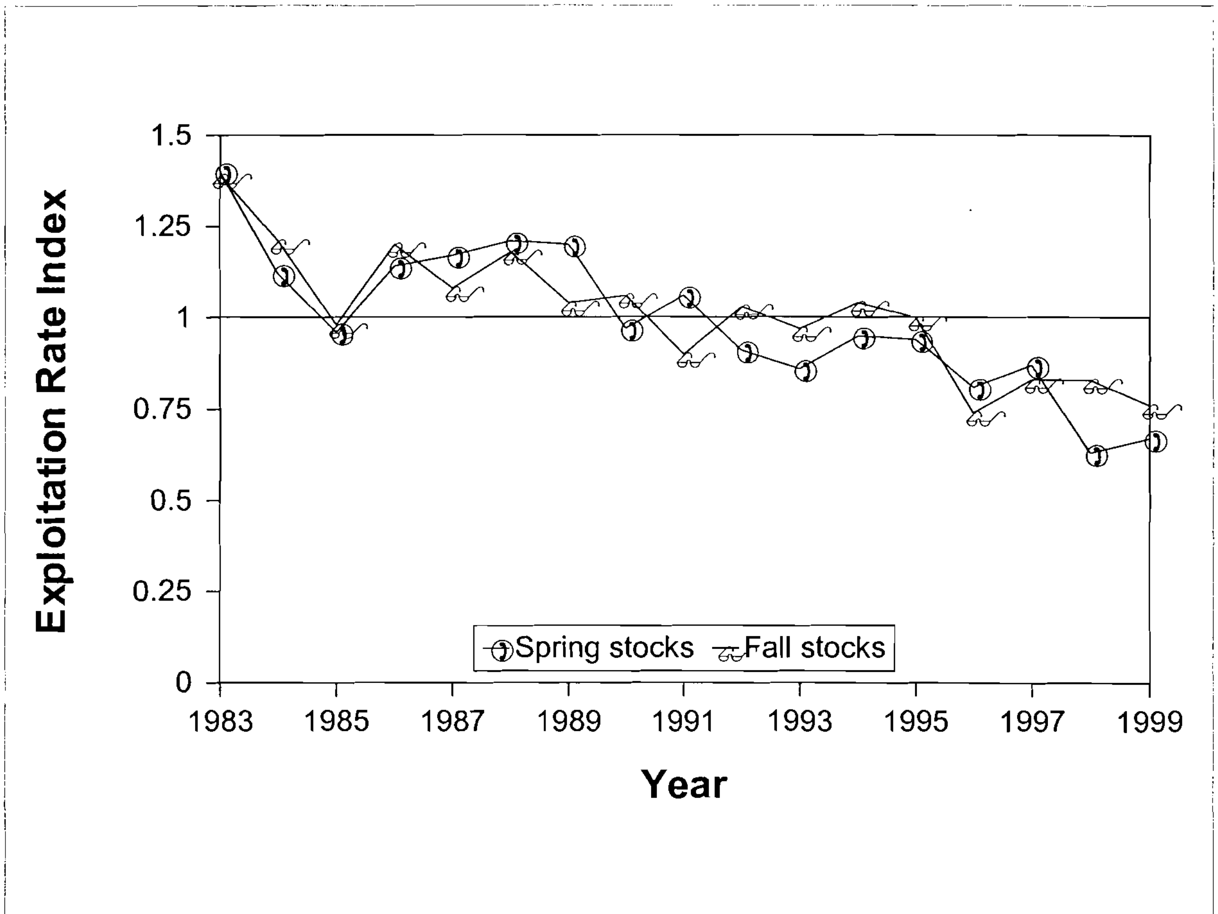


Table 8. Summary of total adult equivalent exploitation rates for the Upper Willamette River chinook ESU.

	Willamette Spring Hatchery					
Brood Year	Total	SEAK	Canada	PFMC	Columbia R.	Other
1971						
1972						
1973						
1974						
1975	0.51	0.02	0.14	0.01	0.32	0.02
1976	0.66	0.13	0.27	0.03	0.22	0.00
1977	0.38	0.06	0.12	0.01	0.18	0.01
1978	0.41	0.06	0.10	0.01	0.23	0.01
1979	0.54	0.12	0.12	0.03	0.26	0.01
1980	0.44	0.05	0.07	0.01	0.32	0.00
1981	0.48	0.13	0.07	0.01	0.26	0.00
1982	0.48	0.08	0.06	0.00	0.33	0.02
1983	0.73	0.16	0.10	0.02	0.44	0.00
1984	0.55	0.07	0.07	0.01	0.38	0.00
1985	0.54	0.04	0.05	0.01	0.43	0.00
1986	0.61	0.10	0.05	0.01	0.45	0.00
1987	0.66	0.10	0.03	0.00	0.53	0.01
1988	0.52	0.08	0.04	0.03	0.37	0.01
1989	0.61	0.12	0.04	0.02	0.43	0.00
1990	0.47	0.04	0.02	0.00	0.40	0.00
1991	0.51	0.06	0.02	0.00	0.44	0.00
1992	0.26	0.02	0.01	0.01	0.22	0.01
1993	0.29	0.08	0.02	0.02	0.17	0.00
1975-1990	0.54	0.09	0.08	0.01	0.35	0.01
1991-1993	0.35	0.05	0.02	0.01	0.27	0.00

Table 9. Summary of total adult equivalent exploitation rates for an aggregate of tule stocks from the Lower Columbia River chinook ESU.

	Tule (Spring Creek, Stayton Ponds, Cowlitz, Bonneville)					
Brood Year	Total	SEAK	Canada	PFMC	Columbia R.	Other
1971						
1972	0.89	0.00	0.27	0.27	0.29	0.05
1973	0.93	0.00	0.15	0.44	0.28	0.06
1974	0.86	0.00	0.22	0.33	0.24	0.07
1975	0.84	0.00	0.32	0.28	0.19	0.05
1976	0.85	0.01	0.35	0.27	0.16	0.06
1977	0.80	0.02	0.28	0.34	0.11	0.04
1978	0.75	0.01	0.32	0.27	0.11	0.04
1979	0.82	0.02	0.31	0.31	0.15	0.03
1980	0.73	0.01	0.41	0.15	0.10	0.06
1981	0.70	0.01	0.42	0.08	0.15	0.02
1982	0.67	0.02	0.28	0.18	0.15	0.05
1983	0.76	0.01	0.29	0.15	0.27	0.04
1984	0.77	0.01	0.25	0.20	0.27	0.04
1985	0.79	0.01	0.26	0.24	0.22	0.06
1986	0.65	0.02	0.16	0.26	0.15	0.05
1987	0.59	0.04	0.22	0.18	0.10	0.05
1988	0.59	0.02	0.23	0.17	0.14	0.03
1989	0.69	0.02	0.18	0.34	0.09	0.05
1990	0.56	0.01	0.17	0.19	0.15	0.04
1991	0.38	0.02	0.24	0.01	0.10	0.02
1992	0.45	0.01	0.03	0.24	0.16	0.01
1993	0.34	0.03	0.10	0.03	0.18	0.00
1972-1990	0.75	0.01	0.27	0.25	0.18	0.05
1991-1993	0.39	0.02	0.12	0.09	0.15	0.01

Table 10. Summary of total adult equivalent exploitation rates for the North Fork Lewis River bright stock from the Lower Columbia River chinook ESU.

	Bright (Lewis River)					
Brood Year	Total	SEAK	Canada	PFMC	Columbia R.	Other
1971						
1972						
1973						
1974						
1975						
1976						
1977	0.51	0.09	0.19	0.06	0.16	0.01
1978	0.56	0.15	0.14	0.09	0.16	0.02
1979	0.50	0.10	0.16	0.07	0.17	0.01
1980						
1981						
1982	0.59	0.09	0.16	0.02	0.31	0.00
1983	0.67	0.06	0.20	0.06	0.35	0.01
1984	0.45	0.03	0.15	0.03	0.24	0.00
1985	0.45	0.08	0.12	0.07	0.17	0.02
1986	0.41	0.05	0.15	0.05	0.16	0.01
1987	0.37	0.04	0.13	0.05	0.15	0.01
1988	0.46	0.05	0.16	0.03	0.21	0.01
1989	0.43	0.00	0.08	0.05	0.30	0.00
1990	0.45	0.08	0.09	0.01	0.27	0.00
1991	0.32	0.13	0.06	0.02	0.11	0.00
1992	0.27	0.15	0.00	0.01	0.11	0.00
1977-1990	0.49	0.07	0.14	0.05	0.22	0.01
1991-1992*	0.29	0.14	0.03	0.01	0.11	0.00

*Unresolved data uncertainties associated with CWT recoveries of this stock in the 1997 return year precluded reporting of results for the 1993 brood year.

Table 11. Summary of total adult equivalent exploitation rates for a composite of Puget Sound spring chinook stocks.

	Puget Sound Spring					
Brood Year	Total	SEAK	Canada	PFMC	Puget Snd	Other
1971						
1972						
1973						
1974						
1975						
1976						
1977						
1978						
1979	0.90	0.00	0.02	0.03	0.86	0.00
1980	0.76	0.02	0.32	0.00	0.41	0.00
1981	0.72	0.01	0.41	0.00	0.29	0.00
1982	0.81	0.00	0.42	0.00	0.38	0.00
1983	0.78	0.00	0.19	0.01	0.59	0.00
1984	0.68	0.00	0.32	0.01	0.36	0.00
1985	0.72	0.00	0.20	0.02	0.50	0.00
1986	0.77	0.00	0.15	0.02	0.60	0.00
1987	0.60	0.00	0.17	0.01	0.42	0.00
1988	0.61	0.00	0.29	0.01	0.31	0.00
1989	0.59	0.01	0.27	0.01	0.31	0.00
1990	0.65	0.00	0.21	0.00	0.43	0.00
1991	0.55	0.00	0.00	0.00	0.55	0.00
1992	0.47	0.00	0.17	0.00	0.29	0.00
1993	0.55	0.00	0.25	0.00	0.29	0.00
1979-1990	0.71	0.00	0.25	0.01	0.45	0.00
1991-1993	0.52	0.00	0.14	0.00	0.38	0.00

Table 12. Summary of total adult equivalent exploitation rates for a composite of Puget Sound fall chinook stocks.

	Puget Sound Fall					
Brood Year	Total	SEAK	Canada	PFMC	Puget Snd	Other
1971	0.82	0.00	0.29	0.05	0.48	0.00
1972	0.89	0.00	0.56	0.01	0.32	0.00
1973	0.90	0.00	0.43	0.03	0.44	0.00
1974	0.93	0.00	0.49	0.02	0.43	0.00
1975	0.91	0.00	0.40	0.05	0.45	0.00
1976						
1977						
1978	0.87	0.00	0.34	0.03	0.49	0.02
1979	0.95	0.00	0.36	0.02	0.57	0.01
1980	0.93	0.00	0.34	0.01	0.58	0.00
1981	0.83	0.00	0.24	0.01	0.57	0.00
1982	0.79	0.00	0.32	0.03	0.44	0.00
1983	0.77	0.00	0.28	0.02	0.46	0.00
1984	0.85	0.00	0.33	0.04	0.44	0.04
1985	0.76	0.00	0.25	0.04	0.47	0.00
1986	0.79	0.00	0.27	0.05	0.47	0.00
1987	0.75	0.01	0.25	0.03	0.46	0.00
1988	0.79	0.00	0.25	0.06	0.48	0.00
1989	0.81	0.01	0.33	0.07	0.40	0.00
1990	0.69	0.00	0.25	0.01	0.42	0.00
1991	0.58	0.02	0.20	0.01	0.35	0.00
1992	0.55	0.00	0.16	0.02	0.36	0.00
1993	0.57	0.01	0.19	0.01	0.35	0.00
1971-1990	0.83	0.00	0.33	0.03	0.46	0.00
1991-1993	0.57	0.01	0.18	0.01	0.36	0.00

Bering Sea/Aleutian Islands and Gulf of Alaska Groundfish Fisheries

Salmon are taken incidentally in the Bering Seas/Aleutian Islands and the Gulf of Alaska (GOA) 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 (BSAI/GOA FMP) of the NPFMC on ESA listed species and concluded that impacts on species listed at that time were low and not likely to jeopardize their continued existence (NMFS 1994, 1995b). Section 7 consultation on this fishery has been reinitiated, but a biological opinion has not been issued. However, information from these previous opinions can be used to characterize the potential catch of these fisheries on the newly listed ESUs.

The incidental catch of chinook from all stocks in the BSAI groundfish fisheries has averaged 40,150 and 0.01 chinook/metric ton groundfish (range = 0 to 6 chinook/metric ton groundfish) (1990-1998)(NOAA 1999). The most recent biological opinion on the groundfish fisheries (NMFS 1995a) concluded that, given a bycatch of approximately this size, the catch of ocean-type fall chinook in the BSAI fishery would be on the order of 2,200 per year. The UWR spring and LCR brights are both ocean-type stocks that migrate to northern waters. Since the incidental catch of ocean-type chinook off the Alaskan coast is unlikely to exceed more than a few thousand fish per year including those from British Columbia, the Washington coast and the unlisted hatchery components, the catch of listed UWR spring chinook is likely to be only a rare event. This conclusion is supported by the analysis of exploitation rates (see sections II.D and IV) in the ocean salmon fishery which are generally low despite a catch that is more than an order of magnitude higher than that of the groundfish bycatch. However, the northern distribution of the LCR bright stock and the possibility that the increase in exploitation rate on the LCR bright stock in the SEAK salmon fishery in the last several years may also be occurring in the BSAI fisheries warrants consideration of the incidental catch of LCR chinook in the groundfish fishery as part of the analysis of the effect of the salmon fishery on the ESU.

The available information is insufficient to estimate impacts in the BSAI fisheries on UCRS chinook ESU. However, the UCRS and SR spring/summers share similar life history and presumably ocean distribution patterns. In its 1994 biological opinion, NMFS concluded that the catch of Snake River spring/summer chinook in the BSAI fisheries was unlikely to average more than one fish per year. Although PS chinook and LCR tules are caught more frequently than UCR springs in ocean fisheries, they have a more southerly distribution and are therefore also not likely to be caught in BSAI fisheries. Although it is possible that UCR spring, PS or LCR tule chinook are taken in the BSAI fisheries, the lack of or low numbers of coded-wire tag (CWT) recoveries in the SEAK salmon fisheries which take many more chinook, and the fact that the majority of chinook caught in the BSAI fisheries are of Alaskan or Asian origin (NMFS 1994) suggest that the annual catch of listed fish would be extremely low. A more definitive analysis of the incidental catch of listed chinook will be made in the re-initiated groundfish opinion.

The incidental catch of chinook from all stocks in the GOA groundfish fisheries has averaged 15,582 annually and 0.04 chinook/metric ton groundfish (range = 0 to 1 chinook/mt groundfish) (1990-1998)(NMFS 1999c). The most recent biological opinion on the groundfish fisheries

(NMFS 1995b) concluded that it was difficult to determine the region of origin or life history type in the GOA fishery, although it did surmise that the GOA fishery would include more stream-type fish than the SEAK fishery, because of the dominance of stream-type fish in the BSAI fishery which is further north and west. The Upper Willamette spring and Lower Columbia River brights are both ocean-type, far north migrating stocks. It is reasonable to assume that these stocks are less impacted in the GOA groundfish fishery than in the SEAK salmon fishery given the probable lower presence of ocean-type fish in the GOA groundfish fishery. The exploitation rate for UWR chinook in the SEAK salmon fishery averaged 5% over the 1990-1993 brood years. However, the average catch in the salmon fishery during those years was approximately 275,000 compared to less than 16,000 in the groundfish fishery. If we assume that the relative abundance of UWR chinook in the fisheries was similar, the estimated ER in the groundfish fishery would be about 0.3%.

A similar analysis was done for the bright component of the LCR ESU. The average 1990-1992 brood year ER in the SEAK salmon fishery is 12%. Given the relative magnitude of catches in the salmon and groundfish fisheries and assuming a similar relative stock composition, the ER in the groundfish fishery would be about 0.7%. However, much of the bycatch of the groundfish fishery is further north and west along the Aleutian Islands. These are therefore likely substantial overestimates of the actual ERs for UWR chinook and the bright component of the LCR chinook ESU in the GOA groundfish fishery.

Puget Sound chinook and LCR tules are caught less frequently in the SEAK salmon fisheries than UWR or LCR brights. The average exploitation rates for PS spring stocks, PS fall stocks, and LCR tules in the SEAK salmon fisheries are 0, < 1%, and < 2%, respectively. Because of their more southerly distribution and they are even less likely to be caught in the GOA groundfish fishery.

There are also groundfish fisheries in Canadian waters that also catch salmon incidentally. Canadian groundfish fisheries have not under gone prior consultation. The bycatch in the Canadian whiting fishery was considered in NMFS original biological opinion concerning the PFMC groundfish fishery (NMFS 1992). Although that has not been subsequently reviewed or updated, the assumption at the time was that the annual bycatch of salmon would be no greater than 14,000 fish per year. Most of these would be chinook so there would likely be some catch of listed fish. However, the total additional catch of chinook in this fishery is small relative to that being considered as part of the directed salmon fisheries. For example, the catch of chinook in the NCBC and WCVI chinook fisheries in Canada in 1998 was about 150,000, a level much reduced from what would have been allowed under the agreement given the estimated abundance levels. Bycatch in the whiting fishery is therefore not likely to be a significant additional impact. We have not reviewed other components of the Canadian groundfish fishery, but NMFS concluded in reviewing PFMC fisheries that the bycatch from bottom trawl gear was likely the same magnitude as that in the whiting fishery and that other gear types such as long lines or pots would have little or no additional catch of salmon.

D. Factors Affecting the Species Outside the Action Area - Other Human Activities

All of the listed species are affected, often substantially, by mortality factors related to other human activities that are commonly referred to as the "Hs". In addition to the harvest H that is considered in detail in this opinion, the species of concern are affected by impacts related to habitat degradation, hatchery programs, and hydro-development. The relative effect of each H to the ESUs, and to each stock within an ESU, differs. However, in general, human development associated with forestry, farming, grazing, road construction, mining, and urbanization have all contributed to the decline of the species. The combined effect of multitude of habitat degradations often poses the greatest risk and greatest challenge to species recovery because they are often the result of multiple dispersed actions, each of which must be addressed. Additionally, habitat degradations by their nature can only be remedied over time as the affected systems slowly recover their properly functioning condition.

Hatcheries have both positive and negative effects. Hatcheries are playing an increasingly important role in conserving natural populations in areas where the habitat can no longer support natural production or where the numbers of returning adults are now so low that intervention is required to reduce the immediate risk of extinction. However, there are also negative consequences associated with hatchery programs, particularly as they were developed and managed in the past. There are genetic interactions associated with the interbreeding of hatchery and wild fish. There are a number of ecological interactions such as predation of wild fish by larger hatchery fish, competition for food and space, and disease transmission. In addition, fisheries that target hatchery fish may over harvest less productive wild populations. Hatchery activities in Puget Sound and the Columbia Basin are currently the subject of ongoing section 7 consultation that are designed to address the adverse effects of ongoing hatchery programs.

Hydro development also has substantially affected or eliminated some populations or even whole ESUs. In some cases, the effects are direct as the dams block access to spawning and rearing habitat. In other cases, the effects are less direct, but nonetheless significant as they increase downstream and upstream passage mortality, change natural flow regimes, dewater or reduce flow to downstream areas, block the recruitment of spawning gravel, or result in elevated temperatures.

Although it is not possible to review here the relative importance of each of these factors on each ESU or stock within the ESUs, it is clear that it is the combined effect of all of the H's that has lead to the decline and resulting current status of the species of concern. 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 reduce 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.

E. Natural Factors Causing Variability in Population Abundance

Changes in the abundance of chinook populations are a result of variations in freshwater and marine environments. For example, large scale changes in climatic regimes, such as El Niño, likely affect changes in ocean productivity; much of the Pacific coast was subject to a series of very dry years during the first part of the decade which adversely affected some the stocks. In more recent years, severe flooding has adversely affected some stocks. For example, the anticipated low return of Lewis River bright fall chinook in 1999 is attributed to flood events during both 1995 and 1996.

Salmon are exposed to high rates of natural predation, particularly during freshwater rearing and migration stages. Ocean predation likely also contributes to significant natural mortality, although the levels of predation are largely unknown. In general, chinook are prey for pelagic fishes, birds, and marine mammals, including harbor seals, sea lions, and killer whales. There have been recent concerns that the rebounding of seal and sea lion populations, following their protection under the Marine Mammal Protection Act of 1972, has resulted in substantial mortality for salmonids. In recent years, for example, sea lions have learned to target UWR spring chinook at Willamette Falls and have gone so far as to climb into the fish ladder where they can easily pick-off migrating spring chinook.

A key factor that has substantially affected many west coast salmon stocks has been the general pattern of long-term decline in ocean productivity. The mechanism whereby stocks are affected is not well understood. The pattern of response to these changing ocean conditions has differed between stocks, presumably due to differences in their timing and distribution. It is presumed that ocean survival is driven largely by events between ocean entry and recruitment to a sub-adult life stage.

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 (Cramer 1999) . This has been referred to as the Pacific Decadal Oscillation (PDO). It is apparent that ocean conditions and resulting productivity affecting many of northwest salmon populations have been in a low phase of the cycle for some time. Smolt-to-adult return rates provide another measure of survival and the effect of ocean conditions on salmon stocks. The smolt-to-adult survival rates for PS chinook stocks, for example, dropped sharply beginning with the 1979 broods to less than half of what they were during the 1974-1977 brood years (Cramer 1999). The variation in ocean conditions has been an important contributor to the decline of many stocks. However, the survival and recovery of these species depends on the ability of these species to persist through periods of low ocean survival when stocks may depend on better quality freshwater habitat and lower relative harvest rates.

The natural factors affecting salmon abundance are extremely variable, specific to different life stages, and have different magnitudes. Where possible, variations in productivity and natural mortality are incorporated in management models.

IV. Effects of the Action

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 listed ESUs that may be adversely affected by the fisheries. 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 listed salmon in the wild. The jeopardy determinations are also based on a consideration of the magnitude of salmon bycatch by species, the geographic distribution of the bycatch, and the available information indicating the relative magnitude of impacts to each ESU. Consideration is also given to the proposed management actions taken to reduce the catch of listed fish. The jeopardy determinations are largely qualitative at this time. The ESUs considered here have just recently been listed. Impacts to these ESUs in the groundfish fisheries have not been previously analyzed and are not tied to more quantitative analysis that are typically part of salmon fishery management models or more holistic life cycle or risk assessment analysis. Such analyses will necessarily be developed over time. In the meantime, NMFS must rely on the best available information in making its judgement about the risk of the proposed action to the newly listed ESUs.

For many of the ESUs considered in the opinion critical habitat has not been designated. As a result, this section will not determine, for those species, if the proposed fisheries are likely to destroy or adversely modify critical habitat. For those ESUs with designated or proposed critical habitat, the action area is outside the range of the designated habitat. As a result, the proposed fisheries are not likely to destroy or adversely modify the critical habitat of any ESU.

There are two general patterns of ocean distribution for the listed chinook ESUs. The chinook ESUs originating in CA (SRWR, CVS, CC chinook) are generally distributed off the California and southern Oregon coast. The other chinook ESUs from Puget Sound and the Columbia River basin are either north on far-north migrating stocks that will be found only rarely to the south. It is therefore useful to first consider both the magnitude and geographic distribution of the anticipated bycatch of chinook in order to characterize the likely impact on each ESU of concern.

There is insufficient information to characterize the stocks composition of the chinook bycatch in the groundfish fisheries. It is therefore not possible to estimate directly of the catch mortality by ESU. More qualitative impact estimates can be derived based on our general understanding of the distribution and timing of stocks that are derived from analysis of salmon fisheries. For some of the ESUs or stocks within an ESU the salmon management models can be used to generally characterize the relative abundance of listed fish in terms of catch per thousand. In other cases, it is more appropriate to use estimates of the exploitation rates in the salmon fisheries along with the associated catch to get a general sense of the level of impact associated with the groundfish fisheries occurring in similar areas and times. However, these estimates are best considered as approximations, as the salmon and groundfish fisheries do not occur in the same time and place, and therefore catch different stock mixes. We know, for example, that the chinook caught in the groundfish fishery are generally smaller and younger-aged fish.

Information from the salmon fishery models is supplemented in the opinion by an analysis of the CWT recoveries that are available for the whiting fishery in particular. Reported recoveries for hatchery or wild salmon stocks from each ESU that are used to represent the distribution of listed fish contribute to our understanding of the presence or absence and distribution of listed fish in the groundfish fisheries. For the SRF chinook ESU only sub-yearling release groups were used to represent the ocean distribution. There were additional releases of yearling smolts from the Lyons Ferry Hatchery. However, because the yearling releases have a different age at maturity and different ocean distribution, they are not considered representative of the listed natural origin fish.

The total annual bycatch of other listed species (coho, chum, sockeye, steelhead, and cutthroat) are reviewed briefly, but are not analyzed in detail because of the consistently low level of catch.

A. Mid-water Trawl - Whiting Fishery

The whiting catch and associated salmonid bycatch for 1991-99 seasons for at-sea and shoreside fisheries is summarized in Table 14. Chinook salmon represent the major portion of the salmon bycatch, with coho, chum, pink and sockeye making up the lessor portion in both the shoreside and at-sea components of the whiting fisheries. Coho encounters averaged only 292 fish per year in the combined shoreside and at-sea fisheries. The highest annual catch of coho was 1,379 fish caught in 1995 in the at-sea fishery compared to 138,000 coho in the ocean salmon fisheries (PFMC 1999b); the highest annual catch of chum was 215 fish caught in the 1994 season, with an average of 105 fish per year from 1991-98; and the highest annual catch of sockeye was 116 fish caught in the 1993 season, with an average of 15 fish per year from 1991-98. There is no reported bycatch of either steelhead or cutthroat trout in whiting fisheries for the eight year period summarized in Table 14.

Most salmon caught in the whiting fishery are chinook salmon. The estimated coastwide bycatch of chinook in the whiting fishery has averaged 6,182 annually since 1991 (Table 14). Limits on chinook bycatch in the whiting fishery were set as result of previous consultation. The bycatch rate is limited to 0.05 chinook/mt of whiting with an associated total catch of 11,000 chinook. Reinititiation of the biological opinion is required if both the bycatch rate and bycatch limit are exceeded (NMFS 1996a). This compares to a catch of chinook in the ocean salmon fisheries off the Oregon and Washington coast that has averaged 167,000 annually during the same 1991 to 1998 time frame (PFMC 1999b). (The salmon fishery catch off the Washington and Oregon coast is used for comparison because that is where most of the whiting fishery occurs.) Time and area restrictions that were designed to avoid areas where bycatch rates were generally higher have been implemented as a result of previous consultations (NMFS 1996a). The start of the whiting fishery in areas north of 42°00' latitude is now delayed until May 15. Fishing inside of 100 fathoms in the Eureka area is prohibited.

As a result of a combination of factors, the distribution of the chinook bycatch in the whiting fishery is primarily to the north in the Columbia and Vancouver INPFC catch areas. There is now very little catch in the Eureka area off southern Oregon and northern California or further south. This represents a substantial change in the distribution of salmon bycatch from what it was prior to 1992 when, for some years, as much as half of the bycatch came from the Eureka area (NMFS 1992). Table 13 summarizes the distribution of chinook bycatch from the at-sea fishery for more recent years. These numbers differ slightly from those provided in Table 14 because the more detailed distributional data shown in Table 13 was taken from older summaries. Nevertheless, this summary is adequate to make the general points that there is now little bycatch to the south and that there has been a shift in the distribution of the bycatch to the more northerly Vancouver catch area in recent years. This is partly due to declining bycatch in the at-sea fishery in the Columbia area and partly due to higher bycatch associated with the tribal fishery. The underlying reasons for this shift in bycatch from south to north is not clear. It is likely due in part to the annual dynamics of the fishery that responds to the distribution of the target species. The fishery is actively managed to avoid salmon bycatch and those efforts have become increasingly sophisticated in recent years. The reasons for the generally higher bycatch and bycatch rate in the tribal fishery are also not well understood, but are likely related in part to the fact that the tribal fishery is limited geographically which limits their ability to move to areas with lower bycatch. It is not clear at this time whether salmon abundance is generally higher in the tribal fishing area or if other factors are involved.

Table 13. Pacific Whiting Fishery - At-Sea Chinook Bycatch By Area.

	Vancouver - 670 Non-Tribal(Tribal)*	Columbia - 710 Non-Tribal	Eureka - 720 Non-Tribal
1994	757	2,870	0
1995	705	10,763	111
1996	871 (1,468)	575	0
1997	377 (2,524)	625	396
1998	584 (2,085)	893	0
1999	3,651 (4,491)	740	0

* Tribal whiting fishery started in 1996.

Table 14. Salmon Bycatch in the Pacific Whiting Fisheries - Summary 1991-99.

At -Sea Fishery (Catcher -processors and vessels delivery to motherships combined)

Year	Whiting (mt)	Chinook (no)	Chinook rate (no/mt whiting)	Coho (no)	Coho rate (no/mt whiting)	Pink (no)	Pink rate (no/mt whiting)	Chum (no)	Sockeye (no)	Steelhead (no)	Total Salmon (no)	Total Salmon (rate)	Chinook CWT Recoveries
1991*	201,755	6,153	0.031	138	0.0007	24	0.0001	8	0	0	6,323	0.031	27
1992*	152,076	4,262	0.028	193	0.0013	0	0	48	0	0	4,503	0.030	13
1993*	93,590	4,968	0.053	17	0.0002	3,397	0.0363	58	116	0	8,556	0.091	14
1994*	176,401	4,024	0.023	65	0.0004	32	0.0002	214	0	0	4,335	0.025	56
1995*	101,858	12,108	0.119	1,379	0.0135	1,575	0.0155	181	6	0	15,249	0.150	104
1996*	128,059	1,676	0.013	64	0.0005	0	0	178	0	0	1,918	0.015	38
1997*	145,459	4,414	0.030	348	0.0024	497	0.0034	114	0	0	5,373	0.037	NA
1998**	144,960	3,563	0.025	114	0.0008	4	.00003	30	0	0	3,681	0.025	NA
1999**	141,105	8,882	0.063	117	0.0008	496	.0035	465	0	0	9964	0.071	NA

Source: NMFS Observer Database (* = Updated as of 5/18/98; ** = Updated as of 11/29/99).

Shoreside Fishery (Vessels delivering to on-shore processing)

Year	Whiting (mt)	Chinook (no)	Chinook rate (no/mt whiting)	Coho (no)	Coho rate (no/mt whiting)	Pink (no)	Pink rate (no/mt whiting)	Chum (no)	Sockeye (no)	Steelhead (no)	Total Salmon (no)	Total Salmon (rate)	Chinook CWT Recoveries
1991	20,359	41	0.002								41	0.002	0
1992	49,092	491	0.010								491	0.010	10
1993	41,926	419	0.010								419	0.010	11
1994	72,367	581	0.008	4		0		0	0		585	0.008	11
1995	73,397	2,954	0.040	2		15		1	0		2,972	0.040	146
1996	84,680	651	0.008	0		0		0	0		651	0.008	23
1997	87,499	1,482	0.017	2		0		0	0		1,484	0.017	NA
1998	87,627	1,699	0.019	8		0		5	1	0	1,713	0.020	NA
1999*	83,350										1,630	0.020	NA

Sources: ODFW 1997, Weeks and Hutton 1998. Note :1994-99 shoreside rates based on salmon turned over by processors, 1991-93 salmon numbers based on observed rates (approx. 50% observer coverage). (* = Preliminary).

B. Bottom Trawl Fishery

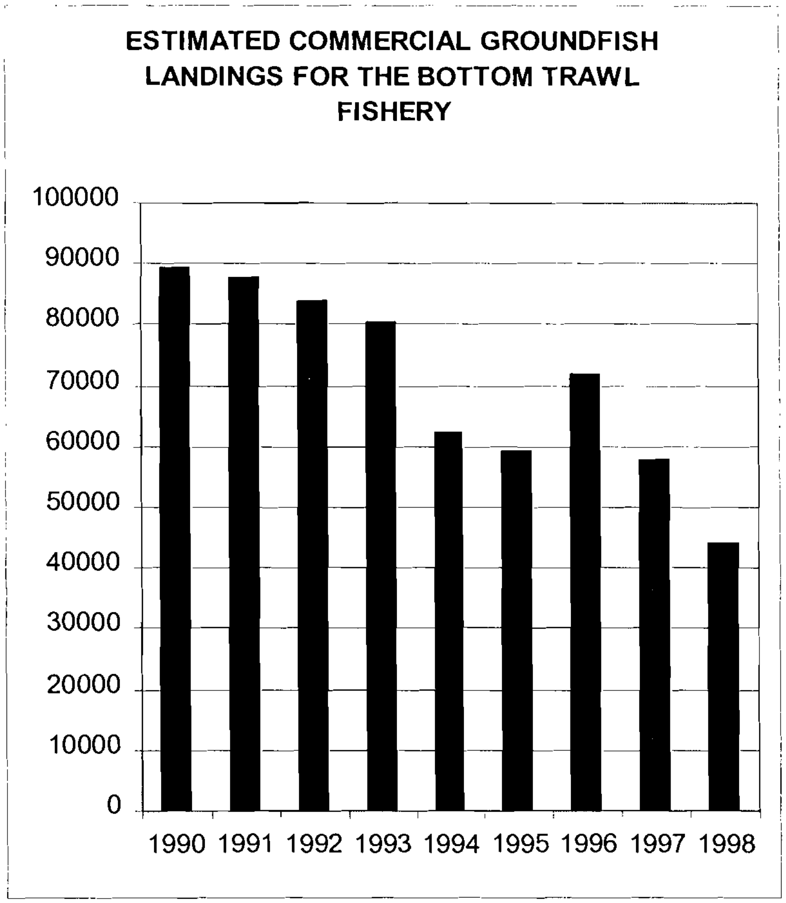
The magnitude and distribution of salmonid bycatch in the bottom trawl fishery was last reviewed in the August 28, 1992 biological opinion. As is the case in the whiting fishery, the salmon bycatch is almost entirely chinook salmon. The NMFS bottom trawl surveys indicated that 96% of the salmon bycatch was chinook (NMFS 1992). Erickson and Pikitch (1994) evaluated incidental catch of chinook salmon in the commercial bottom trawl fishery off the west coast during two time periods, 1985-1987 and 1988-1990. Erickson (Personal communication, 9/17/97) encountered no steelhead or cutthroat trout in these time periods, and a total of 22 coho salmon for the six overlapping years of study.

In the 1992 opinion the estimates of bycatch were developed by expanding bycatch rates using logbook estimates of total trawl hours. Estimates of bottom trawl effort in depths less than 300 fathoms by quarter (Erickson and Pikitch 1994), were then multiplied by estimates of chinook bycatch rates for each quarter and the PFMC area. The resulting catch of chinook in the bottom trawl fishery coastwide was estimated to be between 6,000 and 9,000 fish per year. The available information also suggested that the bycatch of chinook for northern areas is on the order of 5,000 to 8,000 off Washington and northern Oregon, with another 1,000 chinook taken off southern Oregon and California. For 1998 the bycatch rate using logbook estimates of total trawl hours off Oregon and Washington was 6,398. This is within the range that was estimated in the 1992 opinion, and indicates that the bycatch of chinook has not increased.

There has been a significant decrease in the bycatch and effort data in recent years suggesting that the associated bycatch may also be on the decline. Since 1990 the catch in the bottom trawl fishery has decreased by about half (Figure 2). There has been a coincident decline in effort. The reported trawl hours, by state and quarter for tows less than 300 fathoms, indicates that the trend in effort off Washington and Oregon has decreased approximately 63% from 1991 to 1998. Off California from 1991 to 1997 the trend appears to be more constant, with an increase in tow hours only in 1997.

The declining trend is likely to continue in the future. Lingcod , Bocaccio, Canary, Pacific Ocean Perch, and Cowcod were all recently designated as overfished species. In 2000 the Pacific Coast groundfish fisheries will be substantially restricted relative to recent years to protect these species. Of these overfished species, all but Pacific Ocean Perch, occur nearshore, hence the management measures that reduce the harvest of these stocks and associated species will likely result in reduced chinook interceptions.

Figure 2. Estimated commercial groundfish landings (mts) for the bottom trawl fisheries (Extracted from PacFIN July 29th, 1999).



C. Species Specific Affects of the Bycatch

Review of the recent salmon bycatch information suggests that estimates of the magnitude and distribution of bycatch have not changed substantially from those included in previous biological opinions. It is apparent that virtually all of the salmon bycatch is chinook and that other species are little affected by the groundfish fisheries. The chinook bycatch in the whiting fishery continues to be subject to an 11,000 fish constraint. The chinook bycatch in the whiting fishery exceeded the 11,000 fish standard only once in 1995, but has otherwise averaged only 6186 from 1991-98. In recent years the bycatch has been distributed somewhat more to the north.

There is relatively little new information regarding salmon bycatch in the bottom trawl fishery. NMFS therefore continues to rely largely on estimates from the 1992 opinion that suggested a range of 6,000-9,000 salmon per year. This was presumed to include about 1,000 salmon annually in bottom trawl fisheries in California and southern Oregon. Estimates of bycatch in the bottom trawl fishery in Oregon and Washington for 1998 are consistent with expectations. Both catch and effort in the bottom trawl fishery have declined over the last decade and NMFS expects that trend will continue as the recent more restrictive management actions are implemented.

Previously Listed ESUs

NMFS concluded in its earlier biological opinions associated with this fishery (NMFS 1992, 1993, 1996) that the impacts to listed SR sockeye, SR spring/summer chinook, and SRW chinook resulting from implementation of the groundfish FMP were negligible and that the fishery was not likely to jeopardize their continued existence.

NMFS has provided a range of estimates for the expected annual mortality of SRF chinook in the past depending on the available information. In the 1992 opinion, NMFS concluded that the impact on naturally spawning SRF chinook is probably on the order of a few tens of fish, and that it may be less, but is unlikely to be as many as 100. NMFS reviewed its prior estimates and jeopardy conclusion with respect to SRF chinook in 1993 and 1996 and confirmed that the proposed fisheries were not likely to jeopardize the continued existence of the ESU.

For this biological opinion, NMFS again reviewed the available information on CWT recoveries in the groundfish fisheries, information on the catch and distribution of the chinook bycatch, and the associated impact to the ESU. CWT data from fingerling, non-transported releases from the Lyons Ferry Hatchery have been used to represent the SRF chinook ESU. From the analysis of salmon fishery recoveries it is apparent that SRF chinook are widely distributed and susceptible to marine fisheries from California to Alaska (NMFS 1992). However, recoveries from south of central Oregon are relatively rare. The center of distribution of SRF chinook is off the west coast of Vancouver Island. The relative abundance of SRF chinook off the Washington and northern Oregon coasts may be lower, but SRF chinook are still subject to measurable impacts in these areas. There were five observed recoveries of the Lyons Ferry indicator stock reported in the recovery data all from the Washington and northern Oregon coast. The catch rate of the listed SRF chinook in the 1999 ocean salmon fishery in the area off the Washington coast was about 3 listed fish per 1,000. The bycatch of chinook off the Washington and Oregon coasts in the combined groundfish fisheries has ranged from about 10,000-20,000 chinook per year. This suggests that the bycatch of listed SRF chinook is in order of 30-60 per year assuming that the catch rate of SRF chinook is the same in all he groundfish fisheries as it is in the salmon fisheries off the Washington coast. In fact, the concentration of SRF chinook decreases to the south. This estimate is therefore likely biased high. This estimate is consistent with prior expectations, although NMFS again cautions against comparing these directly to other estimates of catch or abundance derived using different methods.

Puget Sound Chinook

PS chinook is a complex ESU with many components each of which has a somewhat different timing and distribution. However, the salmon management models indicate that PS chinook as a group are subject to relative little harvest off the Washington coast and virtually none further south, with most of the catch occurring in Canadian and Puget Sound fisheries (NMFS 1999a).

The available information suggest that the exploitation rate on PS spring chinook as a group in PFMC salmon fisheries was zero for the 1991-1993 brood years, and only 1% in earlier years when salmon fisheries were generally higher (Table 11). The exploitation rate on PS fall stocks averaged 1% for the 1991-1993 brood years, again confirming the relative low abundance of PS stocks off the Washington coast. The average catch off the Washington coast, north of Leadbetter Point, from 1993-1998, that would have contributed to the 1991-1993 brood year harvests, was 22,950 chinook per year (PFMC 1999b). Exploitation rates in earlier years averaged about 3% (Table 12). Catches during the 1980s off the Washington coast, north of Leadbetter Point, averaged 97,800 chinook per year (PFMC 1999c). This compares to estimates of chinook bycatch in the groundfish fishery that are 10,000-20,000 fish per year coastwide. Although some PS chinook are probably caught in the groundfish fishery, the impacts to PS spring chinook, which are the most depressed component of the ESU, are close to zero. This qualitative analysis suggests that the exploitation rate to PS fall stocks is likely only a fraction of 1% per year.

There were 52 CWT recoveries from in the groundfish fishery database from the PS ESU. The distribution of those CWT recoveries in the whiting fishery were off Washington and northern Oregon. The catch rate of these CWT chinook were distributed evenly in the 1980 to 1997 time period, with an average of a 3 to 4 CWT observed recoveries per year. The relative paucity of recoveries confirms the above conclusion that PS chinook are caught only rarely in the groundfish fishery.

Lower Columbia River Chinook

The LCR chinook ESU is composed of spring run, and fall run tule and bright stocks. There are three spring stocks, three self-sustaining natural tule stocks, and likewise, three identified bright stocks that rely primarily on natural production. The population structure of the ESU has not been determined, but it is intuitively obvious that the spring, tule, and bright life history types warrant independent review with respect to their status and the effect of the proposed action. The effects analysis therefore considers each of these life history types independently and, where possible, also considers the status of and presumed effect on each stock.

The three remaining spring stocks within the ESU include those on the Cowlitz, Kalama, and Lewis rivers. Although some spring chinook spawn naturally in each of these rivers, the historic habitat for spring chinook is now largely inaccessible. The remaining spring stocks are therefore dependent, for the time being, 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 stocks, including those provided specifically as a result of the recent PST agreement, will provide additional protection for the hatchery programs until such time that a more comprehensive recovery plan is implemented.

Information from salmon fishery management models provides some perspective about the distribution and likely impact to LCR spring chinook from the groundfish fisheries. The salmon fishery model base period (1979-82) ER for the Cowlitz River spring chinook is 12% for the PFMC fisheries. The 1999 model estimates are for a PFMC ER of 7.2% and a total ocean fishery ER of 10.6%. This suggests that LCR spring stocks have a more southerly distribution than the upriver spring stocks which is consistent with the ocean-type juvenile life history that is characteristic of all LCR chinook. The 7.2% ER estimate in 1999 was associated with expected chinook mortalities in the salmon fisheries of 80,000 off the Washington coast and an additional 156,000 off the Oregon coast in the area north of Humbug Mountain which is close to the southern boundary of the Columbia INPFC catch area. This again compares to an anticipated chinook bycatch in the groundfish fisheries of 10,000-20,000 fish coast-wide.

The LCR is dominated by hatchery-origin tule stocks. The three natural-origin tule stocks in the ESU include those on the Coweeman, East Fork Lewis, and Clackamas rivers. These are apparently self-sustaining natural populations without substantial influence from hatchery-origin fish. These stocks are all relatively small. The interim escapement goals on the Coweeman and East Fork Lewis are 1,000 and 300, respectively. Escapements have been below these goals 8 of the past 10 years for the Coweeman, and 5 of the past 10 years for the East Fork Lewis. The 10 year average escapement for the Coweeman is 700 , compared to a recent 5 year average of 995 (range 146-2,100). In the East Fork Lewis, the 10 year average escapement is 300, compared to a recent 5 year average of 279. There is currently no escapement goal for the Clackamas where escapements have averaged about 350 per year.

Until recently tule hatchery production has been prioritized to support ocean and Lower Columbia River fisheries thus providing the potential for very high ERs. The tule stocks are north migrating, but are most vulnerable to catch in fisheries off the Washington coast and the west coast of Vancouver Island and in the lower river.

The total adult equivalent ERs in the PFMC salmon for the tule hatchery stocks averaged 9% for the 1991-1993 brood years and 19.5% for the decade of the 80s (Table 9). These exploitation rates were associated with average catches of 22,950 for the associated recent catch years, 1993-98, and 97,500 for the earlier time series. Because of their more southerly distribution, fisheries off the Oregon coast impact these stocks as well. The catches of chinook off the Oregon coast during these same time periods were 139,900 and 291,250, respectively. These catches and associated ERs again provide some perspective about the anticipated impacts associated with the groundfish fisheries with expected catches coasted-wide of 10,000-20,000 chinook per year.

There are also three remaining natural-origin bright stocks in the LCR ESU. 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 with the exception of 1999. In 1999 the return is expected to be substantially below goal because of severe flooding during the 1995 and 1996 brood years. Nonetheless, the stock is considered healthy. The Sandy and East Fork Lewis stocks are smaller. Escapements to the Sandy have been stable and on the order of 1,000 fish per year for the last 10-12 years. Less is known about the East Fork stock, but it too appears to be stable in abundance.

The LCR bright stocks are far-north migrating stocks and so are less in PFMC fisheries then other stocks from the ESU. The total adult equivalent brood year ER in the PFMC salmon fisheries averaged 1% in recent years and about 5% in the past (Table 10) when catches were generally higher. Information from the PFMC salmon fishery models for 1999 suggest that the catch rate of chinook from the North Fork Lewis in fisheries off the Washington coast was approximately 2 fish per 1,000, again suggesting that the impact associated with the PFMC groundfish fisheries are quite limited.

Upper Willamette River Chinook

Because of their far-north migrating distribution and spring timing, UWR chinook are subject to relatively little harvest in PFMC fishery catch areas. Upper Willamette Spring chinook reside primarily to the north. They are an early returning spring stock so that adult migrants have largely exited the ocean by March or early April. The whiting fishery in particular does not start in areas north of 42° north latitude until May 15.

The average total brood year ER on UWR chinook in PFMC salmon fisheries is estimated to be about 1% in both the past and near-term time series (Table 8). The traditional start of the salmon fishing season is May 1 so that the salmon fisheries also miss most of the adult migrants.

Despite their distribution and timing, it is apparent from the CWT data that UWR chinook are taken occasionally in the whiting fishery. There were 68 observed recoveries of hatchery origin chinook spring from the Willamette during the 1980-1997 time period with some taken as far south as central Oregon.

The current limitation on opening the whiting fishery after May 15 did not take affect until 1996. About one third of the observed recoveries in past years occurred prior to May 1. The fishery delay my therefore help reduce the likelihood that UWR chinook will be taken in the whiting fishery in the future.

The available information suggests that UWR chinook are taken occasionally in the PFMC groundfish fisheries. The estimated ER in the salmon fisheries is 1%, but these are associated with catches that are substantially larger than the 10,000-20,000 chinook caught coast-wide in the groundfish fisheries. The catch of salmon of the Washington coast alone averaged 22,950 during the 1993-1998 period and 97,500 during the decade of the 1980s.

Upper Columbia River Spring Chinook

Upper Columbia River Spring chinook have a stream-type life history, and their ocean distribution generally to the north and offshore. Upper Columbia River Spring chinook are similar to Snake River spring/summer chinook in that they are subject to very little ocean harvest which is confirmed again here in relation to the groundfish fisheries. The available in suggests that the overall ocean exploitation rate on UCRS is quite low in the salmon fisheries, and is treated a zero in life cycling modeling efforts designed to assess extinction risk and options to promote recovery (NMFS 1999f). Hence it is reasonable to expect even lower impacts in the groundfish fisheries. There were no recoveries of UCRS chinook in the groundfish fisheries. This is consistent with what is known about their life history and distribution. Upper Columbia River chinook are similar to SR spring/summer chinook which are little affected by ocean salmon fisheries either to the north or in PFMC catch areas and therefore presumably are also not affected by the PFMC groundfish fisheries.

California Chinook ESUs

Two additional ESUs located in California were recently listed including CVS chinook and CC chinook. Both are distributed primarily off of California. Of nearly 13,000 CWT recoveries (estimates expanded for sample size) in the salmon fisheries from the Feather River Hatchery indicator stock, 88% were taken off of California and 10% off of Oregon. Of nearly 400 estimated recoveries for the Mad River Hatchery indicator stock, 63% were found off of California with an additional 29% off of the Oregon coast. The remainder were found off of Washington with few recoveries in Canada. Although the observed recoveries from the groundfish fisheries are not directly comparable because they are not expanded for sample size, the counts were low. There were only five observed recoveries representing the CVS chinook and 11 representing CC chinook in the groundfish recovery data base.

Indicator stocks for these newly listed ESUs are not currently include in salmon management models so there are no associated estimates of the ER in salmon fisheries. However, the distribution of the chinook bycatch in the groundfish fisheries is primarily to the north away from the primary areas of distribution for these fish. The bycatch of chinook in the whiting fishery in the Eureka area from southern Oregon south has largely been eliminated in recent years (Table 13). Of the 6,000-9,000 chinook that were expected to be caught annually in the bottom trawl fishery coast-wide, only 1,000 were expected to be taken off of California. This information suggests that CVS chinook and CC chinook are taken rarely in the groundfish fisheries.

V. Cumulative Effects

Cumulative effects are defined as the "effects of future state or private activities, not involving federal activities, which are reasonably certain to occur within the action area of the federal action subject to consultation" (50 CFR 402.02). For the purposes of this analysis, the action area includes ocean fishing areas off the coast of Washington, Oregon, and California. The production of chinook and coho salmon, steelhead, and cutthroat trout by state hatchery programs will likely continue and has the potential to add cumulative impacts to listed populations in the ocean, through competition and predation. Hatchery salmon production also provides targeted harvest opportunity in the ocean through increasing chinook and coho salmon abundance above that which would occur naturally, although harvest mortality associated with these fisheries is specifically considered salmon harvest opinions. At this time, the extent of cumulative impacts from hatchery salmon production is not known. Further evaluation is warranted but this can best be done as part of an overall assessment of species specific hatchery programs.

Because the action area is limited to offshore marine areas, no additional cumulative effects to the listed species are anticipated.

VI. Integration and Synthesis of Effects

NMFS reinitiated consultation regarding the PFMC groundfish FMP to consider the impacts to recently listed species that were not subject to previous review. NMFS has reviewed the current status of each of the newly listed salmonid species shown in Table 1, the environmental baseline for the action area, the effects of the proposed action both to the newly listed and previously listed species, and the cumulative effects. Based upon this review, NMFS concludes that continued implementation of the PFMC groundfish FMP as amended will not jeopardize the continued existence of any of the salmonid ESUs listed or proposed for listing as threatened or endangered under section 7 of the ESA. For the currently listed salmonid species, critical habitat is either not yet designated, or if designated does not include marine areas affected by the groundfish fisheries. The proposed action is therefore also not likely to destroy or adversely modify designated critical habitat for any of the listed salmonid ESUs.

The analysis of the available information indicates that coastal cutthroat trout, steelhead, and sockeye are rarely, if ever, encountered in the groundfish fishery. Coho and chum are caught in relatively low numbers with an annual catch in the combined whiting and mid-water trawl fisheries of tens to a few hundred of fish coast-wide. The majority of these will be unlisted natural-origin or hatchery fish. Given the low bycatch, NMFS concludes it is unlikely that the proposed action will jeopardize the continued existence of any of the currently listed or proposed listed cutthroat trout, steelhead, sockeye, coho, or chum ESUs listed in Table 1.

The bycatch of chinook salmon in the PFMC groundfish fishery is more substantial and does result in the taking of chinook for at least some of the listed ESUs. However, the bycatch of chinook continues to be constrained and within the limits set by previous consultations. Chinook bycatch in the whiting fishery is closely monitored with on-board observer coverage for the mothership and at-sea processors and is limited subject to further consultation to a maximum of 11,000 chinook per year coast-wide. The 11,000 chinook limit has been exceeded in only one year since 1992 (approximately 15,000 in 1995), and, absent 1995, has averaged 6186 from 1991-98 (Table 14).

Substantive management actions have been taken to reduce bycatch in the whiting fishery, particularly in the south. Beginning in 1996 the start of the whiting fishery in the area north of 42° north latitude was delayed until May 15 because of information suggesting that bycatch was higher earlier in the year. The whiting fishery is also closed in the Eureka are inside the 100 fathom line. Most of the vessels participating in the shoreside and at-sea fisheries continue to actively monitor salmon bycatch and use a system of real-time information exchange that allows them to redirect their effort to minimize bycatch when necessary.

There has been one unanticipated change in the pattern of bycatch since the last consultation on the groundfish fishery in 1996. A tribal fishery directed at whiting began in 1996 using a mothership and several catch boats. The tribal fishery is constrained geographically to a relatively small area off the coast south of Neah Bay in the Vancouver INPFC area. Bycatch rates of chinook in the tribal fishery have been consistently higher than other mothership or at-sea operations. Bycatch rates in the tribal fishery have averaged 0.115 chinook/mt whiting compared to 0.019 chinook/mt whiting in the other at-sea components of the fishery for the same period. It may be that the higher bycatch rate is the result of the geographic limitation of the fishery. However, further assessment of the monitoring and response program in the tribal fishery is in order to ensure that chinook bycatch is minimized to the degree possible in the future.

Although the tribal fishery has resulted in more chinook bycatch to the north, it does not substantively change NMFS' assessment of impacts to listed fish or prior conclusions with respect to jeopardy. There is no information to suggest that the concentration of listed chinook in the tribal catch area is higher than off the Washington coast in general. The total bycatch of chinook may be higher then it would have been absent the tribal fishery. However, the tribes' allocation of whiting in recent years has been 14% or less of the total allowable catch which limits the potential bycatch increase. Even with the higher bycatch rates associated with the tribal fishery, the whiting fishery as a whole is still constrained by the 11,000 chinook bycatch limit. Prior assessments with respect to jeopardy were done assuming an annual bycatch of up to 11,000 chinook.

Chinook are also caught incidental to the bottom trawl fishery. Estimates made using available information at the time of the 1992 opinion suggested an annual bycatch of 6,000-9,000 chinook per year most of which occur off Oregon and Washington. There is little new direct information about salmon bycatch in the bottom trawl fishery because of the absence of a bycatch monitoring program. However, both effort and landings in the bottom trawl fishery have declined by about half over the last decade suggesting that the bycatch of salmon is likely declining as well.

After considering the available information on the magnitude and distribution of the chinook bycatch in the whiting and bottom trawl fisheries, NMFS reviewed the information related to anticipated impacts to each of the newly listed chinook ESUs. NMFS reviewed information on CWT recoveries from the groundfish fisheries. Although, the CWT data was used largely to indicate distribution and presence or absence in the fishery. NMFS also used information from salmon fishery management models to approximate the likely range of impacts given the relative magnitude of catch in the respective salmon and groundfish fisheries.

There were no recoveries of UCR chinook in the groundfish fisheries. This is consistent with what is known about their life history and distribution. Upper Columbia River chinook are similar to SR spring/summer chinook which are little affected by ocean salmon fisheries either to the north or in PFMC catch areas and therefore presumably are also not affected by the PFMC groundfish fisheries.

NMFS considered the likely impacts to the spring and summer/fall components of the PS chinook ESU. NMFS concluded that spring stocks were likely caught only rarely in the groundfish fisheries. Summer/fall stocks are likely caught off the Washington coast, but the available information suggests that the ERs are likely a fraction of 1% per year.

The spring and tule components of the LCR chinook ESU are also likely taken in groundfish fisheries off the Oregon and Washington coast. Again, the relative magnitude of catch in salmon and groundfish fisheries in those areas suggests that the exploitation rates on these stocks are quite low, likely less than 1% per year. The bright component of the LCR ESU has a more northerly distribution and is therefore subject to relatively little harvest in the PFMC groundfish fisheries, again likely some small fraction of 1% per year. Estimates for UWR chinook are about the same as those for LCR brights; some small fraction of 1% per year.

Finally, NMFS reviewed the likely impacts to CVS chinook and CC chinook. The California ESUs are distributed primarily off of California where there is relatively little bycatch of chinook. Management actions have been taken that largely preclude the whiting fishery from areas off of California and southern Oregon. Estimates indicate that the catch of chinook in the bottom trawl fishery in the south are on the order of 1,000 fish per year. As a result, this information suggest that CVS chinook and CC chinook are rarely taken in the groundfish fisheries.

NMFS recently reviewed the effect of the recent PST between the U.S. and Canada on the listed salmonid ESUs and also focused on the chinook ESUs that were the primarily subject of this opinion. NMFS considered PFMC groundfish fisheries as part of the Environmental Baseline section in the PST opinion while noting that consultation on the groundfish fisheries was, at the time, underway. This opinion now provides more of the specifics in terms of qualitative estimates of impacts for each ESU and confirms that these impacts are quite low.

Conclusion

After reviewing the current status of listed salmon, the environmental baseline for the action area, the effects of the continued implementation of the Pacific Fishery Management Council's groundfish Fishery Management Plan and the cumulative effects, it is NMFS' biological opinion that the PFMC groundfish FMP, as proposed, is not likely to jeopardize the continued existence of the listed Pacific salmon. No critical habitat has been designated for this species, therefore, none will be affected.

INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by both FWS and NMFS to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by both FWS and NMFS as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limit to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are non-discretionary, and must be undertaken by the agencies so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, for the exemption in section 7(o)(2) to apply. The agencies have a continuing duty to regulate the activity covered by this incidental take statement. If the agencies (1) fail to assume and implement the terms and conditions or (2) fail to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the agencies or applicant must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement. [50 CFR §402.14(i)(3)]

I. Amount or Extent of Incidental Take

Whiting Fishery

Estimates of the bycatch of listed salmon in the whiting fishery are based on the distribution of the fishery and the observed bycatch of salmon in recent years. The estimated bycatch of listed salmon in the whiting fishery in the future assumes that the distribution of catch will not change substantially, that the bycatch will not exceed 0.05 chinook salmon/mt whiting, and that the total bycatch of chinook will not exceed 11,000 fish per year.

Because of the substantial differences in the timing, location, and capacity of the shoreside, at-sea, and Tribal components of this fishery, compliance with the 0.05 chinook salmon/mt whiting bycatch rate will be evaluated separately. Consultation shall be reinitiated if either the shoreside, catcher/processor, mothership, or Tribal components of the fishery exceed or are expected to exceed the bycatch rate of 0.05 chinook salmon/mt whiting and the expected total bycatch of chinook in the fishery is expected to exceed 11,000 fish.

Bottom Trawl Fishery

It was estimated that 6,000 to 9,000 salmon are taken in the bottom trawl fishery annually, and that 5,000 to 8,000 of these are likely to be taken in the Vancouver and Columbia catch areas. However, because there is no bycatch monitoring program, it is not possible to access directly an incidental take limit that would normally be expressed as some measure of salmon bycatch or bycatch rate. This estimate of bycatch in the bottom trawl fishery is based on an analysis of available information from 1985-1990. Because bycatch is not being monitored directly, expectations of bycatch in the future are based on the assumption that the general character of the fishery will not change substantially, particularly in times and places where bycatch rates are assumed to be higher. If the fishery in the future changes substantially in magnitude or character compared to 1985-1990, and particularly, if there is increased catch in nearshore areas or during the winter months or in the Eureka or Monterey areas, consultation shall be reinitiated.

Miscellaneous Gear

Review of available information regarding salmon bycatch for other groundfish gear types, including shrimp trawls, pots, hook-and-line gear, and setnets used in PFMC area fisheries indicates that salmon interactions are unlikely to be more than rare events and that the impacts on listed species will be negligible. As a result, NMFS concludes that the taking of any of the listed salmonid species by these gear types is neither anticipated or authorized.

II. Effect of the Take

In the accompanying biological opinion, NMFS determined that the level of anticipated take in the proposed groundfish fisheries is not likely jeopardize the continued existence of any of the currently listed or proposed salmonid ESUs shown in Table 1, or result in the destruction or adverse modification of their critical habitat.

III. Reasonable and Prudent Measures

NMFS included reasonable and prudent measures in the incidental take statement of the August 28, 1992, and May 14,1996, biological opinions, which remain in effect:

Whiting Fishery

The impacts included in the incidental take statement for the whiting fishery are based, in part, on the assumed bycatch rate of 0.05 chinook salmon/mt whiting. In order to evaluate whether that assumption is valid for future fisheries, continued monitoring at a level sufficient to define the bycatch rate of the motherships and at-sea processors, Tribal, and shorebased components is required to estimate bycatch rates and detect any changing patterns of bycatch.

In addition to collecting bycatch information in the whiting fishery, it is necessary to evaluate, at least monthly, the projected annual total bycatch rate of the fishery. If at anytime during the fishery, it is anticipated that the seasonal coastwide bycatch will exceed 11,000 chinook salmon, NMFS and the PFMC must take action to reduce the bycatch to ensure that the annual authorized take limit can be met. If and when it becomes apparent, based on analysis by either NMFS or PFMC that management measures cannot adequately reduce the bycatch rate to the prescribed level, consultation must be reinitiated.

As specified in the August 1996 biological opinion, the restriction on targeted harvest of whiting inside of 100 fathoms in the Eureka area continues as a condition of the incidental take statement. In addition, the delay of the start of the season until May 15 in areas north of 42° 00' N. latitude will continue.

Bottom Trawl Fishery

The bottom trawl fishery is not being monitored at this time. The incidental take statement permits an annual bycatch of 9,000 salmon, but assumes that the magnitude and character of the fishery will not increase substantially, particularly in those times and areas where bycatch rates are assumed to be higher. In order to evaluate this condition, the PFMC must provide an annual summary that characterizes the bottom trawl fishery and can thus be used to evaluate potential changing trends in fishing patterns.

IV. Terms and Conditions

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action or RPA. 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 August 28, 1992, biological opinion, as amended by the September 27, 1993 and May 14,1996, biological opinions. 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, Tribes, and PFMC chair to ensure that in-season management actions taken during the course of the fisheries are consistent with the harvest objectives established preseason.

2. NMFS, in cooperation with the affected states, Tribes, and PFMC chair, shall monitor the catch and implementation of other management measures at levels that are sufficient to ensure compliance with specified management limitations.

3. NMFS, in cooperation with the affected states, Tribes, and PFMC chair, 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.

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 August 28, 1992, biological opinion, are consistent with these obligations, and therefore should be implemented by NMFS.

1. Since the tribal whiting fishery was initiated in 1996, the associated bycatch rates of salmon have exceeded the 0.05 chinook salmon/mt whiting monitoring standard and have been substantially higher than other components of the fleet. The chinook bycatch rate in the tribal fishery has averaged 0.115 chinook salmon/mt whiting since 1996 compared to estimates for the mothership (excluding tribal), catcher/processor, and shoreside fleets of 0.022, 0.016, and 0.016, respectively. It is not clear at this time whether the bycatch rate could be reduced by

better monitoring or more active inseason management or if the observed rate is the result of geographic limitations associated with the tribal fishery or some other factor. To address this situation, NMFS, in cooperation with the effected tribe or tribes, should review the available information prior to the start of the 2000 fishery and develop an inseason monitoring program and action plan that is designed to minimize the bycatch of salmon to the maximum extent practical.

REINITIATION OF CONSULTATION

This concludes formal consultation on the Pacific Coast Groundfish FMP as amended by Amendment 11. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take specified in the Incidental Take Statement is exceeded; (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) the identified action is subsequently modified in a manner that causes an effect to listed species or critical habitat that was not considered in the biological opinion; (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 incidental take is exceeded, the action agency must immediately reinitiate formal consultation.

In the Reasonable and Prudent Measures of the Incidental Take Statement, NMFS made it clear that if and when it becomes apparent, based on analyses by either NMFS or PFMC, that management measures cannot adequately reduce the bycatch rate to prescribed levels, the amount or extent of incidental take will have been exceeded and section 7 consultation must be reinitiated.

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