Biological Opinion on the effects of the Pacific Coast Salmon Plan and U.S. Fraser Panel Fisheries on the Lower Columbia River Coho and Lower Columbia River Chinook Evolutionarily Significant Units Listed Under the Endangered Species Act and Magnuson-Stevens Act Essential Fish Habitat Consultation.

Action Agency: National Marine Fisheries Service (NMFS)

Species/Evolutionarily Significant Units Affected:

Species	Evolutionarily Significant Unit	Status	Federal Register Notice	
Coho Salmon (O. kisutch)	Lower Columbia River	Threatened	70 FR 37160	6/28/05
Chinook Salmon (O. tshawytscha)	Lower Columbia River	Threatened	70 FR 37160	6/28/05
Steelhead (O. mykiss)	Puget Sound Steelhead	Threatened	72 FR 26722	5/11/07

Activities considered: To promulgate ocean salmon fishing regulations in waters off of the Washington, Oregon and California coasts under the jurisdiction of the Pacific Fisheries Management Council and in the Strait of Juan de Fuca and San Juan salmon fisheries under the jurisdiction of the U.S. Fraser Panel pursuant to the Pacific Salmon Treaty.

Consultation conducted by: NMFS, Sustainable Fisheries Division, Northwest Region.
Consultation Number: F/NWR/2008/02438

NOAA's National Marine Fisheries Service (NMFS) proposes to promulgate ocean salmon fishing regulations within the Exclusive Economic Zone of the Pacific Ocean and to regulate U.S. Fraser Panel Fisheries in northern Puget Sound under the Pacific Salmon Treaty. Federal agencies proposing activities that may affect species listed under the Endangered Species Act (ESA) may request a formal consultation under Section 7(a)(4) of the ESA. In this biological opinion, NMFS reviews information regarding the impacts on listed Lower Columbia River coho and Lower Columbia River Chinook salmon associated with the proposed fisheries. This biological opinion has been prepared in accordance with section 7 of the ESA, as amended (16 U.S.C. 1531 et seq.). A complete administrative record of this biological opinion is on file with NMFS, Sustainable Fisheries Division in Seattle, Washington.

Approved by: D. Robert Lohn
D. Robert Lohn, Regional Administrator

Date: 4/25/2008

INTRODUCTION

The NOAA's National Marine Fisheries Service (NMFS) promulgates ocean fishing regulations within the Exclusive Economic Zone (EEZ) of the Pacific Ocean and regulates U.S. Fraser Panel fisheries in northern Puget Sound under the Pacific Salmon Treaty (PST). There are 27 listed species in the action area that are potentially affected by the action considered in this biological opinion (Table 1). The take of 24 ESA listed salmon ESUs and steelhead DPSs associated with the proposed fisheries is addressed in existing biological opinions (Table 2). This biological opinion considers the effects of proposed Pacific coast ocean salmon fisheries conducted under the Pacific Coast Salmon Plan (hereafter 'PFMC Fisheries') and U.S. Fraser Panel fisheries managed under the PST (hereafter 'Fraser Panel Fisheries') on Lower Columbia River coho and Lower Columbia River Chinook Salmon ESUs. NMFS also an ESA determination regarding the the likely effect of salmon fishing on newly ESA listed Puget Sound Steelhead. Southern Resident killer whales (*Orcinus orca*) have also been listed recently. The effects of the proposed actions on killer whales are being considered in a separate biological opinion.

CONSULTATION HISTORY

Since 1991, 27 salmon ESUs and steelhead Distinct Population Segments (DPSs) have been listed under the ESA on the west coast of the U.S. (Table 1). Beginning in 1991 NMFS considered the effects on salmon species listed under the ESA resulting from PFMC fisheries and issued biological opinions based on the regulations implemented each year rather than the FMP itself. In a biological opinion dated March 8, 1996, NMFS considered the impacts on all salmon species then listed under the ESA resulting from implementation of the Pacific Coast Salmon Fishery Management Plan (FMP) including spring/summer Chinook, fall Chinook, and sockeye salmon from the Snake River and Sacramento River winter Chinook ;NMFS 1996). Subsequent biological opinions beginning in 1997 considered the effects of PFMC fisheries on the growing catalogue of listed species (e.g. NMFS 1997; NMFS 1998; NMFS 1999a; NMFS 2000a; NMFS 2000b). NMFS has reinitiated consultation when new information became available on the status of the ESUs or the impacts of the FMP on the ESUs, or when new ESUs were listed. Beginning with its biological opinion on the 2000-2001 cycle fisheries, NMFS combined its consultation on Pacific coast salmon fisheries with those that occurred in Puget Sound (including the U.S. Fraser Panel Fisheries) for reasons of efficiency, because of the interrelated nature of the preseason planning processes, and to provide a more inclusive assessment of harvest-related impacts on the listed species. Table 2 lists the current biological opinions that consider the effects of the PFMC fisheries on other ESA-listed ESUs or DPSs in the West Coast of the United States.

Table 1. Summary of salmon and steelhead species listed under the Endangered Species Act.

Species	Evolutionarily Significant Unit/ Distinct Population Segment	Status	Federal Register Notice	
Chinook Salmon (O. tshawytscha)	Sacramento River winter-run	Endangered	70 FR 37160	6/28/05
	Snake River fall-run	Threatened	70 FR 37160	6/28/05
	Snake River spring/summer-run	Threatened	70 FR 37160	6/28/05
	Puget Sound	Threatened	70 FR 37160	6/28/05
	Lower Columbia River	Threatened	70 FR 37160	6/28/05
	Upper Willamette River	Threatened	70 FR 37160	6/28/05
	Upper Columbia River spring-run	Endangered	70 FR 37160	6/28/05
	Central Valley spring-run	Threatened	70 FR 37160	6/28/05
	California Coastal	Threatened	70 FR 37160	6/28/05
Chum Salmon (O. keta)	Hood Canal Summer-Run	Threatened	70 FR 37160	6/28/05
	Columbia River	Threatened	70 FR 37160	6/28/05
Coho Salmon (O. kisutch)	Central California Coast	Endangered	70 FR 37160	6/28/05
	S. Oregon/ N. California Coast	Threatened	70 FR 37160	6/28/05
	Lower Columbia River	Threatened	70 FR 37160	6/28/05
Sockeye Salmon (O. nerka)	Snake River	Endangered	70 FR 37160	6/28/05
	Ozette Lake	Threatened	70 FR 37160	6/28/05
Steelhead (O. mykiss)	Southern California	Endangered	71 FR 834	1/05/06
	South-Central California Coast	Threatened	71 FR 834	1/05/06
	Central California Coast	Threatened	71 FR 834	1/05/06
	Northern California	Threatened	71 FR 834	1/05/06
	Upper Columbia River	Threatened	71 FR 834	1/05/06
	Snake River Basin	Threatened	71 FR 834	1/05/06
	Lower Columbia River	Threatened	71 FR 834	1/05/06
	California Central Valley	Threatened	71 FR 834	1/05/06
	Upper Willamette River	Threatened	71 FR 834	1/05/06
	Middle Columbia River	Threatened	71 FR 834	1/05/06
	Puget Sound Steelhead	Threatened	72 FR 26722	5/11/07

Table 2. NMFS ESA decisions regarding ESUs and DPSs affected by PFMC Fisheries and the duration of the 4(d) Limit determination or biological opinion (BO). Only those decisions currently in effect are included.

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

As a result of the previous consultation history, the effects of PFMC fisheries on the Snake River fall Chinook, Snake River spring/summer Chinook, Snake River sockeye, Sacramento River winter-run Chinook, Southern Oregon/Northern California Coast coho, Central California Coast coho, Central Valley Spring-run Chinook, California Coastal Chinook, Upper Willamette River Chinook, Upper Columbia River spring-run Chinook, Columbia River chum, Puget Sound Chinook, Hood Canal summer-run chum, Ozette Lake sockeye and ten steelhead ESUs have been considered for ESA compliance in long-term biological opinions or 4(d) limit approvals (Table 2). In 2007 NMFS reviewed the effect of the proposed actions on newly listed green sturgeon and concluded that there was likely no effect to the listed DPS (NMFS 2007a). The effects of PFMC and Fraser Panel fisheries on Lower Columbia River coho in 2006, and on Lower Columbia River coho and Lower Columbia River Chinook in 2007 were considered in biological opinions related to the 2006 and 2007 annual regulations (NMFS 2006a, 2007a) Because these opinions have expired, Lower Columbia River coho and Lower Columbia River Chinook require further consultation in 2008. As explained in more detail below, this opinion considers the effect of PFMC and U.S. Fraser Panel fisheries on the Lower Columbia River Chinook in 2008 and Lower Columbia River coho in 2008 and for the foreseeable future. Puget

Sound steelhead were listed as threatened on May 11, 2007. The effects of PFMC and Fraser Panel fisheries are therefore also considered here for the first time.

The current salmon FMP requires that the PFMC manage fisheries consistent with NMFS' ESA-related consultation standards or recovery plans to meet the immediate needs for conservation and long-term recovery of the species. These standards are provided annually to the PFMC by NMFS at the start of the pre-season planning process (PFMC 1999). Consistent with the requirements of the salmon FMP, NMFS provided guidance to the PFMC regarding ESA-related management constraints derived from existing opinions and new guidance for the 2008 fisheries for Lower Columbia River coho and Lower Columbia River Chinook (Lohn and McInnis, 2008).

Lower Columbia River Coho

In 1997 the PFMC adopted a management plan (Amendment 13 to the Pacific Coast Ocean Plan) that constrained overall allowable fishery impacts on Oregon Coast Natural coho. The management plan was built around a harvest matrix that allowed harvest impacts to vary depending on brood year escapement and marine survival. In 2000, after a review of Amendment 13, the PFMC adopted changes to the management plan recommended by an ad-hoc Work Group as expert advice, including a lower range of harvest impacts when parental spawner abundance and marine survival were very low. NMFS reviewed the management plan through section 7 consultation and concluded that it was not likely to jeopardize Oregon Coast coho (NMFS 1999).

Lower Columbia River coho were listed under Oregon's ESA in July 1999. A related fishery management plan that was modeled after one for Oregon Coast Natural coho, was approved by the Oregon Fish and Wildlife Commission in July 2001. The plan is similar to that for Oregon Coast coho, but has tables defining the allowable harvest rate for both an ocean and inriver fisheries depending on brood year escapement and marine survival indicators (Tables 3a and 3b) (Melcher 2005). The ocean and river components can be combined to define a total exploitation rate limit for all ocean and inriver fisheries (Table 3c). The matrix was used by the states of Oregon and Washington for managing ocean and Columbia River fisheries for Lower Columbia River coho from 2002-2005.

In 2005 NMFS concluded in a conference opinion that the exploitation rates anticipated in the 2005 fisheries, based on the Oregon matrix, were not likely to jeopardize the continued existence of the Lower Columbia Coho Salmon ESU which were then proposed for listing under the ESA as threatened (NMFS 2005c). Lower Columbia River coho were subsequently listed as threatened under the ESA, effective August 29, 2005. Once the federal listing of Lower Columbia Coho Salmon ESU became effective, the conference opinion was confirmed as the biological opinion (NMFS2005d).

Since the federal listing of Lower Columbia River coho under the ESA, the states of Oregon and Washington have been working with NMFS to develop and evaluate a management plan that can be used as the basis for their long-term management. The states of Oregon and Washington have focused on use of the harvest matrix for Lower Columbia River. Generally speaking, NMFS supports use of management planning tools that allows harvest to vary depending on the year-specific circumstances. Conceptually, we think Oregon's approach is a good one. However, for the last two years, NMFS has taken a more conservative approach for Lower Columbia River coho because of unresolved issues related to application of the matrix. NMFS has relied on the matrix, but limited the total harvest impact rate to that allowed for ocean fisheries (Table 3a). Given the particular circumstances regarding marine survival and escapement, the allowable exploitation rates in 2006 (NMFC 2006a) and 2007 (NMFS 2007a) were 15% and 20%, respectively.

Lower Columbia River Chinook

Lower Columbia River Chinook was first listed on April 24, 1999 (64 FR 14308). In 1999 NMFS wrote a biological opinion for 1999 PFMC fisheries on the nine newly listed ESUs not covered by an existing opinion, including Lower Columbia River Chinook.

The Lower Columbia River Chinook ESU is comprised of a spring component, a far north-migrating bright component, and a component of north-migrating tules. This biological opinion considers the effects of the 2008 regulations implemented pursuant to the Pacific Coast Salmon Plan on the Lower Columbia River Chinook ESU in 2008. Although this opinion focuses on details related to Lower Columbia River tules, the ESA determination relates to the ESU as a whole. Information regarding the spring and upriver bright populations is therefore included this biological opinion, but in less detail.

In past biological opinions NMFS has used the Coweeman population as an index stock for managing the tule component of the ESU. For Lower Columbia River tules, NMFS has previously used an analytical approach (Viability Risk Assessment Procedure – VRAP; NMFS 2000b, NMFS 2004) that involves calculating a "rebuilding exploitation rate" (RER). The RER for a specific population is defined as the maximum exploitation rate that would result in a low probability of the population falling below a specified lower abundance threshold and a high probability that the population would exceed an upper abundance threshold over a specific time period. RERs were used originally as part of the assessment in the 1999 Pacific Salmon Treaty (PST) opinion (NMFS 1999b), the 2000 opinion on PFMC fisheries (NMFS 2000a), and the application of take limits under the 4(d) Rule for populations within the Puget Sound ESU (NMFS 2005a). VRAP and the related RER calculations are discussed in more detail in Section 3 of this opinion.

In 2001 NMFS required that the total brood year exploitation rate for the Coweeman stock [representing the Lower Columbia River tule fall stocks], in all fisheries combined, not exceed 65% (NMFS 2001b). The 65% RER was subsequently reviewed and replaced with an RER of 49% in 2002. The 49% RER was used as the jeopardy standard for the tule component of the Lower Columbia River Chinook ESU from 2002 to 2006.

In the 2006 Guidance Letter to the Council, NMFS indicated their intention to review the 49% RER (Lohn and McInnis 2006). After five years NMFS concluded that a periodic review was warranted. The Lower Columbia Salmon Recovery Plan also called for a review of the 49% standard and the associated effects of fishing on other Lower Columbia River tule populations. NMFS organized an ad hoc Work Group that included staff from the Northwest Fisheries

Science Center and Washington Department of Fish and Wildlife. The Work Group has been working on the project since 2006.

The Work Group focused much of its attention on tule populations in the Coweeman, East Fork Lewis, and Grays rivers, all of which have relatively little hatchery influence and recently updated escapement data. Available information for other populations was compiled and analyzed, but the quality of the data has been subject to less review. The Work Group reviewed available data and updated the RER estimates for the three populations based on the method used to calculate the 49% exploitation rate used for the Coweeman in 2002. The Work Group sought to integrate their review with several recovery planning documents and analyses that have become available since 2002, including the Lower Columbia Fish Recovery Board Recovery Plan (LCFRB 2004) and several Willamette/Lower Columbia Technical Recovery Team (WLC TRT) reports on population viability. In particular, in addition to estimating RERs, the team also considered the viability assessment methods developed by the WLC TRT to evaluate the effects of alternative exploitation rates on population viability, and used information in the LCFRB Plan to evaluate which populations are most important to focus on for recovery. The general conclusion from this array of results was that harvest impacts needed to be reduced. In the 2007 Guidance Letter to the Council, NMFS recommended that the Council lower the exploitation rate in 2007 for the Lower Columbia River tule populations from 49% to 42%. NMFS' guidance to the Council, and other related information, provided the basis for NMFS' consultation on Lower Columbia River Chinook in 2007 (NMFS 2007a).

<u>Puget Sound Steelhead</u>
NMFS previously reviewed the potential effects from PFMC fisheries to the ten steelhead Distinct Populations Segments (DPS) that were listed at the time (NMFS 2000c). The review indicated that steelhead are rarely caught in the proposed marine area fisheries. Based on its review, NMFS concluded that the expected take from the PFMC ocean and Fraser Panel salmon fisheries of steelhead is at most an occasional event. The review indicated that the number of listed steelhead that was caught and killed was probably less than 10 per year, and those would be distributed across all of the then listed DPSs. NMFS concluded that it was not possible to measure or detect potential effects of the proposed actions on the listed steelhead (which, according to the Interagency Section 7 Handbook, is considered an "insignificant effect") and concluded that the proposed action was not likely to adversely affect listed steelhead. Puget Sound steelhead were listed as threatened in 2007 so were not specifically included in the previous review. However, because the analysis was based on the fact that steelhead are rarely caught, the conclusion that the proposed actions are not likely to adversely affect, would apply equally to Puget Sound steelhead. Critical habitat has not yet been designated for Puget Sound steelhead. Consequently, the effect of the proposed fisheries on Puget Sound steelhead will not be considered further in this opinion.

BIOLOGICAL OPINION

1.0 DESCRIPTION OF THE PROPOSED ACTION

1.1 Proposed Action

This opinion considers the effects of two actions on ESA-listed Lower Columbia River coho salmon, Lower Columbia River Chinook salmon, and Puget Sound steelhead: NMFS' implementation of the PFMC's Pacific Coast Salmon Plan and NMFS' regulation of U.S. Fraser Panel fisheries in northern Puget Sound under the Pacific Salmon Treaty (PST).

The ocean salmon fisheries in the EEZ (3-200 nautical miles offshore) off of the states of Washington, Oregon, and California are managed under authority of the Magnuson-Stevens Act (Figure 1). Annual regulations apply to the period from May 1 of the current year through April 30 of the following year. Pursuant to the Magnuson-Stevens Act, NMFS proposes to promulgate ocean salmon fishing regulations developed in accordance with the FMP along with the FMP's associated amendments, most recently amendment 14 (see PFMC 2008a for details on the specific fishery locations and historical catch and effort data). These ocean fisheries include recreational and commercial troll fisheries, and tribal fisheries targeting coho and Chinook. The PFMC provides its management recommendations to the Secretary of Commerce (Secretary), who implements the measures in the EEZ if they are found to be consistent with the Magnuson-Stevens Act and other applicable law such as the ESA. Because the Secretary, acting through NMFS, has the ultimate authority for the FMP and its implementation, NMFS is both the action agency and the consulting agency with respect to PFMC Fisheries.

In developing management recommendations, the PFMC analyzes several management options for ocean fisheries occurring in the EEZ. The analysis includes assumptions regarding the levels of harvest of Lower Columbia River coho, Lower Columbia River Chinook, and other listed species in state marine, estuarine, and freshwater areas. Fisheries in estuarine and freshwater areas of the Columbia River are regulated under authority of the states and tribes, and consistent with the terms of agreements among the *U.S v. Oregon* parties. The *U.S. v. Oregon* parties have tentatively concluded a new ten year agreement regarding fisheries in the mainstem Columbia River. The 2008 *U.S v. Oregon* Agreement is currently the subject of an ongoing consultation that is scheduled for completion on May 5, 2008. Consultation standards for Lower Columbia River coho and Lower Columbia River Chinook are expressed in terms of total exploitation rates with the understanding that impacts occur in both ocean and inriver fisheries. NMFS is considering the effect of these proposed standards in this biological opinion. Once completed, it will be included as part of the Environmental Baseline for the biological opinion on the 2008 *U.S v. Oregon* Agreement.

Under the FMP each stock affected by the fishery is managed subject to a specified conservation objective. For ESA listed species the conservation objectives are referred to as consultation standards. The FMP requires that NMFS provide consultation standards for each listed species, which specify levels of take that are not likely to jeopardize the continued existence of the species. NMFS provides these standards in its annual guidance letter to the Council prior to the start of the annual preseason planning process. NMFS provides the necessary review for these consultation standards through an associated biological opinion. The Council is then required by the FMP to manage their fisheries to meet or exceed those standards.

Generally, NMFS strives to provide consultation standards for listed species that are multi-year or long term. Table 2 lists the biological opinions that considered consultation standards for most of the currently listed species. Long term standards provide greater certainty to the management planning process, and allow for a more comprehensive review related to the effect on the species. These longer term standards are subject to periodic review as they expire or through reinitiation of the section 7 consultation. In some case, NMFS provides consultation standards that apply for only one year. NMFS relies on short term standards when important information is still evolving, as is the case with newly listed species, or when there are substantive changes in available information that require further review.

In 2008 NMFS provided its consultation standards as required through is annual guidance letter to the Council (Lohn and McInnis 2008). For Lower Columbia River coho, NMFS recommended a standard that was to be implemented in 2008 and for the foreseeable future. For Lower Columbia River Chinook the standard was for 2008 only. (These standards are described in more detail below.)

NMFS also has authority to regulate U.S. Fraser Panel Fisheries in northern Puget Sound and annually decides whether to relinquish control to the bilateral Fraser Panel pursuant to the Pacific Salmon Treaty (PST). The bilateral Fraser Panel controls sockeye and pink fisheries conducted in the Strait of Juan de Fuca and San Juan Island region (northern Puget Sound), the Georgia Strait and Fraser River in Canada, and certain high seas and territorial waters westward from the western coasts of Canada and the U.S. between 48 and 49 degrees latitude (a detailed description of U.S. Fraser Panel waters can be found at 50 CFR 300.91, Definitions). The U.S. Fraser Panel assumes control of fisheries for Fraser River sockeye and pink salmon fisheries in panel area waters as defined under the PST from July 1 through September, although the fisheries generally occur between late July and August. A more detailed description of the structure of Fraser Panel fisheries is included in NMFS' biological assessment on related to the effect of 2007 fisheries in Southern Resident killer whales (NMFS 2007b).

The PFMC and Fraser actions have been grouped into this single biological opinion for efficiency and in compliance with the regulatory language of section 7, which allows NMFS to group similar, individual actions within a given geographic area or segment of a comprehensive plan (50 CFR 402.14(b)(6)). For a detailed description of fisheries refer to the 2008 PFMC Pre-Season Report III (PFMC 2008b) and the FMP (PFMC 2003).

1.1.1 Lower Columbia River Coho

For Lower Columbia River coho NMFS indicated in its guidance to the Council that fisheries should be managed in 2008, and for the foreseeable future, using the ocean portion of Oregon's harvest matrix (Lohn and McInnis 2008) (Table 3a). (See the discussion in the Consultation History for more background on the harvest matrix.) The allowable harvest may vary from year-to-year depending on indicators of brood year escapement in the Clackamas and Sandy, and marine survival. In 2008 brood year escapement indicators are mixed. The Clackamas and

Sandy are in the low and medium status categories, respectively, but the marine survival index is in the critical category. Given these circumstances the harvest matrix prescribes a harvest impact of 0 to 8%. As a consequence, ocean salmon fisheries under the Council's jurisdiction in 2008, and commercial and recreational salmon fisheries in the mainstem Columbia River, including select area fisheries (e.g., Youngs Bay), should be managed subject to a total exploitation rate limit on Lower Columbia River coho not to exceed 8%. For 2009 and thereafter, the matrix will be used as it has here to determine the year specific exploitation rate. The exploitation rate limit does not include the effects of Fraser Panel fisheries. The limited incidental catch of coho that occurs in the Fraser fisheries directed at sockeye and pink salmon is assessed separately.

Table 3a. Harvest management matrix for Lower Columbia River coho salmon showing maximum allowable **OCEAN** fishery mortality rate.

Parental Escapement [1/]		Marine Survival Index (based on return of jacks per hatchery smolt)			
		Critical (<0.0008)	Low (<0.0015)	Medium (< 0.0040)	High (> 0.0040)
High	≥ 0.75 full seeding	≤ 8.0%	≤ 15.0%	<30.0%	<45.0%
Medium	0.75 to 0.50 full seeding	≤ 8.0%	< 15.0%	< 20.0%	<38.0%
Low	0.50 to 0.20 full seeding	≤ 8.0%	<15.0%	< 15.0%	< 25.0%
Very Low	0.20 to 0.10 of full seeding	≤ 8.0%	< 11.0%	<11.0%	< 11.0%
Critical	< 0.10 of full seeding	0 – 8.0%	0 – 8.0%	0 – 8.0%	0 – 8.0%

[1/] Full Seeding: Clackamas River = 3,800
Sandy River = 1,340

Table 3b. Harvest management matrix for Lower Columbia River coho salmon showing maximum allowable **FRESHWATER** fishery mortality rates.

Parental Escapement [1/]		**Marine Survival Index** (based on return of jacks per hatchery smolt)			
		Critical (<0.0008)	Low (< 0.0015)	Medium (< 0.0040)	High (> 0.0040)
High	> 0.75 full seeding	< 4.0%	< 7.5%	< 15.0%	< 22.5%
Medium	0.75 to 0.50 full seeding	< 4.0%	< 7.5%	< 11.5%	< 19.0%
Low	0.50 to 0.20 full seeding	< 4.0%	< 7.5%	< 9.0%	< 12.5%
Very Low	0.20 to 0.10 of full seeding	< 4.0%	< 6.0%	< 8.0%	< 10.0%
Critical	< 0.10 of full seeding	0.0 – 4.0%	0.0 – 4.0%	0.0 – 4.0%	0.0 – 4.0%

Table 3c. Harvest management matrix for Lower Columbia River coho salmon showing the maximum allowable combined OCEAN and FRESHWATER fishery mortality rates.

Parental Escapement [1/]		**Marine Survival Index** (based on return of jacks per hatchery smolt)			
		Critical (<0.0008)	Low (< 0.0015)	Medium (< 0.0040)	High (> 0.0040)
High	> 0.75 full seeding	**< 11.7%**	**< 21.4%**	**< 40.5 %**	**< 57.4%**
Medium	0.75 to 0.50 full seeding	**< 11.7%**	**< 21.4%**	**< 29.2%**	**< 49.8%**
Low	0.50 to 0.20 full seeding	**< 11.7%**	**< 21.4%**	**< 22.7%**	**< 34.4%**
Very Low	0.20 to 0.10 of full seeding	**< 11.7%**	**< 16.3%**	**< 18.1%**	**< 19.9%**
Critical	< 0.10 of full seeding	0.0 – 11.7%	0.0 – 11.7%	0.0 – 11.7%	0.0 – 11.7%

1.1.2 Lower Columbia River Chinook

NMFS also provided consultation standards to the Council through its Guidance Letter (Lohn and McInnis 2008). The Lower Columbia River Chinook ESU includes populations with spring, bright and tule life history types. The guidance focused on the requirements for tule populations. For spring Chinook populations, NMFS indicated their expectation that the state management agencies would continue to manage fisheries to meet hatchery escapement goals, but concluded that additional management constraints in Council fisheries were unnecessary. Similarly, NMFS concluded that management constraints for bright populations in Council fisheries, beyond those required for other stocks, were unnecessary.

For Lower Columbia River tule Chinook population, NMFS' guidance was that Council fisheries be managed in 2008 to not exceed a total exploitation rate of 41% in all ocean and inriver fisheries. The 41% exploitation rate limit applies to all fisheries including those managed under the Council and Fraser Panel jurisdiction. As described in more detail below, NMFS will continue its review of the species status and the effects of harvest, and seek to implement changes that are consistent with the evolving information, the expected evolution of the hatchery programs, and the long term goal of recovery articulated in the Lower Columbia Salmon Recovery Plan. NMFS considered the proposed action for 2008 while assuming that exploitation rates in 2009 and thereafter would be no greater than 41%, while conveying to the Council their expectation the further reductions in the harvest may be required.

1.2 Action Area

For the PFMC Fisheries the action area is the EEZ, which is directly affected by the federal action, and the coastal and inland marine waters of the states of Washington, Oregon and California, which may be indirectly affected by the federal action. For the U.S. Fraser Panel Fisheries, the action area includes the U.S. waters of the Strait of Juan de Fuca and the San Juan Islands in northern Puget Sound during the period of Fraser Panel control which is proposed for 2008 (Figure 1) (a more detailed description of U.S. panel waters can be found at CFR 300.91, Definitions and NMFS 2007b.

2.0 Range-Wide Status of the Species and the Environmental Baseline

In order to describe a species' status, it is first necessary to define what "species" means in this context. Traditionally, one thinks of the ESA listing process as pertaining to entire taxonomic species of animals or plants. While this is generally true, the ESA also recognizes that there are times when the listing unit must necessarily be a subset of the species as a whole. In these instances, the ESA allows a "distinct population segment" (DPS) of a species to be listed as threatened or endangered. Lower Columbia River coho and Lower Columbia River Chinook salmon each constitutes an ESU (a salmon DPS) of the taxonomic species *Oncorhynchus kisutch* and *Oncorhynchus tshawytscha*, respectively, and as such are considered "species" under the ESA. The discussion in this opinion is limited to the Lower Columbia River coho and Lower Columbia River Chinook salmon ESUs.

Critical habitat has not yet been proposed for Lower Columbia River coho. Critical Habitat for Lower Columbia River Chinook was designated on September 2, 2005 (70 FR 52630). Critical habitat for Lower Columbia River Chinook does not include offshore marine areas of the Pacific Ocean. The bounds of the action area are therefore outside the bounds of critical habitat for Lower Columbia River Chinook.

Viable Salmonid Population Concept

One approach for assessing the status of an ESU and its component populations developed by NMFS is described in a paper related to Viable Salmonid Populations (VSPs) (McElhany et. al. 2000). This paper provides guidance for determining the conservation status of populations and ESUs that can be used in ESA-related processes. In this biological opinion, we rely on VSP guidance in describing the population or stock structure of the Lower Columbia River coho and Lower Columbia River Chinook salmon ESUs and the related effects of the actions.

The task of identifying populations within an ESU requires making judgments based on the available information. Information regarding the geography, ecology, and genetics of the ESU are relevant to this determination. This is a task that will generally be taken up as part of the recovery planning process. It is appropriate in this biological opinion to consider the potential diversity of the ESU and the status of the component populations using the available information.

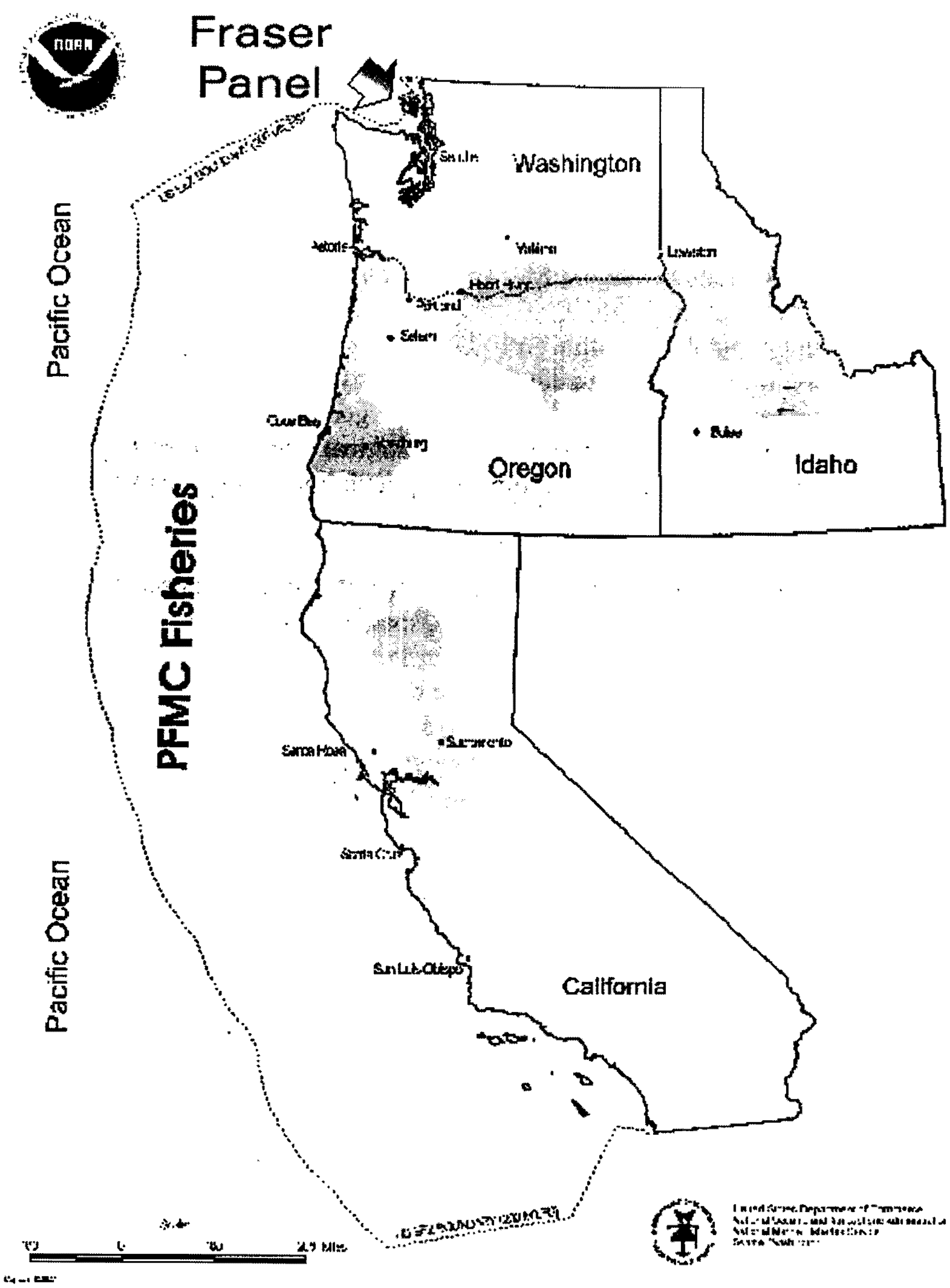
The VSP paper also provides guidance regarding parameters that can be used for evaluating population status including abundance, productivity, spatial structure, and diversity. In this opinion we consider particularly the guidance related to abundance and productivity, but include consideration of other criteria to the degree possible based on the available data. The paper provides several rules of thumb that are intended to serve as guidelines for setting population specific thresholds (McElhany et. al. 2000). The guidance relates to defining both "viable" populations levels and "critical" abundance levels.

Recovery planning for the lower Columbia River and Willamette Basin is well underway. In February 2006, NMFS approved an Interim Regional Recovery Plan for the Washington portions of Lower Columbia Chinook, steelhead, and chum (the plan and related materials are available at http://www.nwr.noaa.gov/Salmon-Recovery-Planning/Recovery-Domains/Willamette-Lower-Columbia/Interim-Recovery.cfm). The Washington plan discussed Lower Columbia River coho in some detail, but since the ESU was not actually listed at the time the plan was submitted to NMFS and made available for public comment, the interim plan approval did not apply to coho. Provisions related to coho are therefore best considered draft.

Since the listing, Washington's Lower Columbia Fish Recovery Board (LCFRB) has done additional work to supplement treatment of coho in its plan, and a full-scale recovery planning effort has been initiated in the Oregon portion of the Lower Columbia for Chinook, steelhead, chum, and coho. When both plans are completed, NMFS will make them available for public review and comment before finalizing them under the ESA. We expect the plans to be completed by the state or local groups by the end of 2008, with a federal register notice of availability for public comment to follow as soon as possible thereafter. (Additional materials on

Oregon's recovery planning process are available at http://www.dfw.state.or.us/fish/esa/upper-willamette/index.asp.)

Figure 1. PFMC Fisheries and Fraser River Panel Fisheries



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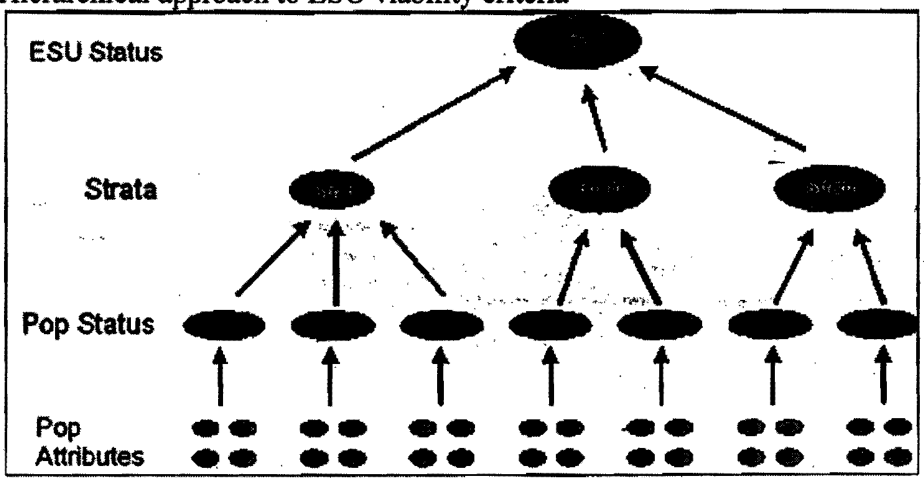
The WLC TRT has developed a hierarchical approach for determining ESU-level viability criteria (Figure 2). Briefly, an ESU is divided into populations (McElhany et. al. 2000). The risk of extinction of each population is evaluated, taking into account population-specific measures of abundance, productivity, spatial structure and diversity. Populations are then grouped into ecologically and geographically similar *strata* (referred to as Major Population Groups by the WLC TRT), which are evaluated on the basis of population status. In order to be considered viable, a stratum generally must have at least half of its historically present populations meeting their population-level viability criteria (McElhany et al. 2006). The ESU-level viability criteria require that each of the ESU's strata be viable.

Figure 2. Hierarchical approach to ESU viability criteria



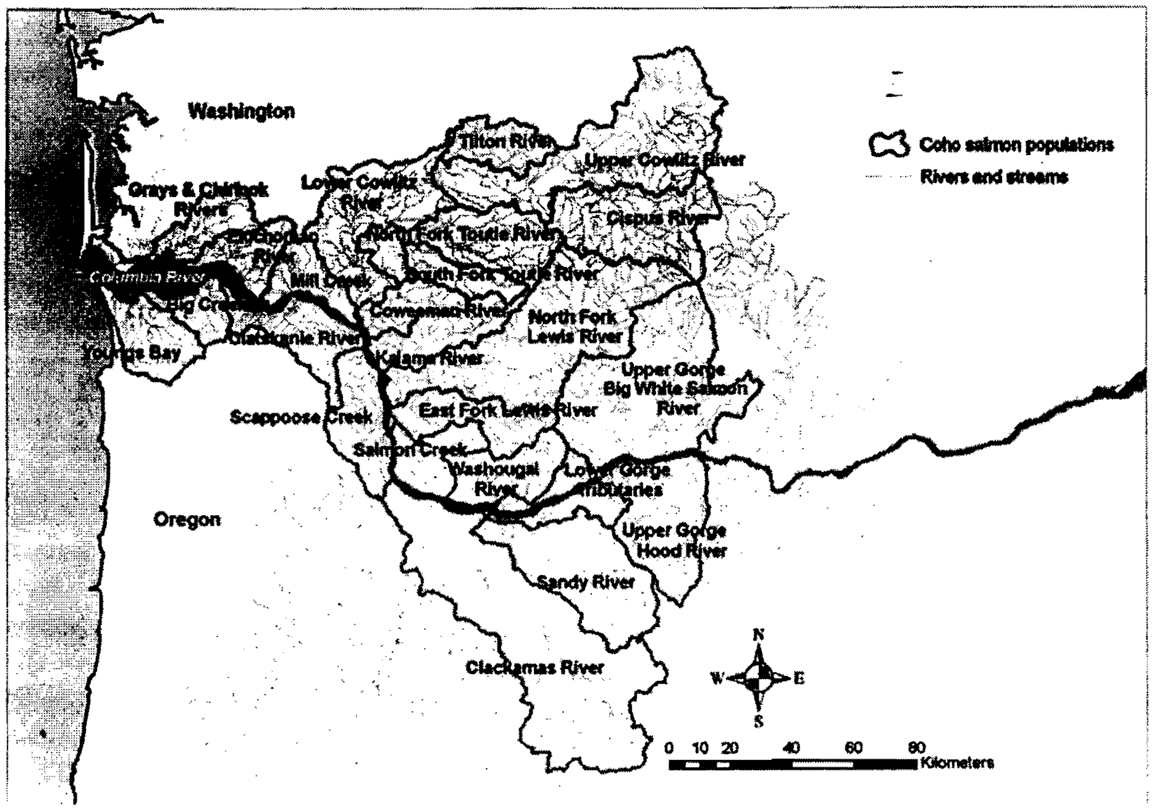
2.1 Species Status

2.1.1 Lower Columbia River Coho

NMFS reviewed the status of the Lower Columbia River coho salmon ESU in 1996 (NMFS 1996b), in 2001 (NMFS 2001c), in 2005 (Good et al., 2005), and most recently in 2006 (McElhany et al., 2006). Good et al. (2005) reported that there were only two populations with any significant natural production (Sandy and Clackamas rivers), and that these populations were at appreciable risk because of low abundance, declining trends, and failure to respond after a dramatic reduction in harvest. The large number of hatchery coho salmon in the ESU help mitigate some of the short-term risks to the ESU, but was also considered a significant risk factor, particularly for the long-term. The Lower Columbia River coho ESU was listed under the ESA on June 28, 2005 (70 FR 37160).

The Lower Columbia River coho ESU includes 24 historical populations in Oregon and Washington between the mouth of the Columbia River and the Cascade crest (Figure 3). Although run time variation is considered inherent to overall coho life history, the ESU includes two distinct runs: early returning (Type S) and late returning (Type N). Type S coho salmon migrate generally south of the Columbia once they reach the ocean, returning to fresh water in mid-August and to the spawning tributaries in early September. Spawning peaks from mid-October to early November. Type N coho have a northern distribution in the ocean, return to the lower Columbia River from late September through December and enter the tributaries from October through January. Most Type N spawning occurs from November through January, but some spawning occurs in February and as late as March (LCFRB 2004). Summary data for the ESU are shown in Table 4. Lower Columbia River coho populations have been partitioned into three "strata" (also referred to as Major Population Groups, MPG) based on major life-history characteristics and ecological zones (Myers et al., 2006). The strata and associated populations for coho salmon are listed in Table 5.

Figure 3. Historical Demographically Independent Populations (DIPs) in the Lower Columbia River Coho Salmon ESU. (Myers et al., 2006 - NOAA Technical Memorandum NMFS-NWFSC-73).



Steel and Sheer (2003) analyzed the number of stream kilometers historically and currently available to salmon populations in the lower Columbia River (Table 6). Stream kilometers usable by salmon are determined based on simple gradient cutoffs and on the presence of impassable barriers. This approach overestimates the number of usable stream kilometers, because it does not account for aspects of habitat quality other than gradient. However, the analysis does indicate that the number of kilometers of stream habitat currently accessible is greatly reduced from the historical condition for some populations. Hydroelectric projects in the Cowlitz, North Fork

Lewis, and White Salmon Rivers have greatly reduced or eliminated access to upstream production areas and therefore extirpated some of the affected populations.

Table 4. Lower Columbia River coho ESU description and major population groups (MPGs). (Sources: NMFS 2005e; Myers et al. 2006)

ESU Description	
Threatened	**Listed under ESA in 2005 (70 FR 37160)**
3 major population groups	24 historical populations
Major Population Group	**Population**
Coast	Grays, Elochoman, Mill Creek, Youngs Bay, Big Creek, Clatskanie, Scappoose Creek
Cascade	Lower Cowlitz, Coweeman, SF Toutle, NF Toutle, Upper Cowlitz, Cispus, Tilton, Kalama, NF Lewis, EF Lewis, Salmon Creek, Washougal, Clackamas, Sandy
Gorge	Lower Gorge, Washington Upper Gorge and (Big)White Salmon River, Oregon Upper Gorge and Hood River
Hatchery programs included in ESU (25)	Grays River, Sea Resources Hatchery, Peterson Coho Project, Big Creek Hatchery, Astoria High School (STEP) Coho Program, Warrenton High School (STEP) Coho Program, Elochoman Type-S Coho Program, Elochoman Type-N Coho Program, Cathlamet High School FFA Type-N Coho Program, Cowlitz Type-N Coho Program in the Upper and Lower Cowlitz Rivers, Cowlitz Game and Anglers Coho Program, Friends of the Cowlitz Coho Program, North Fork Toutle River Hatchery, Kalama River Type-N Coho Program, Kalama River Type-S Coho Program, Lewis River Type-N Coho Program, Lewis River Type-S Coho Program, Fish First Wild Coho Program, Fish First Type-N Coho Program, Syverson Project Type-N Coho Program, Washougal River Type-N Coho Program, Eagle Creek NFH, Sandy Hatchery, and the Bonneville/ Cascade/Oxbow complex coho hatchery programs.

Table 5. The ecological zones (strata) and populations for the Lower Columbia River coho salmon ESU(LCFRB 2004). Primary (P), contributing (C), and stabilizing (S) population designations for the recovery scenario. Respective target viabilities are high or better, medium, and no lower than current levels. Primary populations identified for greater than high viability objectives are denoted with an '*'.

Population/Strata	Status/ Goal[1]	Abundance Range		Viability	
		Viable	Potential	Current	Goal
COASTAL					
Grays /Chinook (WA)	P	600	4,600	Low	High
Mill, Germany, Abernathy (WA)	C	600	3,700	Low	Med
Elochoman/Skamokawa (WA	P	600	7,000	Low	High
Youngs Bay (OR))	S	600	1,200	na	Low
Big Creek (OR)	P	600	1,200	na	High
Clatskanie (OR)	S	600	1,200	na	Low
Scappoose (OR)	P	600	1,200	na	High
CASCADE					
Upper Cowlitz (WA)	P	600	28,800	V Low	Med
Lower Cowlitz (WA)	C	600	19,100	Low	High
Cispus (WA)	C	600	6,600	V Low	Med
Tilton (WA)	C	600	4,000	V Low	Low
South Fork Toutle (WA)	P	600	32,900	Low	High
North Fork Toutle (WA)	P	600	1,200	Low	High
Coweeman (WA)	P	600	7,600	Low	High
Kalama (WA)	C	600	1,300	Low	Med
North Fork Lewis (WA)	C	600	5,900	Low	High
East Fork Lewis (WA)	P	600	4,100	Low	High
Salmon Creek (WA)	S	600	5,700	V Low	V Low
Washougal (WA)	C	600	4,200	Low	Med
Sandy (OR)	P*	600	1,200	na	High+
Clackamas (OR)	P*	600	1,200	na	High+
GORGE					
Lower Gorge Tributaries (WA)	P	600	1,200	Low	High
Upper Gorge Tributaries (WA)	P	600	1,100	Low	High
White Salmon (WA)	C	600	1,200	V Low	Low
Hood River (OR)	C	600	1,200	na	Med

[1] **Primary populations** are those that would be restored to high or "high+" viability. At least two populations per strata must be at high or better viability to meet recommended TRT criteria. Primary populations typically, but not always, include those of high significance and medium viability. In several instances, populations with low or very low current viability were designated as primary populations in order to achieve viable strata and ESU conditions. In addition, where factors suggest that a greater than high viability level can be achieved, populations have been designated as High+. High+ indicates that the population is targeted to reach a viability level between High and Very High levels as defined by the TRT. **Contributing populations** are those for which some restoration will be needed to achieve a stratum-wide average of medium viability. Contributing populations might include those of low to medium significance and viability where improvements can be expected to contribute to recovery. **Stabilizing populations** are those that would be maintained at current levels (likely to be low viability). Stabilizing populations might include those where significance is low, feasibility is low, and uncertainty is high.

Table 6. Current and historically available habitat located below barriers in the Lower Columbia River coho salmon ESU.

Population	Potential Current Habitat (km)	Potential Historical Habitat (km)	Current/ Historical Habitat Ratio (%)
Youngs Bay	178	195	91
Grays River	133	133	100
Big Creek	92	129	71
Elochoman River	85	116	74
Clatskanie River	159	159	100
Mill, Germany, Abernathy Creeks	117	123	96
Scappoose Creek	122	157	78
Cispus River	0	76	0
Tilton River	0	93	0
Upper Cowlitz River	4	276	1
Lower Cowlitz River	418	919	45
North Fork Toutle River	209	330	63
South Fork Toutle River	82	92	89
Coweeman River	61	71	86
Kalama River	78	83	94
North Fork Lewis River	115	525	22
East Fork Lewis River	239	315	76
Clackamas River	568	613	93
Salmon Creek	222	252	88
Sandy River	227	286	79
Washougal River	84	164	51
Lower Gorge Tributaries	34	35	99
Upper Gorge Tributaries	23	27	84
White Salmon River	0	71	0
Hood River	35	35	100
Total	3,286	5,272	62

Twenty-five artificial propagation programs are considered to be part of the ESU: The Grays River, Sea Resources Hatchery, Peterson Coho Project, Big Creek Hatchery, Astoria High School (STEP) Coho Program, Warrenton High School (STEP) Coho Program, Elochoman Type-S Coho Program, Elochoman Type-N Coho Program, Cathlamet High School FFA Type-N Coho Program, Cowlitz Type-N Coho Program in the Upper and Lower Cowlitz Rivers, Cowlitz Game and Anglers Coho Program, Friends of the Cowlitz Coho Program, North Fork Toutle River Hatchery, Kalama River Type-N Coho Program, Kalama River Type-S Coho Program, Lewis River Type-N Coho Program, Lewis River Type-S Coho Program, Fish First Wild Coho Program, Fish First Type-N Coho Program, Syverson Project Type-N Coho Program, Washougal River Type-N Coho Program, Eagle Creek NFH, Sandy Hatchery, and the Bonneville/Cascade/Oxbow complex coho hatchery programs (Table 3). These hatchery stocks were included as part of the listed ESU in part based on a determination that these artificially propagated stocks are no more divergent relative to the local natural population(s) than what would be expected between closely related natural populations within the ESU (70 FR 97160, June 28, 2006).

All of the 25 hatchery programs included in the Lower Columbia River coho ESU are designed to produce fish for harvest, with two small programs also designed to augment the natural spawning populations in the Lewis River basin. Past artificial propagation efforts generally did not mark hatchery fish, mixed broodstocks derived from different local populations, and transplanted stocks among basins throughout the ESU. The result is that the hatchery stocks considered to be part of the ESU represent a homogenization of populations, although some programs have very limited use of out of basin stocks (e.g., Cowlitz Type-N, Toutle Type-S). Several of these risks have recently begun to be addressed by improvements in hatchery practices. All programs in the ESU mark 100-percent of the hatchery fish to afford improved monitoring and evaluation of broodstock and (hatchery- and natural-origin) returns. Past hatchery practices are being modified to comform with best hatchery practices. For example, the practice of transfering of eggs between stations has been eliminated to promote development of locally adapted naturally spawning populations. The status of hatchery programs and their effect on the ESU is discussed in more detail in section 3.2.3.

The abundance of coho returning to the Lower Columbia River from 2001 to 2007 ranged from 318,000 to more than 1,108,000, with most of the abundance comprised of hatchery fish (PFMC 2008a). At present, the Lower Columbia River coho hatchery programs reduce risk to ESU abundance and spatial structure, provide uncertain benefits to ESU productivity, and pose risks to ESU diversity. Overall, artificial propagation mitigates the immediacy of ESU extinction risk in the short-term but is of uncertain contribution in the long term (69 FR 33102, June 14, 2004).

Natural-origin fish are defined as those whose parents spawned in the wild, while hatchery-origin fish are defined as those whose parents were spawned in a hatchery. There is still significant coho production in the Clackamas and Sandy rivers. Good et al. (2005) reports that there appeared to be little natural production from other populations (References for abundance time series and related data are in Good et al., 2005 (Appendix C.5.2)). More recent information indicates that here is more spawning and production of natural-origin smolts than previously thought at least in recent years.

Oregon Populations

The Oregon Department of Fish and Wildlife has tentatively identified six historic populations on the Oregon side of the Lower Columbia River coho ESU. These include the Clackamas and Sandy, Astoria area tributaries, Clatskanie, Scappoose, and Gorge and Hood (as a group). The WLC-TRT split the Astoria tributaries into two populations including Youngs Bay and Big Creek. The WLC TRT also treated the Gorge tributaries and Hood River as separate populations (Table 4).

Clackamas

Presently, the Clackamas River population above the North Fork Dam is one of only two populations in the ESU for which natural production trends can be estimated. The portion of the population above the dam has a relatively low fraction of hatchery-origin spawners, while they dominate the area below the dam. A 2002 stratified random survey by ODFW estimated a total of 2,402 coho spawning in the Clackamas River below North Fork Dam (WLC-TRT 2004). The survey estimated that 78% of the fish observed were of hatchery origin. Counts at North Fork Dam in 2002 indicate a total of 998 coho went above the dam and 12% of those were of hatchery origin. Also, 100% of coho sampled in Clear Creek (a lower Clackamas River tributary) were of natural origin (Brown et al. 2003, cited in NMFS 2004b).

The number of adult coho salmon returns to the North Fork Dam is shown in Figure 4 and Table 7. Prior to 1973, hatchery-origin adults and juveniles were released above North Fork Dam, and the time series from 1957-1972 contains an unknown fraction of hatchery-origin spawners. The adult return of coho to the North Fork Dam has been highly variable over the last 50 years, but without an apparent trend.

Figure 4. Clackamas North Fork Dam counts of adult (3-year-old) coho salmon, 1957–2007 (TAC 2008).

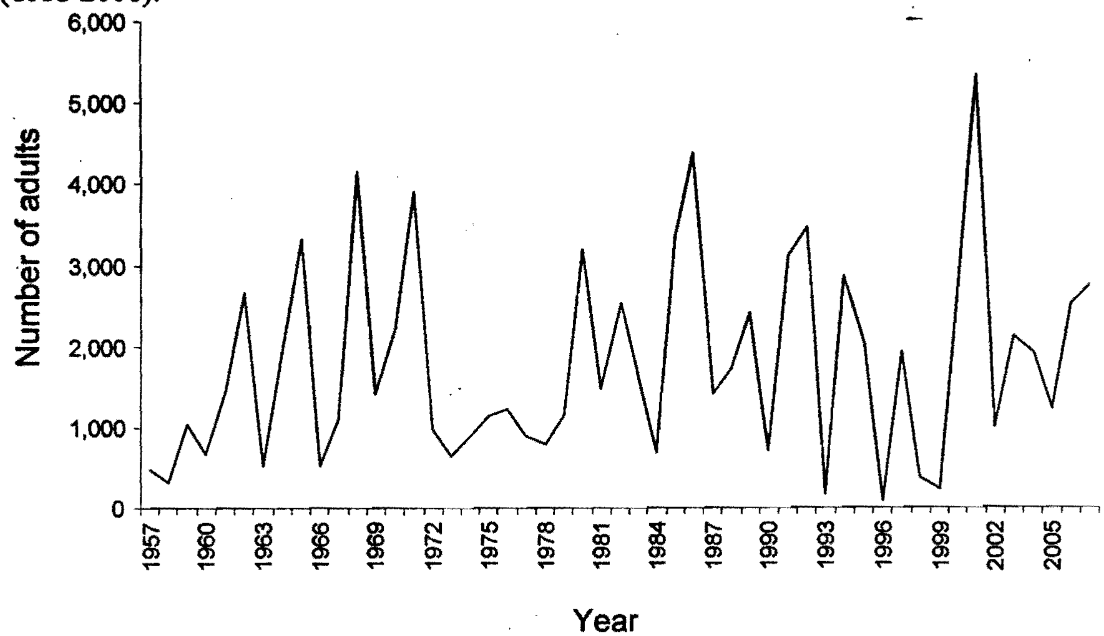


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Table 7. Abundance of wild Clackamas coho, 1957-2006 (Kostow 2007). 2007 data are only through December 31 and are preliminary. The run will not be complete until March 2007 (TAC 2008).

Year	Adult count	Jack count	Total count
1957	484	114	598
1958	309	213	522
1959	1,046	284	1,330
1960	670	1,515	2,185
1961	1,449	740	2,189
1962	2,665	454	3,119
1963	513	1,366	1,879
1964	1,879	597	2,476
1965	3,312	625	3,937
1966	527	250	777
1967	1,096	402	1,498
1968	4,154	542	4,696
1969	1,420	434	1,854
1970	2,220	531	2,751
1971	3,912	183	4,095
1972	978	116	1,094
1973	644	96	740
1974	901	36	937
1975	1,133	56	1,189
1976	1,215	19	1,234
1977	893	49	942
1978	790	57	847
1979	1,138	47	1,185
1980	3,192	50	3,242
1981	1,469	112	1,581
1982	2,543	405	2,948
1983	1,599	78	1,677
1984	683	83	766
1985	3,314	592	3,906
1986	4,373	214	4,587
1987	1,402	318	1,720
1988	1,714	210	1,924
1989	2,413	231	2,644
1990	709	162	871
1991	3,123	317	3,440
1992	3,476	210	3,686
1993	168	31	199
1994	2,873	54	2,927
1995	2,036	69	2,105
1996	88	1	89
1997	1,935	37	1,972
1998	367	15	382
1999	238	61	299
2000	2,833	146	2,979
2001	5,344	184	5,528
2002	998	139	1,137
2003	2,117	194	2,311
2004	1,915	124	2,039
2005	1,168	152	1,320
2006	2,505	176	2,681
2007	2,739	57	2,796

Since almost all Lower Columbia River coho females and most males spawn at 3 years of age, a strong cohort structure is produced. Figure 5 shows returns from the three adult cohorts on the Clackamas. Figure 5 also shows a pattern that is highly variable, but without an obvious or significant trend for the respective cohorts with the possible exception of cohort "C".

Estimates of smolt out migration measured at North Fork Dam on the Clackamas also indicate variable, but generally stable production. There was a recent period in the late1990s where smolt production was reduced followed by higher counts in the first half of this decade (Figure 6).

Tables 8 and 9 provide estimates of long-term and short-term trends and growth rate estimates for Clackamas coho. The long-term trends and growth rate (λ) estimates for the total count at North Fork Dam are slightly positive and the short-term trends and λ are slightly negative (Tables 8 and 9). Both the long-term and short-term trends and λ have relatively high probabilities of being less than one (Tables 10 and 11). However, these metrics were last calculated using data through 2002 and do not account for the observed increases in recent years.

Sandy

The Sandy River population above Marmot Dam is the only other population in the Lower Columbia River coho salmon ESU for which natural production trends can be estimated. The portion of the Sandy River population above Marmot Dam has almost no hatchery-origin spawners, while they dominate the area below the dam (Good et al., 2005). The number of adult coho salmon passing above Marmot Dam is shown in Figure 7 and Table 12.

The long-term and short-term trends for the counts at Marmot Dams are both slightly negative (Tables 8 and 9). The long-term λ is slightly positive and the short-term λ is slightly negative (Tables 8 and 9). However, the confidence intervals on trend and growth rate are large, so there is a great deal of uncertainty. Both the long-term and short-term trends and λ have relatively high probabilities of being less than one (Tables 10 and 11). The abundance trends and growth rate estimates were last calculated using date through 2002 and does not account for the increases observed in recent years. The abundance of Sandy River coho declined substantially through much of the decade of the 1990's. Returns over the last two brood cycles since 2000 have been substantially higher (Figure 7).

Figure 5. Clackamas North Fork Dam counts of adult (3-year-old) coho salmon by cohort, 1957-2002. Cohort A, cohort B and cohort C (TAC 2008).

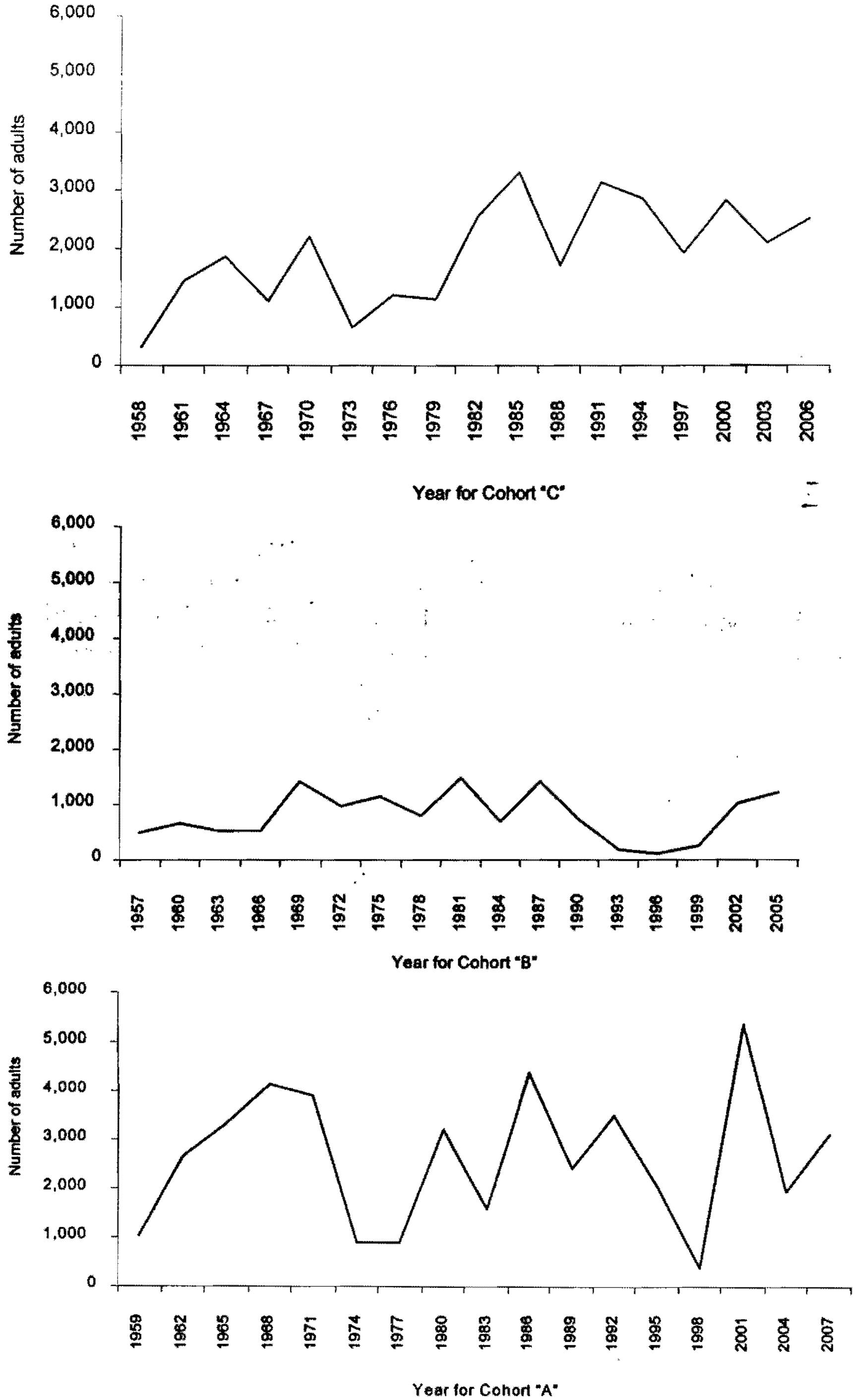


Figure 6. Total outmigrating juvenile coho passing Clackamas North Fork Dam (TAC 2008).

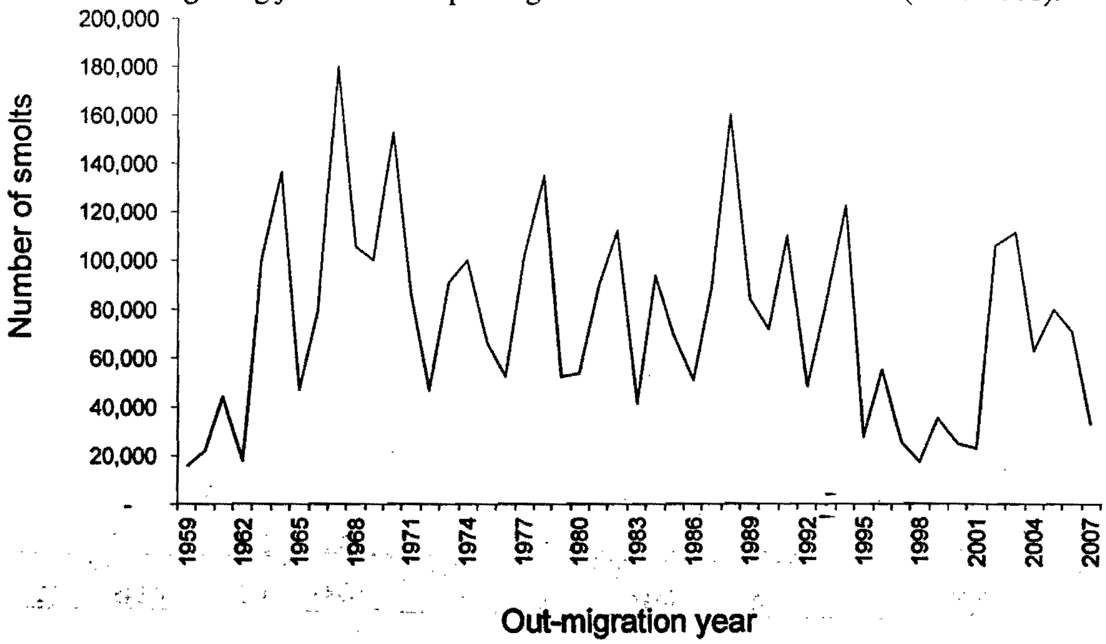


Figure 7. Count of adult coho salmon at the Marmot Dam on the Sandy River. Almost all spawners above Marmot Dam are natural origin (TAC 2008).

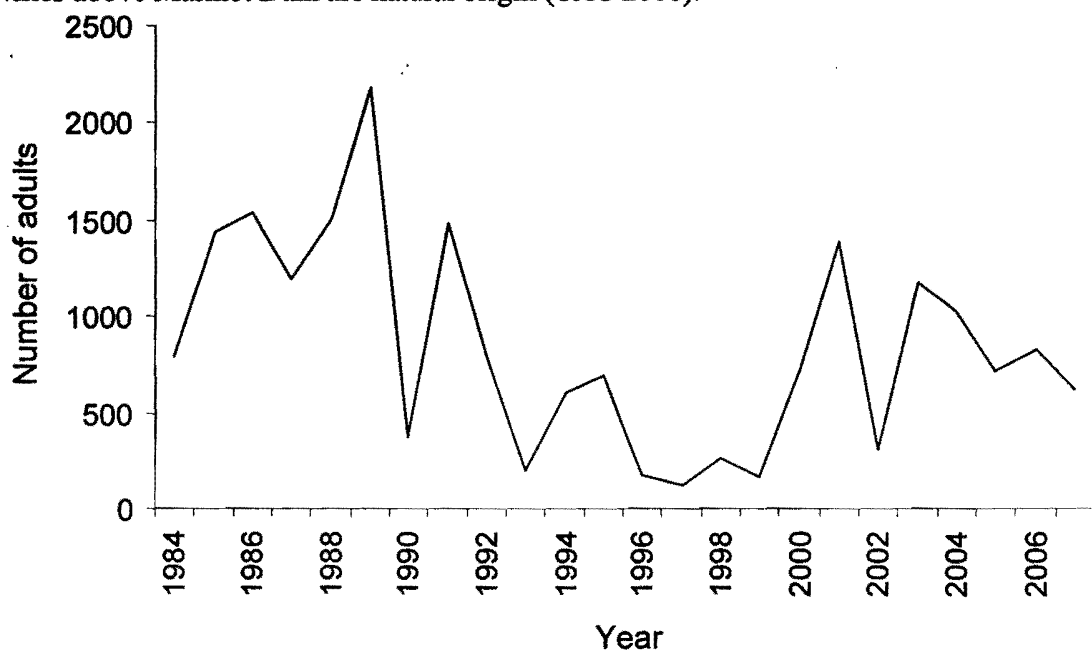


Table 8. Long-term trend and growth rate for subset of Lower Columbia coho salmon populations (95% confidence intervals (C.I.) are in parentheses). For details see Good et

al., 2005. Hatchery = 0 - hatchery fish are assumed to have zero reproductive success; Hatchery = Wild - hatchery fish are assumed to have the same reproductive success as natural-origin fish

Population	Years for Trend	Trend of Total Spawners	Years for λ	Median Growth Rate (λ)	
				Hatchery = 0	Hatchery = Wild
Clackamas (above North Fork Dam)	1957 – 2002	1.009 (0.994 – 1.024)	1973 – 2002	1.028 (0.898 – 1.177)	1.026 (0.897 – 1.174)
Sandy	1977 – 2002	0.997 (0.941 – 1.056)	1977 – 2002	1.012 (0.874 – 1.172)	1.012 (0.874 – 1.172)

Table 9. Short-term trend and growth rate for subset of Lower Columbia coho populations (95% C.I. are in parentheses). For details see Good et al., 2005. Hatchery = 0 - hatchery fish are assumed to have zero reproductive success; Hatchery = Wild - hatchery fish are assumed to have the same reproductive success as natural-origin fish.

Population	Years for Trend	Trend of Total Spawners	Years for λ	Median Growth Rate (λ)	
				Hatchery = 0	Hatchery = Wild
Clackamas (above North Fork Dam)	1990 – 2002	0.949 (0.832 – 1.083)	1990 – 2002	0.975 (0.852 – 1.116)	0.970 (0.848 – 1.110)
Sandy	1990 – 2002	0.964 (0.841 – 1.105)	1977 – 2002	0.979 (0.845 – 1.133)	0.978 (0.845 – 1.132)

Table 10. Probability that the long-term abundance trend or growth rate of Lower Columbia River coho salmon is less than one: Hatchery = 0 - hatchery fish are assumed to have zero reproductive success; Hatchery = Wild - hatchery fish are assumed to have the same reproductive success as natural-origin fish.

Population	Years for Trend	Prob. Trend <1	Years for λ	Prob. λ < 1	
				Hatchery = 0	Hatchery = Wild
Clackamas (above North Fork Dam)	1957 – 2002	0.123	1973 – 2002	0.283	0.296
Sandy	1977 – 2002	0.544	1977 – 2002	0.426	0.427

Table 11. Probability that the short-term abundance trend or growth rate of Lower Columbia River coho salmon is less than one: Hatchery = 0 - hatchery fish are assumed to have zero reproductive success; Hatchery = Wild - hatchery fish are assumed to have the same reproductive success as natural-origin fish.

Population	Years for Trend	Prob. Trend <1	Years for λ	Prob. λ < 1	
				Hatchery = 0	Hatchery = Wild
Clackamas (above North Fork Dam)	1990 – 2002	0.799	1990 – 2002	0.582	0.600
Sandy	1990 – 2002	0.716	1990 – 2002	0.564	0.566

Table 12. Abundance of wild Sandy coho, 1957-2006. No data are available for some years. (TAC 2008).

Year	Adult count	Jack count	Total count
1957			264
1958			330
1959			68
1960			1670
1961			1733
1962			1458
1963			2199
1964			1126
1965			1018
1966	162	67	229
1967	386	283	669
1968	841	440	1281
1969	411	305	716
1970			
1971			
1972			
1973			
1974			
1975			
1976			
1977			283
1978			426
1979			682
1980			635
1981			620
1982	722	20	742
1983	26	34	60
1984	798	8	806
1985	1445	27	1472
1986	1546	48	1594
1987	1205	198	1403
1988	1506	84	1590
1989	2182	113	2295
1990	376	80	456
1991	1491	1	1492
1992	790	55	845
1993	193	27	220
1994	601	47	648
1995	697	19	716
1996	181	0	181
1997	116	0	116
1998	261	0	261
1999	162	19	181
2000	730	12	742
2001	1388	8	1396
2002	310	1	311
2003	1173	26	1199
2004	1025	7	1032
2005	717	28	745
2006	822	13	835
2007	617	0	617

Other Oregon Populations

ODFW initiated an effort in recent years to obtain abundance estimates for more Lower Columbia River coho populations using a random stratified sampling protocol similar to that used to estimate abundance of Oregon coastal coho salmon. Results from this survey are presented in Table 13. Information related to the proportion of these fish that are hatchery origin is limited or unavailable. Estimates of percent hatchery in 2002 for the Scappoose, Clatskanie, Upper Gorge tributaries, and Youngs Bay and Big Creek are 0%, 60%, 65%, and 91%, respectively. These surveys suggest that hatchery-origin spawners dominate Oregon Lower Columbia River ESU coho populations, but there are some potential pockets of natural production.

Prior to the more recent intensive surveys, ODFW conducted coho salmon spawner surveys in the lower Columbia River. These surveys were combined to obtain spawners-per-mile information at the scale of the population units (Figures 8-11). In many years over the last two decades, these surveys have reported no natural-origin coho salmon spawners. Based on the spawners-per-mile survey data, previous assessments have concluded that coho salmon in these populations are extinct or nearly so (ODFW 1999, NMFS 2001e, Good et. al., 2005). The estimates of a few hundred spawners in each of the Oregon-side populations in the recent years is encouraging and suggests that these areas have been recolonized or that prior spawning surveys were less intense and missing fish that may have nonetheless been present.

Table 13. Recent abundance of wild coho in other Oregon population areas (TAC 2008).

Year	Astoria Area		Clatskanie	Scappoose[1]	Gorge and Hood	
	Youngs Bay	Big Creek[1]			Lower Gorge	Hood[1]
1999	0		0	23	22	
2000	285		66	55	19	
2001	171		131	375	40	
2002	364	125	520	453	338	147
2003	45	190	357	317	NA	41
2004	128	124	758	719	NA	126
2005	77	240	348	336	263	1,262
2006	NA	252	747	689	226	373
2007	NA	216	357	333	NA	352

[1] Counts in Big Creek, Scappoose and Hood are a combination of weir/dam counts and spawning ground counts. Dam counts at the weirs/dams are of unmarked fish; spawning ground counts are wild fish based on mark and scale data.

Figure 8. Youngs Bay coho salmon spawners per mile, 1949–2001 (Good et al., 2005).

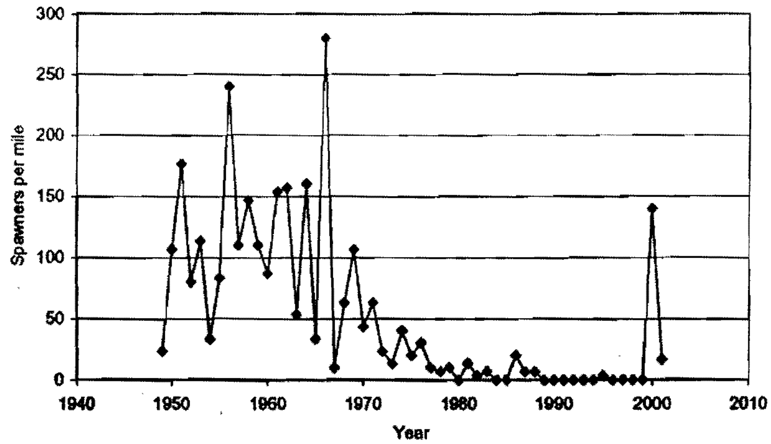


Figure 9. Big Creek coho salmon spawners per mile, 1949–2001 (Good et al., 2005).

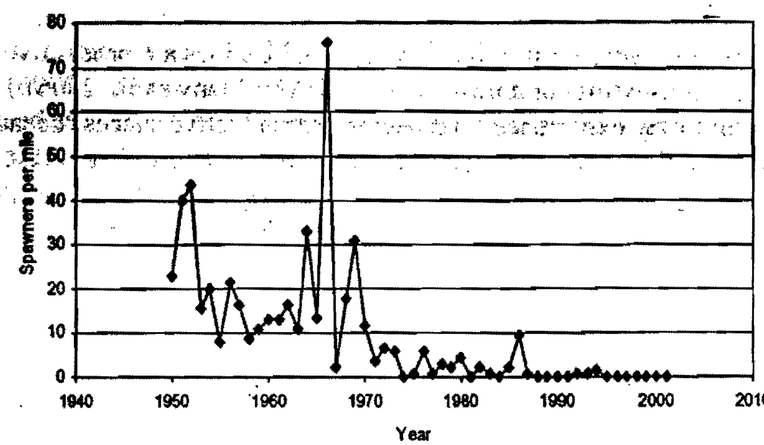


Figure 10. Clatskanie River coho salmon spawners per mile, 1949–2001 (Good et al., 2005).

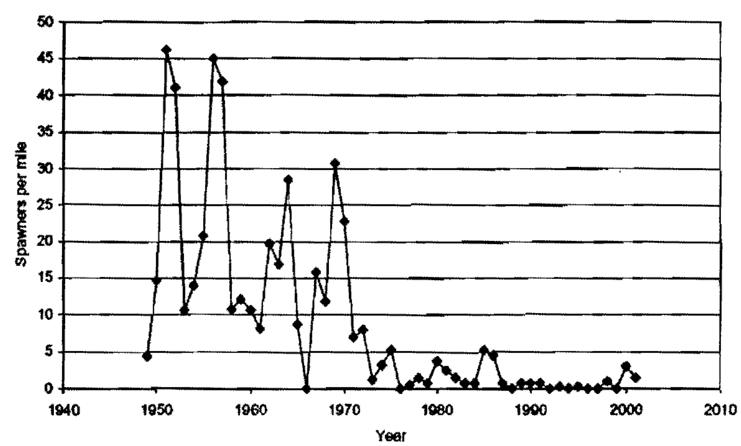
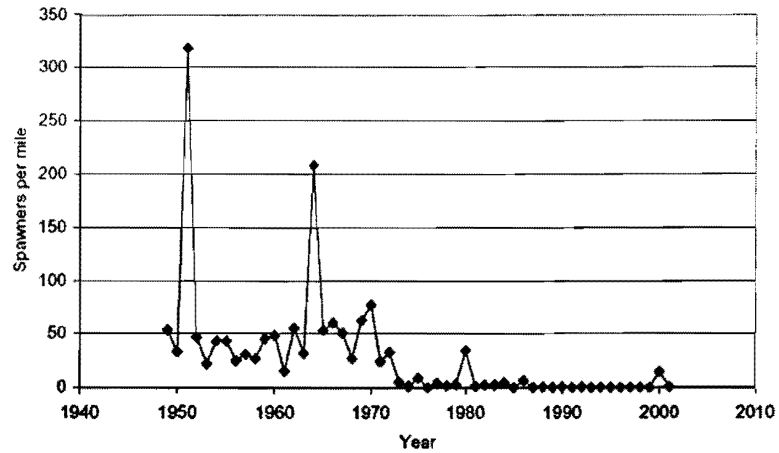


Figure 11. Scappoose River spawners per mile, 1949–2001 (Good et al., 2005).



Abundance estimates for the Oregon population of the Lower Columbia River coho ESU can be compared to available abundance criteria. The WLC TRT defines a reproductive failure threshold (RFT) and quasi-extinction threshold (QET) (McElhany et al., 2006). At very low abundance, populations may experience a decrease in reproductive success because of factors such as the inability to efficiently find mates, random demographic effects (the variation in individual reproduction become important), changes in predator-prey interactions, and other "Allee" effects. The reproductive failure threshold (RFT) is used to define an abundance below which no recruitment is assumed to occur.

Ecological and demographic risk processes not captured in the simple recruitment function model are likely to come into play at abundances below the QET. An extinction event is more than a single year reproductive failure and the WLC TRT has set QET as a threshold abundance averaged over a population's mean generation time. Like the RFT, processes that affect QET are likely to be a function of both absolute abundance and of how the population is spread out on the landscape. The WLC TRT set QET and RFT levels using population size categories. For small, medium and large coho populations, RFT and QET levels are both set at 100, 200, and 300 respectively.

The Interim Regional Lower Columbia Salmon Recovery Plan provides preliminary estimates of minimum abundance levels associated with viable status (LCFRB 2004). Table 14 lists the RFT/QET and viability abundance levels for Oregon population of the Lower Columbia River coho salmon ESU.

Table 14. RFT/QET and Minimum Viability Abundance Thresholds for Oregon population of the Lower Columbia River coho salmon ESU.

Population	RFT/QET McElhany et al.(2006)	Minimum Viability Abundance LCFRB (2004)
Clackamas	200	600
Sandy	300	600
Astoria Area		
Big Creek	100	600
Youngs Bay	100	600
Clatskanie	200	600
Scapoose	200	600
Lower Gorge Tributaries	100	600
Hood River	200	600

In recent years at least, all the Oregon populations have been above the RFT/QET levels. The Clackamas has been well above the minimum viability abundance level; the Sandy has been above the viability abundance level at least in recent years.

The WLC TRT and ODFW recently reviewed the status of the Oregon population of the Lower Columbia River coho salmon ESU (McElhany et al., 2006). They evaluated information related to measures of abundance, productivity, spatial structure and diversity criteria. The methods used are discussed in the draft report in some detail (McElhany et al., 2006). The report provides an overall summary of population status for the Oregon population of the Lower Columbia River coho salmon ESU (Figure 12). The results generally indicate that many of the populations are currently at high risk with none being in a desirable low risk status.

Washington Populations

Hatchery production also dominates the Washington side of this ESU, and no populations are known to be naturally self-sustaining, with the majority of spawners believed to be hatchery strays. There are no estimates of spawner abundance for Washington Lower Columbia River coho salmon ESU populations. However, WDFW began trapping outmigrating juvenile coho several years ago, and these data indicate that natural production is occurring in several areas (Table 15).

There is no direct way to determine whether these populations would be naturally self-sustaining in the absence of hatchery-origin spawners. WDFW suggests that juvenile outmigrant production seen in the monitored streams is typical of other Washington Lower Columbia River ESU streams and that a substantial number of natural-origin spawners may return to the lower Columbia River each year, but are not observed because there is no monitoring for coho spawners on the Washington side.

Figure 12. Overall summary of population status for Oregon Lower Columbia River coho populations.

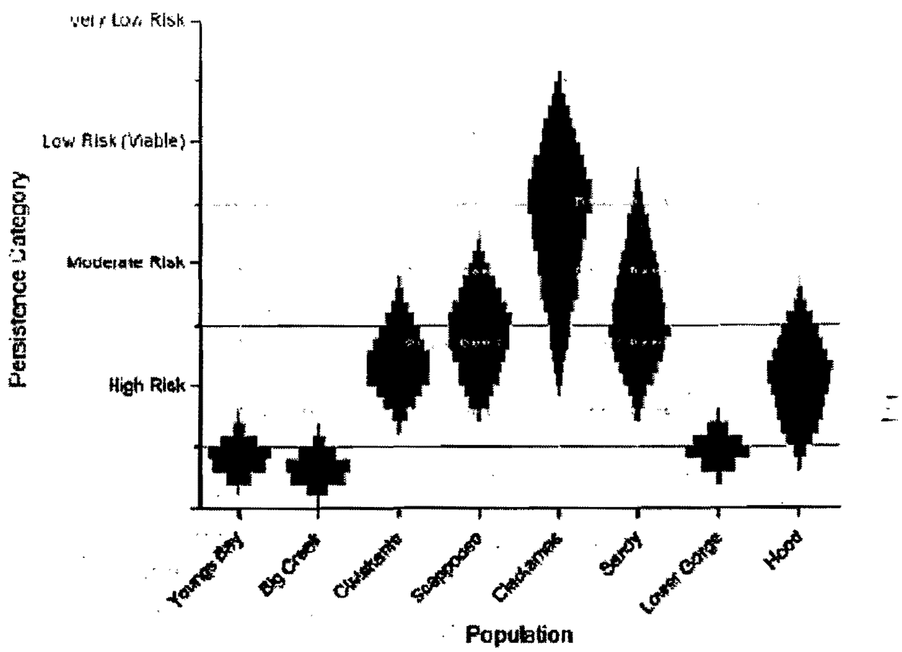


Table 15. Estimates of natural coho salmon juvenile outmigrants from Washington Lower Columbia River streams (TAC 2008).

Out-migrant Year	Cedar Creek	Mill Creek	Abernathy Creek	Germany Creek	East Fork Lewis River	Cowlitz Falls Dam	Mayfield Dam
1997						3,700	700
1998	38,400					110,000	16,700
1999	28,000					15,100	9,700
2000	20,300				4,514-9,028	106,900	23,500
2001	24,200	6,300	6,500	8,200		334,700	82,200
2002	35,000	8,200	5,400	4,300		166,800	11,900
2003	36,700	10,500	9,600	6,200		403,600	38,900
2004	37,000	5,700	6,400	5,100		396,200	36,100
2005	58,300					766,100	40,900
2006	46,000	6,700	4,400	2,300		370,000	33,600
2007	29,300	7,000	3,300	2,300		277,400	34,200

Estimates are based on expansions from smolt traps, not total census. Cedar Creek is a tributary of the North Fork Lewis River population. Mill, Germany and Abernathy Creeks are combined into a single population unit for TRT analysis. The Cowlitz River above Cowlitz Falls is partitioned into three independent populations (Upper Cowlitz, Cispus, and Tilton Rivers). The East Fork Lewis River estimate shows a range based on uncertainties about trap efficiency.

The Washington Department of Fish and Wildlife used the estimates of smolt production from monitored streams to estimate the total smolt production from the Washington portion of the Lower Columbia River coho salmon ESU in 2007. The estimate of total natural-origin smolt production in 2007 was 476,100 (Volkhardt et al., 2008).

Table 16. Estimated smolt production from streams with hatcheries, streams without hatcheries, minimum abundance from monitored streams, and predicted smolt abundance for the Washington-side of the Lower Columbia River ESU (Volkhardt et al., 2008).

Node	Smolt Abundance			Smolt Density (smolts/sq. mile)		
	5.00%	Median	95.00%	5.00%	Median	95.00%
Unmonitored H_streams	193,700	200,100	206,800	233	241	249
Unmonitored W_streams	79,460	82,520	85,810	128	133	138
Monitored Streams	191,200	193,400	195,800			
Natural-origin Smolt Prediction	467,900	476,100	484,900			

These smolt production estimates, in combination with estimates of marine survival, were used to develop estimates of adult returns of natural-origin Lower Columbia River coho of 9,500 to the Washington side of the ESU (PFMC 2008c). This was combined with estimates of 3,900 natural-origin Lower Columbia River coho to the Oregon side of the ESU, for a total of 13,400 natural-origin adults returning in 2008 (PFMC 2008c).

This natural-origin production includes a mix of fish from streams that have a substantial amount of hatchery-origin strays and others where hatchery straying is believed to be relatively limited. Information gathered over the last several years suggests there is more coho production on both the Washington and Oregon-side streams than previously believed and that coho production in the ESU is not limited to that which occurs in the Clackamas and Sandy rivers

The populations above Cowlitz Falls on the Cowlitz River (Upper Cowlitz, Cispus, and Tilton Rivers) are also suitable for natural coho production (Table 15). However, these populations are not currently considered self-sustaining. Three dams block anadromous passage to the upper Cowlitz River. Currently, adult coho salmon (some of hatchery origin) are collected below the lower dam (Mayfield Dam) and trucked to the area above the upper dam (Cowlitz Falls Dam). There is no appreciable downstream passage through the dams, so juvenile outmigrants are collected at Cowlitz Falls Dam and trucked below Mayfield Dam. At this time, collection efficiency of outmigrating juveniles at Cowlitz Falls is so low (40–60%) that the spawners cannot replace themselves (i.e., fewer adult coho salmon return from the relatively low number of outmigrants that are released below Mayfield Dam than are planted above Cowlitz Falls Dam). Thus, hatchery production (in addition to the trap-and-haul operation) maintains the populations.

Preliminary viability and recovery goals have been established by WLC TRT (2004) and Lower Columbia Fish Recovery Board (LCRFB) and are presented in Table 5. The methodology for establishing recovery goals is described in LCFRB (2004). It should be noted that the viability goal assumes no hatchery fish presence, and average ocean conditions. Due to resource constraints, the recovery goals for coho salmon made assumptions that the distribution of coho and steelhead spawning was the same, which under-estimates the actual coho salmon distribution. WDFW and LCFRB are currently developing more specific information to be included in the recovery plan for the Lower Columbia River coho. The coho viability goals for abundance therefore should be considered preliminary.

Current Rangewide Status of Critical Habitat

NMFS has not yet designated critical habitat for this ESU.

2.1.2 Lower Columbia River Chinook

Lower Columbia River Chinook display three life history types including early fall runs ("tules"), late fall run ("brights") and spring-runs (Table 17). Both spring and fall runs have been designated as part of a Lower Columbia River Chinook ESU that includes Oregon and Washington populations in tributaries from the ocean to and including the Big White Salmon River in Washington and Hood River in Oregon. Fall Chinook salmon historically were found throughout the entire range, while spring Chinook salmon historically were only found in the upper portions of basins with snowmelt driven flow regimes (western Cascade Crest and Columbia Gorge tributaries). Late fall Chinook salmon were identified in only two basins in the western Cascade Crest tributaries. In general, late fall Chinook salmon also matured at an older average age than either lower Columbia River spring or fall Chinook salmon, and had a more northerly oceanic distribution. Currently, the abundance of fall Chinook greatly exceeds that of the spring component.

Table 17. Life history and population characteristics of Lower Columbia River Chinook salmon originating in Washington portions of the lower Columbia River.

Characteristic	Racial Features		
	Spring	**Tule fall**	**Late fall bright**
Number of extant populations	7 (including 4 that are possibly extinct)	13	1
Life history type	Stream	Ocean	Ocean
River entry timing	March – June	August – September	August – October
Spawn timing	August – September	September – November	November – January
Spawning habitat type	Headwater large tributaries	Mainstem large tributaries	Mainstem large tributaries
Emergence timing	December – January	January – April	March – May
Duration in freshwater	Usually 12-14 months	1-4 months, a few up to 12 months	1-4 months, a few up to 12 months
Rearing habitat	Tributaries and mainstem	Mainstem, tributaries, sloughs, estuary	Mainstem, tributaries, sloughs, estuary
Estuarine use	A few days to weeks	Several weeks up to several months	Several weeks up to several months
Ocean migration	As far north as Alaska	As far north as Alaska	As far north as Alaska
Age at return	4-5 years	3-5 years	3-5 years
Estimated historical spawners	125,000	140,000	19,000
Recent natural spawners	800	6,500	9,000
Recent hatchery adults	12,600 (1990-2000)	37,000 (1991-1995)	NA

Lower Columbia River Chinook salmon is composed of 32 historical populations. The populations are distributed through three ecological zones. The combination of life history types based on run timing, and ecological zones result in six major population groups (MPG, referred to as strata by the WLC TRT) (Table 18). There are 23 fall and late fall populations, and nine spring populations, some of which existed historically but are now extinct. Also included in the ESU are 17 hatchery programs. Excluded from the ESU are Carson spring Chinook, and introduced bright fall Chinook occurring in the Wind and (Big) White Salmon rivers as well as spring Chinook released at terminal fishery areas in Youngs Bay, Blind Slough, and Deep River and in the mainstem Columbia. Populations of spring Chinook in the Willamette, including the Clackamas, are also in a separate ESU.

The LCFRB Recovery Plan described a recovery scenario for Lower Columbia River Chinook. They identified each population's role in recovery as a primary, contributing, or stabilizing populations which generally refer to a desired viability level. The Recovery Plan also suggested viable abundance goals for each population (Table 19).

Steel and Sheer (2003) analyzed the number of stream kilometers historically and currently available to salmon populations in the lower Columbia River (Table 20). Stream kilometers usable by salmon are determined based on simple gradient cutoffs and on the presence of impassable barriers. This approach overestimates the number of usable stream kilometers, because it does not account for aspects of habitat quality other than gradient. However, the analysis does indicate that the number of kilometers of stream habitat currently accessible is greatly reduced from the historical condition for some populations. Hydroelectric projects in the Cowlitz, North Fork Lewis, and White Salmon Rivers have greatly reduced or eliminated access to upstream production areas and therefore extirpated some of the affected populations.

Table 18. Chinook salmon ESU description and major population groups (MPGs) (Sources: NMFS 2005e; Myers et al. 2006). The designations "(C)" and "(G)" identify Core and Genetic Legacy populations, respectively (Appendix B in McElhany et al. 2003).[1]

ESU Description	
Threatened	**Listed under ESA in 1999; reaffirmed in 2005**
6 major population groups	32 historical populations
Major Population Group	**Population**
Cascade Spring	Upper Cowlitz (C,G), Cispus (C), Tilton, Toutle, Kalama, Lewis (C), Sandy (C,G)
Gorge Spring	(Big) White Salmon (C), Hood
Coastal Fall	Grays, Elochoman (C), Mill Creek, Youngs Bay, Big Creek (C), Clatskanie, Scappoose
Cascade Fall	Lower Cowlitz (C), Upper Cowlitz, Toutle (C), Coweeman (G), Kalama, Lewis (G), Salmon Creek, Washougal, Clackamas (C), Sandy
Cascade Late Fall	Lewis (C,G), Sandy (C,G)
Gorge Fall	Lower Gorge, Upper Gorge (C,G), (Big) White Salmon (C,G), Hood
Hatchery programs included in ESU (17)	Sea Resources Tule Chinook, Big Creek Tule Chinook, Astoria High School (STEP) Tule Chinook, Warrenton High School (STEP) Tule Chinook, Elochoman River Tule Chinook, Cowlitz Tule Chinook Program, North Fork Toutle Tule Chinook, Kalama Tule Chinook, Washougal River Tule Chinook, Spring Creek NFH Tule Chinook, Cowlitz spring Chinook (2 programs), Friends of Cowlitz spring Chinook, Kalama River spring Chinook, Lewis River spring Chinook, Fish First spring Chinook, Sandy River Hatchery (ODFW stock #11)

1 Core populations are defined as those that, historically, represented a substantial portion of the species abundance. Genetic legacy populations are defined as those that have had minimal influence from nonendemic fish due to artificial propagation activities, or may exhibit important life history characteristics that are no longer found throughout the ESU (McElhany et al. 2003).

Table 19. The ecological zones and populations for the Lower Columbia River Chinook salmon ESU (LCFRB 2004). Primary populations identified for greater than high viability objectives are denoted with an '*'. Recent averages are compiled from Tables 19, 20, and 21. Percent wild indicated if available.

Population/Strata	Status /Goal[1]	Abundance Range		Recent 5 Year Average	
		Viable	Potential	Spawners	% wild
GORGE SPRING					
White Salmon (WA)	C	1,400	2,800	5,237	19
Hood (OR)	P	1,400	2,800		
CASCADE SPRING					
Upper Cowlitz (WA)	P*	2,800	8,100	10,500	NA
Cispus (WA)	P*	1,400	2,300		
Tilton (WA)	S	1,400	2,800		
Toutle (WA)	C	1,400	3,400		
Kalama (WA)	P	1,400	1,400		
NF Lewis (WA)	P	2,200	3,900		
Sandy (OR)	P	2,600	5,200		
CASCADE LATE FALL					
NF Lewis (WA)	P*	6,500	16,600		
Sandy (OR)	P	5,100	10,200		
COAST FALL (Tule)					
Grays/Chinook (WA)	P	1,400	1,400	336	78
Eloch/Skam (WA)	P	1,400	4,500	4,751	31
Mill/Aber/Germ (WA)	C	2,000	3,200	4,063	23
Youngs Bay (OR)	S	1,400	2,800		
Big Creek (OR)	S	1,400	2,800		
Clatskanie (OR)	P	1,400	2,800	179	43
Scapoose (OR)	S	1,400	2,800		
CASCADE FALL (Tule)					
Lower Cowlitz (WA)	C	3,900	33,200		
Upper Cowlitz (WA)	S	1,400	10,800		
Toutle (WA)	S	1,400	14,100		
Coweeman (WA)	P*	3,000	4,100	1,128	82
Kalama (WA)	P	1,300	3,200	12,680	7
EF Lewis/Salmon (WA)	P*	1,900	3,900	597	75
Washougal (WA)	P	5,800	5,800	5,334	39
Clackamas (OR)	C	1,400	2,800		
Sandy (OR)	S	1,400	2,800		
GORGE FALL (Tule)					
Lower Gorge (WA)	C	1,400	2,800		
Upper Gorge (WA)	S	1,400	2,400		
White Salmon (WA)	C	1,600	3,200		
Hood (OR)	S	1,400	2,800		

[1] **Primary populations** are those that would be restored to high or "high+" viability. At least two populations per strata must be at high or better viability to meet recommended TRT criteria. Primary populations typically, but not always, include those of high significance and medium viability. In several instances, populations with low or very low current viability were designated as primary populations in order to achieve viable strata and ESU conditions. In addition, where factors suggest that a greater than high viability level can be achieved, populations have been designated as High+. High+ indicates that the population is targeted to reach a viability level between High and Very High levels as defined by the TRT. **Contributing populations** are those for which some restoration will be needed to achieve a stratum-wide average of medium viability. Contributing populations might include those of low to medium significance and viability where improvements can be expected to contribute to recovery. **Stabilizing populations** are those that would be maintained at current levels (likely to be low viability). Stabilizing populations might include those where significance is low, feasibility is low, and uncertainty is high.

Table 20. Current and historically available habitat located below barriers in the Lower Columbia River Chinook salmon ESU.

Population/Strata	Potential Current Habitat (km)	Potential Historical Habitat (km)	Current/ Historical Habitat Ratio (%)
GORGE SPRING			
White Salmon (WA)	0	232	0
Hood (OR)	150	150	99
CASCADE SPRING			
Upper Cowlitz (WA)	4	276	1
Cispus (WA)	0	76	0
Tilton (WA)	0	93	0
Toutle (WA)	217	313	69
Kalama (WA)	78	83	94
Lewis (WA)	87	365	24
Sandy (OR)	167	218	77
CASCADE LATE FALL			
NF Lewis (WA)	87	166	52
Sandy (OR)	217	225	96
COAST FALL (Tule)			
Grays/Chinook (WA)	133	133	100
Eloch/Skam (WA)	85	116	74
Mill/Aber/Germ (WA)	117	123	96
Youngs Bay (OR)	178	195	91
Big Creek (OR)	92	129	71
Clatskamie (OR)	159	159	100
Scapoose (OR)	122	157	78
CASCADE FALL (Tule)			
Lower Cowlitz (WA)	418	919	45
Upper Cowlitz (WA)	-	-	-
Toutle (WA)	217	313	69
Coweeman (WA)	61	71	86
Kalama (WA)	78	83	94
Lewis/Salmon (WA)	438	598	73
Washougal (WA)	84	164	51
Clackamas (OR)	568	613	93
Sandy (OR)	227	286	79
GORGE FALL (Tule)			
Lower Gorge (WA)	34	35	99
Upper Gorge (WA)	23	27	84
White Salmon (WA)	0	71	0
Hood (OR)	35	35	100

The information in Table 21 was reported in NMFS' most recent status review (Good et al. 2005). Draft status assessments were updated for Oregon populations in a more recent review (McElhany et al. 2007). Some of the natural runs (e.g., the Youngs Bay, Kalama River and Upper and Lower Gorge fall runs, and all of the spring run populations) have been replaced largely by hatchery production. Quantitative data is not available for about half of the populations.

The majority of populations for which data is available have a long-term trend of less than 1, indicating the population is in decline. In addition, for most populations there is a high probability that the true trend/growth rate is less than 1 (Table 16 in Good et al. 2005). Assuming that the reproductive success of hatchery-origin fish has been equal to that of natural-origin fish, the analysis indicates a negative long-term growth rate for all of the populations except the Coweeman River fall run, which has had very few hatchery-origin spawners. The North Fork Lewis River late fall population is considered the healthiest and is significantly larger than any other natural-origin population in the ESU.

The data used for the analysis shown in Table 21 is current only through 2001 for Washington populations and 2004 for Oregon populations. More recent estimates of escapement along with available data for the time series are shown in the following tables.

The return of spring Chinook to the Cowlitz, Kalama, Lewis, and Sandy river populations have all numbered in the thousands in recent years (Table 22). The Cowlitz and Lewis populations on the Washington side are managed for hatchery production since most of the historical spawning habitat is inaccessible due to hydro development in the upper basin. A supplementation program is now being developed on the Cowlitz that involves trap and haul of adults and juveniles. A supplementation program is also being developed on the Kalama with fish being passed above the ladder at Kalama Falls. Historically, the Kalama was a relatively small system compared to the other three (Table 22). A supplementation program is also being developed for the Lewis River, but population is still dependent on hatchery production. These systems have all met their respective hatchery escapement goals in recent years, and are expected to do so again in 2008. The existence of the hatchery programs mitigates the risk to these populations. The Cowlitz and Lewis populations would be extinct but for the hatchery programs.

The Sandy River is managed with an integrated hatchery supplementation program that incorporates natural-origin brood stock. There is some spawning in the lower river, but the area above Marmot Dam is preserved for natural-origin production. The return of natural-origin fish to Marmot Dam has averaged almost 1,700 since 2000. This not account for the additional spawning of natural-origin fish below the dam. The tentative viable abundance goal for Sandy River spring Chinook is 2,600, although the goal is subject to reconsideration through Oregon's ongoing recovery planning process. The total return of spring Chinook to the Sandy including hatchery fish has averaged more than 6,000 since 2000 (Table 22).

Table 21. Abundance, productivity, and trends of Lower Columbia River Chinook salmon populations (sources: Good et al. 2005 for Washington and McElhany et al. 2007 for Oregon populations).

	Strata	Population	State	Recent Abundance of Natural Spawners			Long-term Trend[b]		Median Growth Rate[c]	
				Years	Geo Mean	pHOS[a]	Years	Value	Years	λ
Spring	Cascade	Cowlitz	W	na	na	na	80-01	0.994	na	na
		Cispus	W	2001	1,787	na	na	na	na	na
		Tilton	W	na	na	na	na	na	na	na
		Toutle	W	na	na	na	na	na	na	na
		Kalama	W	97-01	98	na	80-01	0.945	na	na
		NF Lewis	W	97-01	347	na	80-01	0.935	na	na
		Sandy	O	90-04	959	52%	90-04	1.047	90-04	0.834
	Gorge	(Big) White Salmon	W	na	na	na	na	na	na	na
		Hood	O	94-98	51	na	na	na	na	na
Fall	Coastal	Grays	W	97-01	59	38%	64-01	0.965	80-01	0.844
		Elochoman	W	97-01	186	68%	64-01	1.019	80-01	0.800
		Mill	W	97-01	362	47%	80-01	0.965	80-01	0.829
		Youngs Bay	O	na	na	na	na	na	na	na
		Big Creek	O	na	na	na	na	na	na	na
		Clatskanie	O	90-04	41	15%	90-04	1.077	90-04	1.152
		Scappoose	O	na	na	na	na	na	na	na
	Cascade	Lower Cowlitz	W	96-01	463	62%	64-00	0.951	80-01	0.682
		Upper Cowlitz	W	na	na	na	na	na	na	na
		Toutle	W	na	na	na	na	na	na	na
		Coweeman	W	97-01	274	0%	64-01	1.046	80-01	1.091
		Kalama	W	97-01	655	67%	64-01	0.994	80-01	0.818
		Lewis	W	97-01	256	0%	80-01	0.981	80-01	0.979
		Salmon	W	na	na	na	na	na	na	na
		Washougal	W	97-01	1,130	58%	64-01	1.088	80-01	0.815
		Clackamas	O	98-01	40	na	67-01	0.937	na	na
		Sandy	O	97-01	183	na	na	na	na	na
	Gorge	Lower Gorge	W/O	na	na	na	na	na	na	na
		Upper Gorge	W/O	97-01	109	13%	64-01	0.935	80-01	0.955
		(Big) White Salmon	W	97-01	218	21%	67-01	0.941	80-01	0.945
		Hood River	O	00-04	36	na	na	na	na	na
Late Fall	Cascade	NF Lewis	W	97-01	6,818	13%	64-01	0.992	80-01	0.948
		Sandy	O	90-04	2,771	5%	81-04	0.983	81-04	0.997

[a] Average recent proportion of hatchery-origin spawners. Hatchery-origin fish are the offspring of fish that were spawned in a hatchery. Gomeans are calculated for total spawners where hatchery fractions are unavailable.
[b] Long-term trend of total (hatchery- and natural-origin) spawners (regression of log-transformed spawner indices against time).
[c] Long-term median population growth rate after accounting for hatchery spawners (equal spawning success assumption).
Note: time series represent available information and therefore may not correspond to reference periods identified in this biological opinion's evaluations for other species.

Table 22. Total annual escapement of Lower Columbia River spring Chinook populations (TAC 2008).

Year or Average	Cowlitz River [a]	Kalama River	Lewis River [a]	Sandy River (Total)	Sandy River (natural-origin fish at Marmot Dam)[b]
1971-1975	11,900	1,100	200	-	
1976-1980	19,680	2,020	2,980	975	
1981-1985	19,960	3,740	4,220	1,940	
1986-1990	10,691	1,877	11,340	2,425	
1991-1995	6,801	1,976	5,870	5,088	
1996	1,787	627	1,730	3,997	
1997	1,877	505	2,196	4,625	
1998	1,055	407	1,611	3,768	
1999	2,069	977	1,753	3,985	
2000	2,199	1,418	2,515	3,641	1,984
2001	1,649	1,784	3,777	5,329	2,445
2002	5,019	2,883	3,554	5,903	1,275
2003	15,890	4,528	5,104	5,600	1,151
2004	16,712	4,573	11,090	12,675	2,698
2005	9,200	3,100	3,400	7,475	1,808
2006	7,000	5,600	7,500	4,812	1,381
2007	3,700	7,300	6,700	3,400	790

[a] Includes hatchery escapements, tributary recreational catch, and natural spawning escapement for 1975 to present. The years 1071-73 are based on using he 1975-76 Cowlitz River recreational fishery adult harvest rate
[b] TAC (2008)

There are two bright Chinook populations in the Lower Columbia River Chinook ESU in the Sandy and North Fork Lewis rivers. The Sandy population is currently less robust. The escapement of natural-origin fish has been variable, but without apparent trend since 1993 and averaged about 750 since 2002 (Table 23). The viable abundance goal is 5,100 from the LCFRB Recovery Plan, but this is likely high and something that is being reviewed as Oregon proceeds with its recovery planning process. The North Fork Lewis population is the principal indicator stock. It is a natural-origin population with little or no hatchery influence. The maximum sustained yield escapement goal is 5,700. The viable abundance goal is 6,500. The escapement in the North Fork Lewis was below the escapement goal in 2007. This is consistent with a pattern of low escapements for other far north migrating bright populations including Oregon coastal stocks and upriver brights that return to the Hanford Reach area. This pattern of low escapements for a diverse range of stocks suggests that they were all affected by poor ocean conditions. Escapement to the North Fork Lewis is expected to be below goal again in 2008 (PFMC 2008b).

Table 23. Annual escapement of Lower Columbia River bright fall Chinook populations (TAC 2008).

Year	Sandy River	North Fork Lewis
1993	1,314	6,429
1994	941	8,439
1995	1,036	9,718
1996	505	12,700
1997	2,001	8,168
1998	773	5,167
1999	447	2,639
2000	84	8,727
2001	824	11,272
2002	1,275	13,284
2003	619	13,433
2004	601	14,165
2005	770	10,197
2006	1,130	10,522
2007	171	3,130

Table 24 provides escapement information for several of the tule populations including estimates of the proportion of spawners that are natural origin. The Coweeman, Grays, and East Fork Lewis populations are subject to less hatchery straying. The Cowlitz, Kalama, Washougal, Elochoman, and Mill/Abernathy/Germany populations are more strongly influenced by hatchery fish because of in-basin hatchery programs or their close proximity to such programs. The natural-origin populations are generally below their viability abundance goals. The populations that are more strongly influenced by hatchery origin fish are generally at or above their viability goals, but only because of the contribution of hatchery fish.

The LCFRB Recovery Plan provides an overview of the status of populations in the ESU based on TRT recommendations for assessing viability. The risk of extinction category integrates abundance and other viability criteria (Table 25). The Recovery Plan also characterizes population status relative to persistence (which combines the abundance and productivity criteria), spatial structure, and diversity, and also habitat characteristics (Table 26). This overview for tule populations suggests that risk related to abundance and productivity are higher than those for spatial structure and diversity. Lower scores indicate higher risk. The scores for persistence for most populations range between 1.5 and 2.0. The scores for spatial structure generally range between 3 and 4, and for diversity between 2 and 3, respectively.

Table 24. Annual escapement of Lower Columbia River tule Chinook **populations**

	Coweeman		Grays		Lewis		Cowlitz		Kalama		Washougal		Elochoman		Ge/Ab/Mi	
Year	#	% wild	#	% wild	#	% wild	#	% wild	#	% wild	#	% wild	#	% wild	#	% wild
1977	337	1.00	1,009	0.65	1,086		5,837	0.26	6,549	0.50	1,652	0.46	568			
1978	243	1.00	1,806	0.65	1,448		3,192	0.26	3,711	0.50	593	0.46	1,846			
1979	344	1.00	344	0.65	1,304		8,253	0.26	2,731	0.50	2,388	0.46	1,478			
1980	180	1.00	125	0.65	899	1.00	1,793	0.26	5,850	0.50	3,437	0.46	64	0.42	516	0.49
1981	116	1.00	208	0.65	799	1.00	3,213	0.26	1,917	0.50	1,841	0.46	138	0.42	1,367	0.48
1982	149	1.00	272	0.65	646	1.00	2,100	0.26	4,595	0.50	330	0.46	340	0.42	2,750	0.50
1983	122	1.00	825	0.65	598	1.00	2,463	0.26	2,722	0.50	2,677	0.46	1,016	0.42	3,725	0.51
1984	683	1.00	252	0.65	340	1.00	1,737	0.26	3,043	0.50	1,217	0.46	294	0.42	614	0.52
1985	491	0.95	532	0.65	1,029	1.00	3,200	0.26	1,259	0.50	1,983	0.46	464	0.42	1,815	0.53
1986	396	1.00	370	0.65	696	1.00	2,474	0.26	2,601	0.50	1,589	0.46	918	0.42	980	0.49
1987	386	1.00	555	0.65	256	1.00	4,260	0.26	9,651	0.50	3,625	0.46	2,458	0.42	6,168	0.59
1988	1,890	1.00	680	0.65	744	1.00	5,327	0.26	24,549	0.50	3,328	0.46	1,370	0.42	3,133	0.69
1989	2,549	1.00	516	0.65	972	0.78	4,917	0.26	20,495	0.50	4,578	0.46	122	0.42	2,792	0.69
1990	812	1.00	166	0.65	563	1.00	1,833	0.26	2,157	0.50	2,205	0.46	174	0.42	650	0.63
1991	340	1.00	127	0.94	470	1.00	935	0.26	5,152	0.54	3,673	0.47	196	0.09	2,017	0.85
1992	1,247	1.00	109	1.00	335	1.00	1,022	0.26	3,683	0.48	2,399	0.76	190	1.00	839	0.47
1993	890	1.00	27	1.00	164	1.00	1,330	0.06	1,961	0.89	3,924	0.52	288	0.78	885	0.71
1994	1,695	1.00	30	1.00	610	1.00	1,225	0.19	2,190	0.73	3,888	0.70	706	0.98	3,854	0.40
1995	1,368	1.00	9	1.00	409	1.00	1,370	0.13	3,094	0.69	3,063	0.39	156	0.50	1,395	0.51
1996	2,305	1.00	280	0.48	403	1.00	1,325	0.58	10,676	0.44	2,921	0.17	533	0.66	593	0.54
1997	689	1.00	15	0.64	305	1.00	2,007	0.72	3,548	0.40	4,669	0.12	1,875	0.11	603	0.23
1998	491	1.00	96	0.41	127	1.00	1,665	0.37	4,355	0.69	2,971	0.24	228	0.25	368	0.60
1999	299	1.00	195	0.51	331	1.00	969	0.16	2,655	0.03	3,129	0.68	718	0.25	575	0.69
2000	290	1.00	169	0.96	515	1.00	2,165	0.10	1,420	0.19	2,155	0.70	196	0.62	416	0.58
2001	802	0.73	261	0.64	750	0.70	3,647	0.44	3,714	0.19	3,901	0.43	2,354	0.82	4,024	0.39
2002	877	0.97	107	1.00	1,032	0.77	9,671	0.76	18,952	0.01	6,050	0.47	7,581	0.00	3,343	0.05
2003	1,106	0.89	398	0.72	738	0.98	7,001	0.88	24,782	0.01	3,444	0.39	6,820	0.65	3,810	0.56
2004	1,503	0.91	766	0.90	1,388	0.29	4,621	0.70	6,680	0.10	10,597	0.25	4,796	0.01	6,804	0.02
2005	853	0.60	147	0.66	607	1.00	2,968	0.17	9,272	0.03	2,678	0.41	2,204	0.05	2,083	0.13
2006	561		383		427		2,944		10,386		2,600		317		322	

Table 25. Risk of extinction (in 100 years) categories for populations of Lower Columbia River Chinook salmon (sources: Washington's Lower Columbia Fish Recovery Board plan [LCFRB 2004] and McElhany et al. [2007] for Oregon populations).

Type	Strata	Population	State	Extinction Risk Category
Spring	Cascade	Cowlitz	W	H
		Cispus	W	H
		Tilton	W	VH
		Toutle	W	VH
		Kalama	W	VH
		NF Lewis	W	VH
		Sandy	O	M
	Gorge	(Big) White Salmon	W	VH
		Hood	O	VH
Fall	Coastal	Grays/Chinook	W	H
		Elochoman/Skamokawa	W	H
		Mill/Abernathy/Germany	W	H
		Youngs Bay	O	VH
		Big Creek	O	VH
		Clatskanie	O	H
		Scappoose	O	VH
	Cascade	Lower Cowlitz	W	H
		Upper Cowlitz	W	VH
		Toutle	W	H
		Coweeman	W	M
		Kalama	W	H
		Lewis	W	M
		Salmon	W	VH
		Washougal	W	H
		Clackamas	O	VH
		Sandy	O	VH
	Gorge	Lower Gorge	W/O	H/VH
		Upper Gorge	W/O	H/VH
		(Big) White Salmon	W	H
		Hood River	O	VH
Late Fall	Cascade	NF Lewis	W	M
		Sandy	O	L

Table 26. LCFRB status summaries for Lower Columbia River tule Chinook populations LCFRB, Appendix E)

Strata	State	Population	Persistence	Spatial Structure	Diversity	Habitat
Coast Fall	WA	Grays	1.5	4	2.5	1.5
	WA	Elochoman	1.5	3	2	2
	WA	Mill/Abern/Ger	1.8	4	2	2
	OR	Youngs Bay				
	OR	Big Creek				
	OR	Clatskanie				
	OR	Scappoose				
Cascade Fall	WA	Lower Cowlitz	1.7	4	2.5	1.5
	WA	Coweeman	2.2	4	3	2
	WA	Toutle	1.6	3	2	1.75
	WA	Upper Cowlitz	1.2	2	2	2
	WA	Kalama	1.8	4	2.5	2
	WA	Lewis Salmon	2.2	4	3	2
	WA	Washougal	1.7	4	2	2
	OR	Sandy	1.7	4	2	2
	OR	Clackamas				
Gorge Fall	WA	Lower Gorge	1.8	3	2.5	2.5
	WA	Upper Gorge	1.8	2	2.5	2
	OR	Big White Salmon	1.7	2	2.5	1.5
	OR	Hood				

Notes:
Summaries are taken directly from the LCFRB Recovery Plan. All are on a 4 point scale, with 4 being lowest risk and 0 being highest risk.
Persistence: 0 = extinct or very high risk of extiction (0-40% probability of persistance in 100 years); 1 = Relatively high risk of extinction (40-75% probability of persistance in 100 years); 2 = Moderate risk of extinction (75-95% probability of persistance in 100 years); 3 = Low (negligible) risk of extinction (95-99% probability of persistance in 100 years); 4 = Very low risk of extinction (>99% probability of persistance in 100 years)
Spatial Structure: 0 = Inadequate to support a population at all (e.g., completely blocked); 1 = Adequate to support a population far below viable size (only small portion of historic range accessible); 2 = Adequate to support a moderate, but less than viable, population (majority of historica range accessible but fish are not using it); 3 = Adequate to support a viable population but subcriteria for dynamics or catestrophic risk are not met; 4 = Adequate to support a viable population (all historical areas accessible and used; key use areas broadly distributed among multiple reaches or tributaries)
Diversity: 0 = functionally extirpated or consist primarily of stray hatchery fish; 1 = large fractions of non-local hatchery stocks; substantial shifts in life-history; 2 = Significant hatchery influence or periods of critically low escapement; 3 = Limited hatchery influence with stable life history patterns. No extended intervals of critically low escapements; rapid rebounds from periodic declines in numbers; 4 = Stable life history patterns, minimal hatchery influence, no extended intervals of critically low escapements, rapid rebounds from periodic declines in numbers.
Habitat: 0 = Quality not suitable for salmon production; 1 = Highly impaired; significant natural production may occur only in favorable years; 2 = Moderately impaired; signficant degredation in habitat quality associated with reduced population productivity; 3 = Intact habitat. Some degredation but habitat is sufficient to produce signficant numbers of fish; 4 = Favorable habitat. Quality is near or at optimums for salmon.

Current Rangewide Status of Critical Habitat

Designated critical habitat for LCR Chinook salmon includes all Columbia River estuarine areas and river reaches proceeding upstream to the confluence with the Hood River as well as specific stream reaches in the following subbasins: Middle Columbia/Hood, Lower Columbia/Sandy, Lewis, Lower Columbia/Clatskanie, Upper Cowlitz, Cowlitz, Lower Columbia, Grays/Elochoman, Clackamas, and Lower Willamette (NMFS 2005 II). There are 48 watersheds within the range of this ESU. Four watersheds received a low rating, 13 received a medium rating, and 31 received a high rating for their conservation value (i.e., for recovery). The lower Columbia River rearing/migration corridor is considered to have a high conservation value and is the only habitat area designated in one of the high value watersheds identified above. This corridor connects every population with the ocean and is used by rearing/migrating juveniles and migrating adults. The Columbia River estuary is a unique and essential area for juveniles and adults making the physiological transition between life in freshwater and marine habitats. Of the 1,655 miles of habitat eligible for designation, 1,311 miles of stream are designated critical habitat. The lower Columbia River unit includes the estuary, where both juveniles and adults make the critical physiological transition between life in freshwater and marine habitats, but does not otherwise include offshore marine areas.

3.2 Human Induced Effects

3.2.1 The Hydropower System

Hydropower development on the Columbia River and its tributaries has dramatically affected anadromous salmonids in the basin. Dams have eliminated spawning and rearing habitat and altered the natural hydrograph of the Columbia River – decreasing spring and summer flows and increasing fall and winter flows. Power operations cause flow levels and river elevations to fluctuate – slowing fish movement through reservoirs, altering riparian ecology, and stranding fish in shallow areas. The dams in the migration corridors kill smolts and adults and alter their migrations. The dams have also converted the once-swift river into a series of slow-moving reservoirs – slowing the smolts' journey to the ocean and creating habitat for predators.

Mainstem

The Federal Columbia River Power System (FCRPS) consists of 14 sets of dams, powerhouses, and reservoirs, operated as a coordinated system for power production and flood control (while also effectuating other project purposes) on behalf of the Federal government under various Congressional authorities. These projects are: Dworshak, Lower Granite, Little Goose, Lower Monumental, and Ice Harbor dams, power plants, and reservoirs in the Snake River basin; Albeni Falls, Hungry Horse, Libby, Grand Coulee and Banks Lake (features of the Columbia Basin Project), and Chief Joseph dams, power plants, and reservoirs in the upper Columbia River basin; and McNary, John Day, The Dalles, and Bonneville dams, power plants, and reservoirs in the lower Columbia River basin. The Bureau of Reclamation also operates a system of projects in the Upper Snake River. The FCRPS and Bureau of Reclamation Upper Snake River projects are collectively referred to here as the FCRPS and Reclamation Actions.

The plan for operation of the FCRPS through 2014 is described in U.S. Army Corps of Engineers (USACE et al., 2004), the Final Updated Proposed Action (UPA) for the FCRPS Biological Opinion Remand (2004 UPA). In June 2005, the Federal District Court reviewed the NMFS

2004 Federal Columbia River Power System (FCRPS) Biological Opinion (NMFS 2004b) in *National Wildlife Federation, et al., vs. National Marine Fisheries Service, et al.* The court ordered a remand of NMFS (2004b) on October 7, 2005, but left the biological opinion in place during the remand period. Pending any court ordered changed hydrosystem operations during the remand process, the FCRPS Action Agencies (i.e., USACE, USBR, and BPA) are following the actions identified in the 2004 UPA, along with certain additional actions (primarily summer spill at Snake River projects) ordered by the Court. The court ordered remand process is nearly complete with final biological opinions on the FCRPS and Reclamation Actions scheduled to be completed on May 5, 2008. NMFS released draft biological opinions on the FCRPS and Reclamation actions on October 30, 2007 (NMFS 2007c). NMFS took comment on the draft opinions and is now taking those comments into account as it seeks to complete the final opinions.

Only a few of the Gorge strata populations of Lower Columbia River coho and Chinook ESUs are located above Bonneville Dam, the lower most of the mainstem projects. These ESUs are therefore subject to fewer affects than other upstream ESUs. However, there may still be affects to the ESUs resulting from storage and regulation of flows, and subsequent affects on the estuary. Information related to the positive and negative effects of the FCRPS and Reclamation actions are discussed in the draft biological opinions (NMFS 2007c).

<u>Willamette Basin</u>

The occurrence and magnitude of floods events has been significantly altered in the Willamette Basin (Figure 13). This change has implications to nutrient input, stream habitat dynamics, and the survival of salmonid juveniles in the Lower Columbia River . Current flow regimes in the Willamette Basin are different from the natural regimes observed historically. Winter and spring water releases from the dams are warmer and of lower discharge, which has accelerated egg development and fish emerge earlier than what occurred historically. Summer flows are higher and cooler than historically. In the fall, flows are relatively high because the dams are being drawn down in preparation for the next year's winter run-off into the reservoirs.

<u>Clackamas River</u>

In 1917, the fish ladder at Cazadero dam (located at today's Faraday Diversion Dam site) washed out, blocking access to the upper basin. After the ladder was repaired in 1939, the remnant populations in the lower river seeded the upper Clackamas River basin.

Currently the Portland General Electric (PGE) dams and reservoirs in the upper basin alter fish habitat and influence both upstream and downstream fish migration patterns (Table 27). The reservoirs have eliminated approximately 12.4 miles of stream and river habitat and added more than 1,700 acres of standing water habitat in the reservoirs (S.P. Cramer & Associates 2001, Table 3). There is no fish passage at the Oak Grove Fork facilities. These facilities are above a natural 20-foot waterfall that blocks anadromous fish runs.

Figure 13. Comparison of the magnitude and frequency of floods before dam development and under current dam regulation at four locations on the mainstem Willamette River. Floods events that, on average, recurred every ten years during pre-dam development, now occur a low magnitude every 100 years (Data from Benner and Sedell 1997).

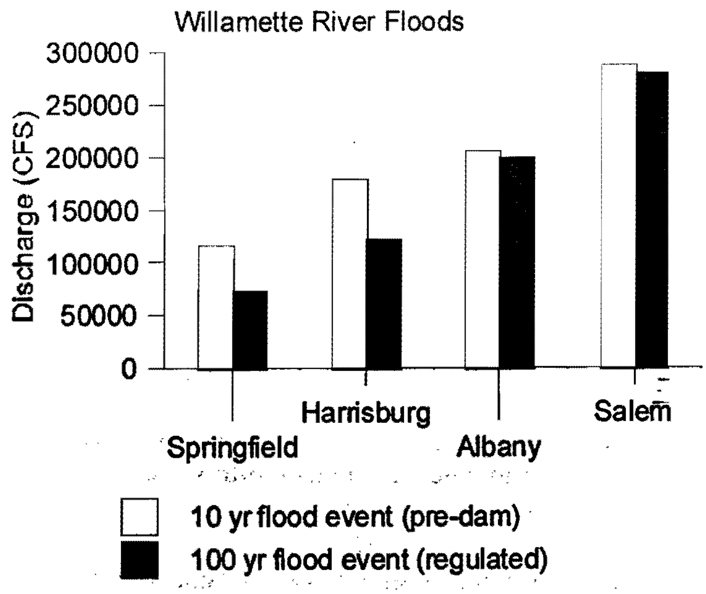


Table 27. Characteristics of the reservoirs developed by Portland General Electric in the Clackamas River Basin (Cramer & Associates 2001).

Reservoir	First Year	Stream Impounded	River Mile	Surface Area (Acres)	Fish Passage Status
Faraday	1907	--	26.2	26	NA
River Mill	1911	Clackamas River	23.3	63	Yes
Harriet	1924	Oak Grove Fork	4.8	22	No
Timothy	1956	Oak Grove Fork	15.2	1,282	No
North Fork	1958	Clackamas River	31.1	330	Yes

Salmon migrating up the Clackamas River are delayed as they move through the mainstem PGE facilities. The fish first must ascend the River Mill fish ladder (RM 23.3). After proceeding through 2.9-mile long Estacada Lake the fish then encounter the Faraday Powerhouse tailrace. The powerhouse is located off the channel but fish must detect and move into the usually much smaller flow in the diversion. The diversion reach has a minimum flow of 120 cfs and powerhouse flow can be as high as 4,900 cfs (Shibahara 2004). After passing the Faraday Powerhouse tailrace, migrating fish move through the 2.2-mile long diversion reach to the Faraday Diversion Dam. At the diversion dam, fish enter the 1.7-mile North Fork fish ladder.

Approximately 300 yards upstream of the fish ladder entrance, the fish ladder is blocked and all fish enter a trap for sorting of wild and hatchery fish (which are identified by their adipose fin clip). Wild fish are either transported upstream to the head of the North Fork Reservoir or released back into the fish ladder above the block. Seventeen miles upstream of the North Fork Dam, fish pass through the tailrace of the Oak Grove Powerhouse, which is not a physical barrier. Water diverted out of the Oak Grove Fork above the natural barrier enters the Clackamas River at this point and fish may be attracted to the powerhouse flows (Shibahara 2004a, cited in Runyon and Salminen 2005). There are migration delays and effects of the trap facility and its operation that place fish under stress and potentially cause mortality. The PGE dams also impact juvenile salmon migrating downstream. Fish passage improvements at the PGE facilities are being examined through the FERC process for re-licensing the Clackamas River hydroelectric projects.

Cowlitz River

Two major hydroelectric dams impact anadromous fish runs on the Cowlitz River: Mayfield Dam, which was completed in 1962, and Mossyrock Dam, completed in 1968. These dams flooded miles of spawning and rearing habitat and blocked upstream and downstream migration, for both anadromous and resident fish. Between 1961 and 1968, downstream migrants were passed over Mayfield Dam via fish passage facilities. Since the construction of Mossyrock Dam and the Cowlitz Salmon Hatchery Barrier Dam in 1968, no volitional upstream passage remains. For brief periods, anadromous fish have been hauled around the dams by trucks to stock the upper watershed for sport fishing (Stober,1986), but anadromous fish production in the upper basin was effectively eliminated. Recent efforts are being made to reintroduce Chinook salmon in areas above the dams through a trap and haul operation.

3.2.2 Human-Induced Habitat Degradation

The Lower Columbia Fish Recovery Plan (LCFRB 2004) provides a detailed overview and basin-specific assessment of habitat conditions on the Washington side of the Lower Columbia River coho and Lower Columbia River Chinook ESUs. Generally, the quality and quantity of freshwater habitat in much of the Columbia River Basin has declined dramatically in the last 150 years. Forestry, farming, grazing, road construction, hydrosystem development, mining, and other development have radically changed habitat conditions in the basin. Water quality in streams throughout the Columbia River Basin has been degraded by human activities such as dams and diversion structures, water withdrawals, farming and animal grazing, road construction, timber harvest activities, mining activities, and development. Over 2,500 streams, river segments, and lakes in the Northwest do not meet Federally-approved, state and tribal water quality standards and are now listed as water quality limited under section 303(d) of the Clean Water Act. Tributary water quality problems contribute to poor water quality when sediment and contaminants from the tributaries settle in mainstem reaches and the estuary.

Most of the water bodies in Oregon, Washington, and Idaho on the 303(d) list do not meet water quality standards for temperature. High water temperatures adversely affect salmonid metabolism, growth rate, and disease resistance, as well as the timing of adult migrations, fry emergence, and smoltification. Many factors can cause high stream temperatures, but they are primarily related to land-use practices rather than point-source discharges. Some common actions that cause high stream temperatures are the removal of trees or shrubs that directly shade streams, water withdrawals for irrigation or other purposes, and warm irrigation return flows.

Loss of wetlands and increases in groundwater withdrawals contribute to lower base-stream flows which, in turn, contribute to temperature increases. Activities that create shallower streams (e.g., channel widening) also cause temperature increases.

Pollutants also degrade water quality. Salmon require clean gravel for successful spawning, egg incubation, and the emergence of fry. Fine sediments clog the spaces between gravel and restrict the flow of oxygen-rich water to the incubating eggs. Excess nutrients, low levels of dissolved oxygen, heavy metals, and changes in pH also directly affect the water quality for salmon.

Water quantity problems are also an important cause of habitat degradation and reduced fish production. Millions of acres of land in the basin are irrigated. Although some of the water withdrawn from streams eventually returns as agricultural runoff or groundwater recharge, crops consume a large proportion of it. Withdrawals affect seasonal flow patterns by removing water from streams in the summer (mostly May through September) and restoring it to surface streams and groundwater in ways that are difficult to measure. Withdrawing water for irrigation, human consumption, and other uses increases temperatures, smolt travel time, and sedimentation. Return water from irrigated fields introduces nutrients and pesticides into streams and rivers. Water withdrawals (primarily for irrigation) have lowered summer flows in nearly every stream in the basin and thereby profoundly decreased the quantity and quality of habitat.

Blockages that stop downstream and upstream fish movement exist at many dams and barriers, whether they are for agricultural, hydropower, municipal/industrial, or flood control purposes. Culverts that are not designed for fish passage also block upstream migration. Migrating fish are often killed when they are diverted into unscreened or inadequately screened water conveyances or turbines. While many fish-passage improvements have been made in recent years, manmade structures continue to block migrations or kill fish throughout the basin.

On the landscape scale, human activities have affected the timing and amount of peak water runoff from rain and snowmelt. Forest and range management practices have changed vegetation types and density which, in turn, affect runoff timing and duration. Many riparian areas, flood plains, and wetlands that once stored water during periods of high runoff have been destroyed by development that paves over or compacts soil – thus increasing runoff and altering its natural pattern.

Land ownership has also played its part in the region's habitat and land-use changes. Federal lands, which compose 50 percent of the basin, are generally forested and influence upstream portions of the watersheds. While there is substantial habitat degradation across all ownerships, in general, habitat in many headwater stream sections is in better condition than in the largely non-Federal lower portions of tributaries (Doppelt et al. 1993; Frissell 1993; Henjum et al. 1994; Quigley and Arbelbide 1997). In the past, valley bottoms were among the most productive fish habitats in the basin (Stanford and Ward 1992; ISG 1996; Spence et al. 1996). Today, agricultural and urban land development and water withdrawals have substantially altered the habitat for fish and wildlife. Streams in these areas typically have high water temperatures, sedimentation problems, low flows, simplified stream channels, and reduced riparian vegetation. Floodplains have been reduced in size, off-channel habitat features have been lost or disconnected from the main channel, and the amount of large woody debris (large snags/log structures) in rivers has been reduced. Most of the remaining habitats are affected by flow fluctuations associated with reservoir management.

The Columbia River estuary (through which all the basin's species must pass) has also been changed by human activities. Historically, the downstream half of the estuary was a dynamic environment with multiple channels, extensive wetlands, sandbars, and shallow areas. The mouth of the Columbia River was about four miles wide. Winter and spring floods, low flows in late summer, large woody debris floating downstream, and a shallow bar at the mouth of the Columbia River kept the environment dynamic. Today, navigation channels have been dredged, deepened, and maintained; jetties and pile-dike fields have been constructed to stabilize and concentrate flow in navigation channels; marsh and riparian habitats have been filled and diked; and causeways have been constructed across waterways. These actions have decreased the width of the mouth of the Columbia River to two miles and increased the depth of the Columbia River channel at the bar from less than 20 to more than 55 feet. Sand deposition at river mouths has extended the Oregon coastline approximately four miles seaward and the Washington coastline approximately two miles seaward (Thomas 1981).

More than 50 percent of the original marshes and spruce swamps in the estuary have been converted to industrial, transportation, recreational, agricultural, or urban uses. More than 3,000 acres of intertidal marsh and spruce swamps have been converted to other uses since 1948 (LCREP 1999). Many wetlands along the shore in the upper reaches of the estuary have been converted to industrial and agricultural lands after levees and dikes were constructed. Furthermore, water storage and release patterns from reservoirs upstream of the estuary have changed the seasonal pattern and volume of discharge. The peaks of spring/summer floods have been reduced, and the amount of water discharged during winter has increased.

Human-caused habitat alterations have also increased the number of predators feeding on Columbia River salmon. For example, researchers estimated that a population of terns on Rice Island (created under the Columbia River Channel Operation and Maintenance Program) consumed six to 25 million out-migrating salmonid smolts during 1997 (Roby et al. 1998) and seven to 15 million out-migrating smolts during 1998 (Collis et al. 1999). Even after considerable efforts by Federal and state agencies to remedy this problem, between 5 and 7 million smolts were consumed in 2001. As another example, populations of Northern pikeminnow (a salmonid predator) in the Columbia River have skyrocketed since the advent of the mainstem dams and their warm, slow-moving reservoirs.

To counteract all the ill effects listed in this section, Federal, state, tribal, and private entities are engaged – singly and in partnership – in recovery efforts to help slow and, eventually, reverse the decline of salmon and steelhead populations. Nevertheless, while these efforts represent a number of good beginnings, it must be stated that much remains to be done to recover Columbia River salmon. A discussion of the types of recovery strategies and management measures currently underway and under consideration can be found in the Lower Columbia River Salmon Recovery Plan (LCFRB 2004).

3.2.3 Hatcheries

For more than 100 years, hatcheries in the Pacific Northwest have been used primarily to (a) produce fish for harvest and (b) replace natural production lost to dam construction and other development – and in many fewer instances, to protect and rebuild naturally produced salmonid populations. As a result, most salmonids returning to the region are derived primarily from hatchery fish. In 1987, for example, 95 percent of the coho salmon, 70 percent of the spring Chinook salmon, 80 percent of the summer Chinook salmon, 50 percent of the fall Chinook salmon, and 70 percent of the steelhead returning to the Columbia River Basin originated in hatcheries (CBFWA 1990). Because hatcheries have traditionally focused on providing fish for harvest and technologies have been limited, it is only recently that the substantial adverse effects of hatcheries on natural-origin populations been demonstrated. For example, the production of hatchery fish, among other factors, has contributed to the 90 percent reduction in natural-origin coho salmon runs in the lower Columbia River over the past 30 years (Flagg et al. 1995).

NMFS has identified four primary ways hatcheries may harm wild-run salmon and steelhead: (1) ecological effects, (2) genetic effects, (3) overharvest effects, and (4) masking effects (NMFS 2000b) Ecologically, hatchery fish can predate on, displace, and compete with natural-origin fish. These effects are most likely to occur when fish are released in poor condition and do not migrate to marine waters, but rather remain in the streams for extended rearing periods. Hatchery fish also may transmit hatchery-borne diseases, and hatcheries themselves may release disease-carrying effluent into streams. Hatchery fish can affect the genetic variability of native fish by interbreeding with them. Interbreeding can also result from the introduction of stocks from other areas. Interbred fish are less adapted to the local habitats where the original native stock evolved and may therefore be less productive there.

In many areas, hatchery fish provide increased fishing opportunities. However, when natural-origin fish mix with hatchery stock in these areas, naturally produced fish can be overharvested. Moreover, when migrating adult hatchery and natural-origin fish mix on the spawning grounds, the health of the natural-origin runs and the habitat's ability to support them can be overestimated. This potential overestimate exists because the hatchery fish mask the surveyors' ability to discern actual natural-origin run status, thus resulting in harvest objectives that were too high to sustain the naturally produced populations.

Over the last several years, the role hatcheries play in the Columbia Basin has been expanded from simple production to supporting species recovery. The evaluation of hatchery programs and implementation of hatchery reform in the Lower Columbia River is occurring through several processes, including: (1) the Lower Columbia River Recovery and Fish and Wildlife Subbasin Plan; (2) Hatchery Genetic and Management Plan development for ESA compliance; (3) FERC-related plans on the Cowlitz and Lewis Rivers; and, (4) the federally mandated Artificial Production Review and Evaluation. More recently a National Environmental Policy Act (NEPA) review of all Mitchell Act funded hatchery facilities was initiated which will include many of those producing Lower Columbia River coho and Lower Columbia River Chinook. The Lower Columbia River recovery plan in Washington identifies strategies and measures to support recovery of naturally-spawning fish. The plan also includes associated research and monitoring elements designed to clarify interactions between natural and hatchery fish and quantify the effects artificial propagation has on natural fish. The objective is to rehabilitate depleted populations and provide for harvest while minimizing impacts to wild fish. For more detail on the use of hatcheries in recovery strategies, see the Lower River Recovery and Fish and Wildlife Subbasin Plan (LCFRB 2004).

When evaluating harvest actions an ESU, NMFS also considers the effect of fisheries on listed hatchery origin coho. Among other things, NMFS considers whether hatchery programs will meet their escapement objectives. This is particularly important for hatchery programs that preserve the genetic legacy of key components of the ESU, or for programs used for recovery-related supplementation efforts.

As discussed above, there are 21 hatchery programs considered part of the Lower Columbia River coho ESU. Only two of the 25 populations thought to have existed historically (Clackamas and Sandy rivers) have appreciable natural production, although recent information indicates that natural production is more wide-spread that previously believed. Because hatcheries have traditionally focused on providing fish for harvest and available technology has been limited, it is only recently that the substantial adverse effects of hatcheries on natural populations have been demonstrated. While not the primary factor, it is now known that the production of hatchery fish, among other factors, has contributed to the 90 percent reduction in natural coho salmon runs in the lower Columbia River over the past 30 years (Flagg et al. 1995).

The states of Oregon and Washington and other co-managers are currently engaged in a substantial review of hatchery management practices through the Hatchery Scientific Review Group (HSRG). The HSRG was established and funded by Congress to provide an independent review of current hatchery programs in the Columbia River Basin. The HSRG has largely completed their work on Lower Columbia River tule populations and provided their recommendations (HSRG 2007). A general conclusion from the information generated by the HSRG is that the current production programs are not consistent with practices that reduce impacts on naturally-spawning populations, and will have to be modified substantially to reduce the adverse effects of hatchery fish on key natural populations identified in the Interim Recovery Plan as necessary for broad sense recovery of the ESU. The adverse effects are caused in part by excess hatchery adults returning to natural spawning grounds. There are two general options for addressing the problem. In summary form, they are to either substantially reduce or eliminate existing hatchery programs, or to reprogram existing production to reduce straying, increase the ability of fisheries to differentially harvest hatchery fish, and install where appropriate a system of weirs below primary population natural spawning areas.

Early in 2007 NMFS highlighted the need to change current hatchery programs and anticipated that decisions regarding the direction for those programs would be made soon (Lohn and McInnis 2007). NMFS followed with a letter to the states of Oregon and Washington in November 2007 that again highlighted the immediate need for decisions about hatchery programs (Turner 2007). In response, the states have considered the HSRG recommendations, the LCSRP and other information in order to develop a comprehensive and integrated hatchery and harvest reform program. A framework of that reform plan was provided to NMFS in January 2008 (Anderson and Bowles 2008) and includes:

- mass marking hatchery produced tule Chinook to allow for brood stock management, assessment and control of hatchery strays, and implementation of mark selective fisheries;
- developing a system of weirs and hatchery intake improvements to manage returning fish;
- reducing some programs and transferring hatchery releases between programs to

maximize production and minimize the adverse effects of hatchery strays on priority populations, and
- developing techniques to enable commercial scale mark selective fisheries.

NMFS appreciates the scale and complexity of the reforms proposed by the states and commends them for their undertaking.

To be effective the program obviously must be implemented. The states propose that changes be phased in over time. Much of the program is currently unfunded and there will be complexities related to the design, permitting, and construction of each project. However, NMFS is aware that substantive and essential steps already have been taken to implement elements of the program. First, the program depends fundamentally on the requirement that all hatchery fish be mass marked with an adipose fin clip so they can be distinguished visually. Visual identification of hatchery fish allows for mark selective fisheries, sorting of hatchery fish returning to the rivers, and identification of hatchery fish in natural-origin spawning areas. Federal legislation requires that all hatchery fish intended for harvest, and produced in federal hatcheries or supported by federal funding, be marked with an adipose fin clip. NMFS' recent letter reiterates the marking requirement and reminds the states who manage the hatcheries that marking is required regardless of funding limitations. If necessary, production will have to be reduced to meet the marking requirement (Turner 2007).

The states' proposal also calls for the design, permitting, and construction of eight hatchery weirs or hatchery intake modifications (Anderson and Bowles 2008). The associated work schedule calls for completion in 2012. Much of the work is contingent on future funding, but several elements of the project are either completed or already funded. Funding proposals have been submitted for subsequent steps. For example, the weir on the Lower Elochoman, and design of the weir on the upper Elochoman, were completed in 2007. Design and permitting phases for the Washougal and Grays weirs were funded with work scheduled for completion in 2008. Funding proposals have been submitted for other design, permitting, and construction elements of the project. Potential sources for funding include, but are not limited to, Pacific Coastal Salmon Recovery Funds and Mitchell Act money. NMFS has indicated it will continue to monitor progress of the project, but is otherwise prepared to use available Mitchell Act funds on measures that will bring the production programs into compliance over time (Turner 2007).

The reform plan calls for reductions in hatchery production and transfer of some production between programs. The Chinook hatchery program on the Grays River was closed previously with last releases in 1997 and last returns from those releases in 2000 or 2001.

We can not conclude that all elements of the hatchery reform initiative are reasonably certain to occur, but it is clear that essential and significant parts of the program have already been implemented and therefore can be considered as part of the baseline.

3.2.4 Harvest

Salmon and steelhead have been harvested in the Pacific Northwest as long as there have been people there. For thousands of years, native Americans have fished on salmon and other species in the mainstem and tributaries of the Columbia River for ceremonial and subsistence use and for barter. Salmon were possibly the most important single component of the Native American diet, and were eaten fresh, smoked, or dried (Craig and Hacker 1940). A wide variety of gears and methods were used, including hoop and dip nets at cascades such as Celilo and Willamette Falls, to spears, weirs, and traps (usually in smaller streams and headwater areas).

Commercial fishing developed rapidly with the arrival of European settlers and the advent of canning technologies in the late 1800s. The development of non-Indian fisheries began in about 1830; by 1861, commercial fishing was an important economic activity. The early commercial fisheries used gill nets, seines hauled from shore, traps, and fish wheels. Later, purse seines and trolling (using hook and line) fisheries developed. Recreational fishing began in the late 1800s, occurring primarily in tributary locations (ODFW/WDFW 2000).

Salmonids' capacity to produce more adults than are needed for spawning offers the potential for sustainable harvest of naturally produced (versus hatchery-produced) fish. This potential can be realized only if two basic management requirements are met: (1) enough adults return to spawn and perpetuate the run, and (2) the productive capacity of the habitat is maintained. Catches may fluctuate in response to such variables as ocean productivity cycles, periods of drought, and natural disturbance events, but as long as the two management requirements are met, fishing can be sustained indefinitely. Unfortunately, both prerequisites for sustainable harvest have been violated routinely in the past. The lack of coordinated management across jurisdictions, combined with competitive economic pressures to increase catches or to sustain them in periods of lower production, resulted in harvests that were too high and escapements that were too low. At the same time, habitat has been increasingly degraded as described above, reducing the capacity of the salmon stocks to produce numbers in excess of their spawning escapement requirements.

In recent years harvest management has undergone significant reforms and many of the past problems have been addressed, e.g., the use of mark selective fisheries; shaping fisheries in area and time to minimize mortality on wild coho and a major change in the harvest management strategy to explicitly incorporate ocean and freshwater survival data (described in Subsection 3.1). Principles of weak stock management are now the prevailing paradigm. As a result, mixed stock fisheries are managed based on the needs of natural-origin stocks. Managers also account, where possible, for total harvest mortality across all fisheries. The focus is now on conservation and secondarily on providing harvest opportunity where possible directed at harvestable hatchery and natural-origin stocks.

Lower Columbia River coho and Lower Columbia River Chinook are harvested throughout their migratory range from Canada to Oregon in fisheries intended to harvest salmon and to a lesser degree in fisheries directed on other species. Lower Columbia River coho and Lower Columbia River tule Chinook salmon are also caught in Canadian fisheries. The effects of Canadian fisheries on Lower Columbia River coho in recent years has been quite low (exploitation rates < 1.0%) in large part due to the severe constraints on coho catch in Canadian Fisheries. The impacts on Lower Columbia River tule Chinook populations in Canadian fisheries are more substantial. The exploitation rate on Lower Columbia River tule Chinook in Canadian fisheries averaged about 25% from 2002-2006.

Recovery Planning
Recovery planning for the lower Columbia River and Willamette Basin is well underway. In February 2006, NMFS approved an Interim Regional Recovery Plan for the Washington portions of Lower Columbia Chinook, steelhead, and chum. The Washington plan discussed Lower Columbia River coho in some detail, but since the ESU was not actually listed at the time the plan was submitted to NMFS and made available for public comment, the interim plan approval did not apply to coho. Provisions related to coho are therefore best considered as preliminary.

Since the listing, Washington's Lower Columbia Fish Recovery Board has undertaken additional work to supplement treatment of coho in its plan, and a full-scale recovery planning effort has been undertaken in the Oregon portion of the Lower Columbia for Chinook, steelhead, chum, and coho. When both plans are completed, NMFS will make them available for public review and comment before finalizing them under the ESA. We expect the plans to be completed by the state or local groups by the end of 2008, with a federal register notice of availability for public comment to follow as soon as possible thereafter.

In conducting section 7 consultations, NMFS uses recovery plans as a source of information that describes, among other things, recovery goals and recommended actions to address limiting factors. Compliance of an action with a recovery plan (or noncompliance) is not a directly relevant criterion for assessing jeopardy. However, recovery plans do provide a broad context for evaluating an action and perspective for how recovery planners presumed the activity would be treated.

The LCFRB's Recovery Plan is predicated on the restoration of healthy natural-origin populations that provide significant harvest opportunity. The recovery goals are therefore defined with the presumption that they will provide for sustainable harvest of naturally spawning populations. The Plan describes a near-term strategy for limiting harvest impacts, and a long-term strategy for restoring naturally-spawning populations to harvestable levels. The Recovery Plan describes species-specific actions that are designed to meet the near-term strategy to limit harvest to a level that will allow for rebuilding to achieve recovery. The Recovery Plan therefore anticipates that "limited" harvest will occur during the recovery phase. The task remains, however, to define the specific level of harvest that is consistent with future survival and recovery. That task is something that is properly considered through the consultation process.

NMFS considered the indirect effect that harvest may have through limitations on marine derived nutrients. The proposed fisheries will reduce the abundance of LCR Chinook and LCR coho returning to spawn in natural production areas. NMFS considered the likelihood that the reduction in spawning would affect the amount of marine derived nutrients and thus the subsequent production of fish. Marine derived nutrients were not identified specifically in the LCRFB Recovery Plan or subbasin plans as a limiting factor for any of the populations in these ESUs. For many of the populations, the abundance of hatchery fish on the spawning grounds is high and likely exceeds the need for nutrients. Although there may be an indirect effect to future production for some populations as a result of the proposed fisheries, NMFS concluded that those effects are negligible.

Lower Columbia River Coho

Table 28 includes the available information on exploitation rates of Lower Columbia River coho in ocean and freshwater fisheries. Previously, Oregon Coast Natural coho were used as a surrogate for estimating ocean fisheries impacts to Lower Columbia River coho. In 2006, largely as a consequence of increased attention resulting from its listing, the methods for assessing harvest in ocean fisheries were changed so that these were more specific to Lower Columbia River coho.

Until 1993 the exploitation rates in salmon fisheries on Lower Columbia River coho have been very high, contributing to their decline (Table 28). The combined ocean and inriver exploitation rates for Lower Columbia River coho averaged 91% through 1983, averaged 69% from 1984-1993, and decreased to an average of 17% from 1994-2007.

Recovery Planning for Lower Columbia River Coho

The LCFRB Recovery Plan outlines four harvest actions to be taken for Lower Columbia River coho. These include directions to:

1. evaluate the harvest matrix developed by Oregon for Lower Columbia River coho;
2. implement mark selective fisheries in ocean, Columbia River, and tributary fisheries;
3. regulate commercial fisheries in the mainstem Columbia River using time, area, and gear restrictions to minimize impacts to early and late timed natural-origin coho, and;
4. evaluate whether the management strategy designed to protect natural-origin Clackamas coho provides adequate protection for other late-timed Washington populations as well.

Table 28. Estimated Ocean (all marine area fisheries) and Inriver Exploitation Rates on Lower Columbia River Natural Coho, 1970-2007 (TAC 2008).

Year	Ocean Exploitation Rate [1]	Inriver Exploitation Rate [2]	Total Exploitation Rate
1970	65.2%	28.4%	93.6%
1971	82.5%	9.9%	92.4%
1972	84.3%	8.6%	92.9%
1973	81.9%	11.2%	93.1%
1974	83.5%	9.2%	92.7%
1975	81.4%	10.1%	91.5%
1976	89.9%	5.5%	95.4%
1977	88.8%	5.3%	94.1%
1978	82.5%	7.9%	90.4%
1979	79.4%	9.5%	88.9%
1980	73.1%	24.5%	97.6%
1981	81.1%	6.8%	87.9%
1982	61.6%	20.8%	82.4%
1983	78.7%	3.9%	82.6%
1984	31.9%	27.0%	58.9%
1985	43.2%	22.3%	65.5%
1986	33.5%	39.7%	73.2%
1987	59.5%	19.4%	78.9%
1988	56.4%	20.3%	76.7%
1989	55.3%	22.7%	78.0%
1990	68.9%	7.5%	76.4%
1991	45.4%	19.1%	64.5%
1992	50.9%	8.7%	59.6%
1993	42.3%	10.5%	52.8%
1994	7.0%	3.5%	10.5%
1995	12.0%	0.3%	12.3%
1996	8.0%	4.4%	12.4%
1997	12.0%	1.6%	13.6%
1998	8.0%	0.2%	8.2%
1999	9.0%	18.5%	27.5%
2000	7.0%	17.5%	24.5%
2001	7.0%	6.4%	13.4%
2002	12.0%	2.1%	14.1%
2003	14.0%	8.9%	22.9%
2004	15.0%	9.3%	24.3%
2005	11.0%	6.5%	17.5%
2006	6.8%	6.5%	13.3%
2007	11.9%	6.7%	18.6%

[1] Used Oregon Coast coho as surrogate; for 2006 and 2007 used Lower Columbia River hatchery indicator stocks (PFMC 2007)

[2] Used inriver exploitation rates through 2000 from C. LeFleur. WDFW Pers. Com. (March 22, 2007); for 2001-2005 used inriver exploitation rates on unmarked fish from C. Melcher. ODFW Pers. Com. (April 2, 2007)

Items 1 and 4 are the subject of the ongoing review being done by NMFS in collaboration with the states of Oregon and Washington. NMFS guidance letters to the Council in recent years have all described the status of the ongoing review related to Lower Columbia River coho. A key question remains whether the Clackamas and Sandy populations that are used as indicators in the harvest matrix are sufficient to represent other populations in the ESU. In the mean time, NMFS has taken a conservative approach to implementing the matrix by limiting the total harvest impact for all fisheries to that which would be allowed in the ocean portion of the fishery. As a consequence, in 2006 and 2007, the total exploitation rates were limited to 15% rather than 21.4%, and 20% rather than 29.2%, respectively (Tables 3a-3c). NMFS most recent guidance indicated that fisheries should be managed conservatively in 2008 and for the foreseeable future, as they have in the last two years, until outstanding issues related to the matrix are resolved (Lohn and McInnis 2008).

Items 2 and 3 listed above are management actions designed to limit harvest of natural origin fish while maximizing access to harvestable hatchery fish. These management actions are being fully implemented subject to the constraints defined by the overall limits on exploitation rate.

Lower Columbia River Chinook

Tables 29, 30, and 31 provide estimates of harvest impacts and their distribution across fisheries for spring, bright, and tule populations in the Lower Columbia River Chinook ESU

Table 29 provides estimates of harvest impacts to Lower Columbia River spring Chinook populations. Exploitation rates were generally higher prior to the mid 1990's averaging 50% through 1994. Spring Chinook stocks in the Columbia River, including Upper Willamette River spring Chinook decreased significantly in the mid 1990's, which led to significant reduction in harvest, particularly inriver. Stock abundance gradually rebuilt, reaching another peak by the early part of the 2000 decade. Fishery impacts increased some in response to higher abundance, but by 1999, both Upper Willamette River Chinook and Lower Columbia River Chinook ESUs had been listed under the ESA. As a consequence, fishery managers implemented mass-marking programs for hatchery-origin fish and phased in mark-selective fisheries. Total exploitation rates beginning in 1995 averaged about 27%, although actual exploitation rates on unmarked natural-origin fish are lower as a consequence of the implementation of mark-selective fisheries inriver. Those estimates are not immediately available. Fishery impacts reported under the heading of Columbia River include those that occur in tributary sport fisheries. Tributary sport fisheries are not included in fisheries covered by the 2008 Agreement. Oregon and Washington manage their tributary sport fisheries separately subject to provisions of Fishery Management and Evaluation Plans (FMEPs). These FMEPs were considered for ESA purposes under limit #4 of the 4(d) Rule (65 FR 42422 July 10, 2000) ([[ref OR and WA tributary 4ds). Fisheries in tributaries are managed to meet escapement goals. The effects on Lower Columbia River spring Chinook in mainstem fisheries that occur subject to the U.S. v Oregon agreement are constrained by harvest rate limits for upriver spring Chinook stocks that in most cases may not exceed 2%.

Table 29. Total adult equivalent exploitation rates (catch/catch + escapement) for Cowlitz spring Chinook which are used as an example of exploitation rates on Lower Columbia River spring Chinook populations (Simmons 2008).

		Ocean					Columbia River	
	Total		Canada		Southern US		Non-Indian	Indian
Year	Exploitation Rate	Southeast Alaska	WCVI	Other Canada	PFMC	PgtSd	Exp Rate	Exp Rate
1980	52%	2%	5%	4%	17%	0%	24%	0%
1981	48%	3%	5%	4%	17%	0%	20%	0%
1982	55%	2%	5%	3%	15%	0%	30%	0%
1983	57%	2%	9%	5%	9%	0%	32%	0%
1984	54%	2%	11%	5%	4%	0%	31%	0%
1985	43%	1%	5%	3%	8%	0%	25%	0%
1986	52%	1%	5%	3%	12%	0%	31%	0%
1987	45%	1%	5%	3%	11%	0%	25%	0%
1988	49%	1%	5%	2%	16%	0%	26%	0%
1989	50%	1%	3%	3%	19%	0%	25%	0%
1990	57%	1%	5%	2%	23%	0%	26%	0%
1991	54%	1%	4%	3%	14%	0%	32%	0%
1992	46%	1%	5%	3%	19%	0%	19%	0%
1993	48%	1%	5%	3%	15%	0%	25%	0%
1994	45%	1%	4%	3%	3%	0%	35%	0%
1995	10%	1%	2%	1%	4%	0%	1%	0%
1996	11%	1%	0%	0%	7%	0%	2%	0%
1997	16%	1%	1%	2%	5%	0%	7%	0%
1998	12%	1%	0%	2%	9%	0%	0%	0%
1999	38%	1%	1%	1%	15%	0%	20%	0%
2000	38%	1%	3%	1%	9%	0%	25%	0%
2001	21%	1%	2%	1%	7%	0%	10%	0%
2002	43%	1%	2%	2%	13%	0%	24%	0%
2003	34%	1%	3%	2%	13%	0%	16%	0%
2004	31%	1%	3%	2%	13%	0%	11%	0%
2005	36%	1%	4%	2%	17%	0%	11%	0%
2006	34%	1%	4%	3%	16%	0%	11%	0%

Table 30 provides estimates of harvest estimates to the North Fork Lewis bright Chinook population. Exploitation rates were generally higher through 1989 (averaging 56%), declining during the decade of the 1990s (averaging 36%), and increased slightly since 2000 (averaging 38%).

Table 30. Total adult equivalent exploitation rate (catch/catch + escapement) for North Fork Lewis bright Chinook population (Simmons 2008).

Year	Total exploitation rate	Ocean					Columbia River	
		Southeast Alaska	Canada		Southern US		Non-Indian Exp Rate	Indian Exp Rate
			WCVI	Other Canada	PFMC	PgtSd		
1979	64%	9%	8%	6%	9%	2%	29%	0%
1980	68%	11%	8%	7%	8%	2%	33%	0%
1981	39%	11%	6%	6%	6%	2%	7%	0%
1982	43%	9%	6%	6%	8%	2%	12%	0%
1983	42%	10%	11%	6%	4%	3%	8%	0%
1984	58%	10%	15%	7%	2%	2%	22%	0%
1985	54%	6%	7%	6%	5%	3%	27%	0%
1986	64%	5%	8%	6%	6%	4%	35%	0%
1987	65%	5%	8%	5%	5%	3%	39%	0%
1988	68%	6%	10%	5%	7%	3%	38%	0%
1989	44%	7%	3%	4%	4%	1%	24%	0%
1990	38%	8%	6%	4%	7%	2%	12%	0%
1991	57%	7%	5%	5%	5%	2%	33%	0%
1992	57%	7%	9%	6%	7%	3%	25%	0%
1993	51%	7%	6%	4%	7%	3%	25%	0%
1994	38%	7%	11%	9%	1%	3%	7%	0%
1995	36%	7%	3%	2%	1%	1%	22%	0%
1996	16%	7%	0%	0%	2%	2%	3%	0%
1997	25%	11%	2%	3%	2%	2%	7%	0%
1998	23%	11%	0%	2%	1%	1%	8%	0%
1999	19%	6%	1%	2%	7%	2%	0%	0%
2000	24%	6%	5%	1%	5%	2%	5%	0%
2001	31%	7%	4%	1%	6%	3%	11%	0%
2002	41%	9%	3%	3%	7%	3%	15%	0%
2003	50%	11%	3%	4%	5%	2%	24%	0%
2004	40%	9%	2%	2%	3%	1%	22%	0%
2005	50%	8%	6%	5%	8%	3%	20%	0%
2006	32%	10%	2%	3%	3%	1%	13%	0%

Table 31 provides estimates of harvest impacts for tule Chinook populations based on an aggregate of coded wire tag indicator stocks. Exploitation rates were generally higher through 1993 (averaging 69%), lower through 1999 (averaging 34%), then increasing since 2000 (averaging 49%). From 2002 to 2006 fisheries were managed subject to a 49% exploitation rate limit. Total exploitation rates have been higher in some years but have averaged 49% from 2002 to 2006 (Table 31).

Table 31. Total adult equivalent exploitation rates (catch/catch + escapement) for Lower Columbia River natural-origin tule populations (Simmons 2008).

	Ocean					Columbia River	
Year	Total Exp. Rate	SEAK Exp. Rate	Canada Exp. Rate	PFMC Exp. Rate	Pgt Snd Exp. Rate	Non-Treaty Exp. Rate	Treaty Exp. Rate
1983	69%	4%	34%	21%	3%	7%	0%
1984	70%	4%	40%	6%	3%	16%	1%
1985	66%	4%	35%	16%	3%	9%	0%
1986	82%	3%	38%	15%	4%	22%	0%
1987	82%	2%	27%	20%	4%	28%	0%
1988	81%	3%	25%	15%	2%	36%	0%
1989	59%	4%	19%	10%	3%	23%	0%
1990	60%	4%	26%	19%	3%	9%	0%
1991	63%	3%	28%	15%	4%	12%	0%
1992	65%	3%	31%	21%	4%	8%	0%
1993	61%	3%	27%	18%	3%	9%	0%
1994	33%	4%	26%	2%	1%	0%	0%
1995	36%	4%	21%	6%	2%	3%	1%
1996	26%	3%	4%	7%	1%	9%	0%
1997	35%	5%	12%	7%	2%	10%	0%
1998	33%	4%	13%	6%	0%	9%	0%
1999	42%	3%	10%	13%	0%	15%	0%
2000	48%	4%	23%	9%	0%	13%	0%
2001	51%	2%	29%	12%	0%	7%	0%
2002	51%	3%	24%	14%	0%	9%	0%
2003	47%	4%	21%	10%	0%	12%	0%
2004	45%	4%	25%	9%	0%	7%	0%
2005	51%	4%	28%	11%	0%	7%	0%
2006	51%	4%	28%	12%	0%	7%	0%

Recovery Planning for Lower Columbia River Chinook
The LCFRB Recovery Plan specifies nine actions to be taken for Lower Columbia River Chinook. These include directions to:

1. review the 49% RER used for managing tule Chinook and analyze other populations to determine applicability of the Coweeman-based RER as an indicator for other populations in the ESU;
2. consider the use of a sliding scale for managing tule Chinook based on indicators of abundance and marine survival;
3. periodically review harvest targets for fall Chinook to assure that harvest objectives are synchronized with habitat productivity and capacity;
4. develop a collaborative forum among managers to consider how harvest impacts will be shared between ocean and river fisheries, and treaty and non-treaty fishers;
5. review management tools to assure impacts to fall Chinook remain within agreed limits;
6. manage ocean and inriver fisheries to meet the escapement goal for North Fork Lewis River Chinook;
7. develop better management tools for inseason monitoring of stock specific impacts of fall Chinook in Columbia River fisheries;
8. develop a basin wide marking plan for hatchery tule Chinook;
9. address technical and policy issues related to mass marking of tule Chinook and develop programs to monitor recoveries.

Most of these actions either have been or are being implemented. Items 1 and 3 call for a review of the RER objectives, and inclusion of other populations in the analysis. The ad hoc Work Group reviewed the Coweeman RER and added two more populations to the mix. The idea of using a sliding scale (item 2) to manage tule Chinook has not been pursued in detail, but may be forthcoming after consideration of more population specific criteria. A forum for managing fall Chinook (item 4) has developed by necessity in recent years through the Council and North of Falcon preseason planning processes.

Item 5 calls for a review of management practices to assure harvest impacts remain within prescribed limits. The Northwest Fisheries Science Center previously conducted such reviews (Kope 2005, 2006, 2007). The Council and ad hoc Work Group continued to focus on the problem in 2007 and 2008. The Council approved a newly developed indicator stock for Lower Columbia River natural-origin tule Chinook for use in preseason modeling. The Work Group also developed a harvest indicator stock based on a composite of CWT groups that is compatible with that used by the Council (LCTCWG 2008). The Council made necessary adjustments in their assessment procedures.

Fisheries have been managed routinely to meet the escapement goal for the North Fork Lewis, although there was a shortfall in 2007 as described in the status section (item 6). Further review of inseason management procedures for Columbia River fisheries may still be in order, although we are not aware of any particular problems with existing methods (item 7). Hatchery managers have already implemented a mass marking program for all tule Chinook programs in the basin (item 8), although further work is likely needed on related policy and technical details (item 9). So actions recommended by the Recovery Plan have, for the most part, been implemented, although there is still work to be done to define the specific level of harvest that is consistent with survival and recovery.

The Lower Columbia River Chinook ESU is more complex than many in that it incorporates three distinct life history types. In addition to defining and accounting for the population structure and geographical strata, it is also necessary to consider the status and effects of the action of spring, bright, and tule life history types. The LCFRB Recovery Plan defines the population structure of the ESU, and recommends a tentative recovery scenario that associates each population with a target viability level (Table 17). The Plan also provides preliminary recommendations for minimum viability abundance goals. As described above, additional recovery planning activities are ongoing including Oregon's effort to finalize recovery criteria for Oregon-side populations. Some of the details in the current Plan may change. For example, the HSRG has recommended changes in the target viability levels for some populations under the recovery scenario (HSRG 2007).

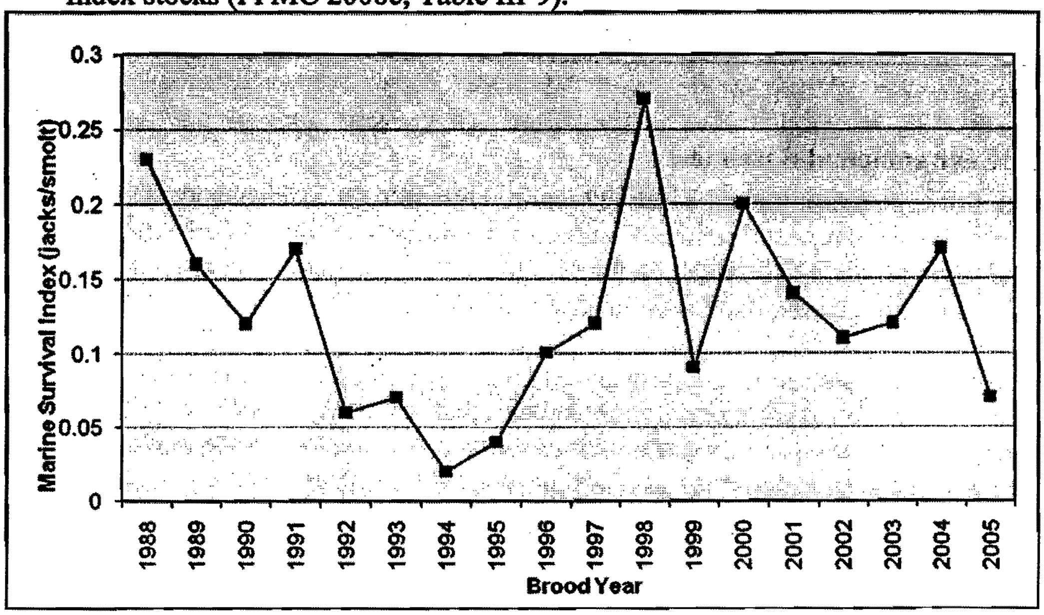
3.2.5 Natural Conditions

Natural changes in the freshwater and marine environments play a major role in salmonid abundance. Recent evidence suggests that marine survival among salmonids fluctuates in response to 20- to 30-year cycles of climatic conditions and ocean productivity (Hare et al. 1999). This phenomenon has been referred to as the Pacific Decadal Oscillation; this has also been referred to as the Bidecadal Oscillation (Mantua et al. 1997). The variation in ocean conditions has been an important contributor to the decline of many stocks. It is apparent that ocean conditions that affect the productivity of Pacific Northwest salmon populations have been in a low phase of the cycle for some time (Mantua, 2007). However, recent information suggests that ocean conditions may have undergone a substantive change beginning in 1999 as indicated by cooler ocean temperatures, changes in species composition of zooplankton, fewer pelagic predators such as hake and mackerel, and the increased abundance of bait fish (personal communication with Bob Emmett, Research Scientist, NMFS, June 7, 2001). Many salmon stocks in the Columbia Basin and along the west coast have shown substantial increases in abundance, in some cases to record levels in recent years. Although there were several years of apparently favorable ocean conditions in the earlier part of the decade, for many stocks there has been a general pattern of decline over the last few years. Escapements in 2007 were low for many stocks, particularly for those coming from coastal areas off Oregon and California. The declines are likely related to poor ocean conditions (MacFarlane et.al. 2008, Varansi and Bartoo 2008).

The effect of improving ocean conditions is discussed in the proposed listing notice for Lower Columbia River coho and Chinook ESUs (69 FR 33102, June 14, 2004). In summary, the Federal Register notice cautions that even under the most optimistic scenario, increases in abundance might be only temporary and could mask a failure to address underlying factors for decline. The real conservation concern for West Coast salmon is not how they perform during periods of high marine survival, but how prolonged periods of poor marine survival affect the VSP parameters of abundance, growth rate, spatial structure, and diversity. It is reasonable to assume that salmon populations have persisted over time, under pristine conditions through many such cycles in the past. Less certain is how the populations will fare in periods of poor ocean survival when their freshwater, estuary, and nearshore marine habitats are degraded. Down turns in survival in the last few years suggest the need for continued scrutiny of affected populations

For Lower Columbia River coho, the variability in marine survival is indicated by the return rate of hatchery jacks per smolt released. Marine survival for coho was very low during the decade of the 1990s, but has been generally higher for the last 8-10 years (Figure 14). Marine survival for the 2005 brood year of Lower Columbia River coho which is indicative of expected returns in 2008, was categorized as Extremely Low (PFMC 2008c; Table III-9).

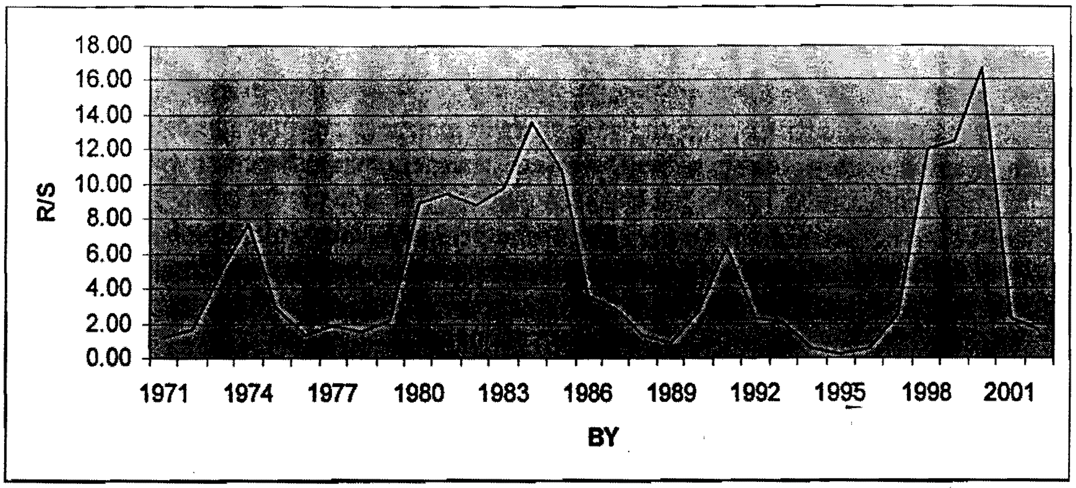
Figure 14. The marine survival rate for hatchery smolts for Oregon Production Index stocks (PFMC 2008c; Table III-9).



Marine survival for Lower Columbia River Chinook stocks is indicated by estimates of brood year specific returns per spawner. The Chinook brood year survival rates need to be lagged forward appropriately to be compared to those of coho (note that the time series for coho is shorter than for Chinook). The general pattern of survival is similar, with a decade of relative low survival rated beginning with brood year 1987 or so, followed by several years of higher survival rates (Figure 15).

Salmon are exposed to high rates of natural predation, particularly during freshwater rearing and migration stages. Ocean predation may also contribute to substantial natural mortality, although it is not known to what degree. In general, salmonids are prey for pelagic fishes, birds, and marine mammals, including harbor seals, sea lions, and killer whales. There have been recent concerns that the rebound of seal and sea lion populations – following their protection under the Marine Mammal Protection Act of 1972 – has caused a substantial number of salmonid deaths.

Figure 15. Recruits per spawner by brood year for Coweeman tule Chinook.



3.3 Environmental Baseline

The following environmental baseline section refers to the historical and current effects under the environmental baseline. However, by definition, the proposed action is not part of the environmental baseline, therefore no future PFMC or U.S. Fraser Panel harvest effects on coho are assumed or implied in the baseline.

Environmental baselines for biological opinions are defined by regulation at 50 CFR 402.02, which states that an environmental baseline is the physical result of all past and present state, Federal, and private activities in the action area affecting the listed species, along with the anticipated impacts of all proposed Federal projects unrelated to the proposed action, in the action area (that have already undergone formal or early section 7 consultation). By examining those individual effects of activities in the action area, together with the effects described in the previous section, it is possible to describe the species' status in the action area at the time that the actions that are the subject of this opinion are proposed.
As described in section 1.2, the action area comprises the offshore and near shore marine areas in the EEZ, and the the coastal and inland marine waters of the states of Washington, Oregon and California which may be indirectly affected by the federal action, and the Strait of Juan de Fuca and San Juan Islands (Figure 1). The discussion of activities under the environmental baseline that affect the Lower Columbia River coho and Lower Columbia River Chinook ESUs focus on salmon and groundfish fisheries in the action area. We are not aware of other activities in the action area that have significant effects on the ESUs in question.

The impacts considered in this and the following sections include the estimated fishing-related mortality associated with direct, indirect, and inter-related and inter-dependent effects of the action. For example, fishing activities may result in non-lethal (harassment, pursue, etc) take associated with the operation of certain gear types or fishing methods, e.g., effects on fish behavior. However, these effects are unknown and unquantifiable at this time.

3.3.1 Groundfish Fisheries

NMFS recently concluded a supplemental biological opinion regarding the PFMC Groundfish Fish Management Plan with particular attention to both the whiting fishery and limited entry trawl fisheries (NMFS 2006b). The total bycatch of all coho in the whiting fishery has averaged 250 fish per year coast-wide since 1991. The bycatch of coho in the limited entry trawl fishery averaged 40 fish per year from 2002-2004. Given the scope of the groundfish fisheries in the action area, catch information actually indicates that coho bycatch is a rare event. Individual coho from the Lower Columbia River ESU may be caught on occasion as bycatch in the groundfish fisheries, but the overall impact on the ESU is considered negligible.

The bycatch of all Chinook in the whiting fishery has averaged 7,075 fish coast-wide since 1991. The bycatch of Chinook in the limited entry trawl fishery averaged 11,320 fish annually from 2002-2004. Of the listed Chinook ESUs, NMFS concluded that four (Snake River fall Chinook, Lower Columbia River Chinook, Upper Willamette Chinook, and Puget Sound Chinook) were the ones most likely to be subject to measurable impacts. Qualitative characterization of these ESU-specific impacts ranged from rare to exploitation rates that ranged from a "small fraction of 1% per year" to "less than 1% per year" depending on the ESU or populations being considered. The bycatch of Chinook in the groundfish fisheries compares to the hundreds of thousands, sometimes exceeding a million, Chinook caught in salmon fisheries off the west coast each year (PFMC 2007). Impacts in the groundfish fisheries are not zero, but are relatively small.

3.3.2 U.S. Fraser Panel Fisheries

The catch of Lower Columbia River coho in Puget Sound fisheries is generally quite low. Tribal and non-tribal Puget Sound salmon fisheries have accounted for less than one percent on average of the fishery-related mortality of the Lower Columbia River coho salmon ESU (range = 0.1% to 2.2%)(personal communication with Larrie Lavoy, WDFW, Salmon Policy Analyst, March 21, 2005; PFMC 2001; PFMC 2002; PFMC 2003b; PFMC 2004). Impacts in U.S. Fraser Panel Fisheries would be lower since they are a subset of Puget Sound fisheries. Exploitation rates for the Lower Columbia River coho salmon ESU have averaged 0.2 percent historically (range = 0.0% to 0.3%) and 0.1 percent since 2001 (range = 0.1% to 0.2%).

The exploitation rate of Lower Columbia River tule Chinook in Puget Sound fisheries is also low, averaging less than 0.5%, both over the long term, and in recent years. Fraser fisheries are again, a subset of those that occur in Puget Sound so impacts in Fraser Panel fisheries would be even lower.

3.3.3 PFMC Salmon Fisheries

PFMC fisheries have generally accounted for about 60% of the Lower Columbia River coho harvest mortality since 1994 when harvest of coho was reduced. Exploitation rates for ocean fisheries averaged 80% from 1970-1983, 49% from 1984-1993, and 10% from 1994-2007 (Table 28). Estimates of exploitation rates are higher since 2002, and are based on preseason model estimates.

The harvest impacts to Lower Columbia River spring Chinook populations in PFMC and Fraser Panel fisheries have been relatively consistent, and averaged about 10% since 1994 (Table 29). The harvest impacts to Lower Columbia River bright populations in these fisheries have generally been less than 10% averaging less than 5% since 1979 (Table 30). For Lower Columbia River tule Chinook, PFMC and Fraser fisheries have generally accounted for about 35% of the total harvest mortality. Exploitation rates in PFMC fisheries averaged 16% from 1983-1993 and 9% since 1994 (Table 31).

3.4 Summary

In conclusion, given all the factors for decline—even taking into account the corrective measures that have been implemented—it is still clear that biological requirements for Lower Columbia river coho and Lower Columbia River Chinook are currently not being met. There is some indication the Lower Columbia River coho ESU may be responding favorably to improved natural conditions and actions taken to reduce human-induced mortality. However, the survival and recovery of the species depends on their ability to also persist through periods of low ocean survival. Thus circumstances are such that there must be a continued improvement in the environmental conditions (over those currently included under the environmental baseline and outside the action area but greatly affecting the ESUs). Any further degradation of the environmental conditions could have a large impact because the ESUs are already at risk. In addition, efforts to minimize impacts caused by dams, harvest, hatchery operations, and habitat degradation must continue. Since 1994, postseason estimates of harvest related mortality for Lower Columbia River coho have averaged 10% in the PFMC and U.S. Fraser Panel fisheries. Since 1994, the exploitation rate of Lower Columbia River tule Chinook in the action area has averaged about 9%. The bycatch of Lower Columbia River coho and Lower Columbia River Chinook in PFMC area groundfish fisheries are comparatively much lower.

4.0 EFFECTS OF THE ACTION

The purpose of this section is to identify and evaluate the effects of the proposed PFMC and U.S. Fraser Panel Fisheries on listed Lower Columbia River coho and Lower Columbia River Chinook. The methods NMFS uses for evaluating effects are discussed first, followed by discussions of the effects of the proposed fisheries on the two ESUs.

4.1 Factors to Be Considered

Fisheries may affect salmonid ESUs in several ways which have bearing on the likelihood of continued survival and recovery of the species. Immediate mortality effects accrue from the capture, by hook or net, and subsequent retention of individual fish - those effects are considered explicitly in this opinion. In addition, mortalities may occur to any fish which is caught and released alive. This is important to consider in the review of fishery management actions, as catch-and-release mortalities primarily result from implementation of management regulations designed to reduce mortalities to listed fish through live release.

The catch-and-release mortality rate varies for different gear types, different species, and different fishing conditions, and those values are often not well known. Catch-and-release mortality rates have been estimated from available data and applied by the PFMC Salmon Technical Team (STT) and co-managers in the calculation of impacts to listed fish evaluated in this consultation. The STT applies a 7.0 to 26.0 percent incidental mortality rate to both Chinook and coho caught and released during recreational fishing and ocean troll activities in PFMC Fisheries depending on the area caught and the age of the fish. Mortality rates ranging from 10 to 45 percent are applied to both Chinook and coho caught and released during purse seine or other commercial net fisheries inside Puget Sound, including Fraser Panel area fisheries

The STT also applies an incidental mortality rate to Chinook and coho that encounter the gear but drop off the gear before they can be handled by the fishermen. This drop off or 'other' mortality is estimated as 5 percent of total encounters for commercial troll and recreational gear, and from 1.0 to 3.0 percent for gillnet, setnet, and reef net gear (MEW, 2006). Estimates of catch-and-release mortality are combined with landed catch estimates when reporting the expected total mortality, and so are also specifically accounted for in this biological opinion.

NMFS' Guidance Letter to PFMC provided several observations that are relevant to this consultation (Lohn and McInnis 2008), particularly the relationship between ocean and inriver fisheries. Lower Columbia River coho and Lower Columbia River Chinook are caught in ocean fisheries. These species are also caught in the Columbia River, primarily in state managed commercial and recreational fisheries in areas below Bonneville Dam. The inriver fisheries are currently managed subject to the terms of the 2005-2007 Interim Management Agreement between the U.S. v. Oregon parties. The 2005 Interim Agreement and the associated biological opinion were recently extended by the parties through May 8, 2008 (Lohn 2008). The *U.S v. Oregon* parties are expected to complete a new successor agreement by May 8. This section 7 consultation applies specifically to PFMC area and Fraser Panel Fisheries. Fisheries in the Columbia River will not begin to catch Lower Columbia River coho or Lower Columbia River Chinook until at least August as the fish begin to return to spawn.

The 2008-2017 *U.S v. Oregon* Agreement would succeed the 2005 Interim Agreement and includes provisions related to fall season fisheries and their affect on Lower Columbia River Chinook and coho. In brief, the *U.S v. Oregon* fisheries would be subject to the same total harvest limits for Lower Columbia River Chinook and coho that are being considered in this consultation. Allocation of harvest between ocean and inriver fisheries can occur, but both are subject to the same overall limit. Because this consultation on PFMC and Fraser fisheries will be completed first, it is the primary vehicle for analyzing the overall effect of harvest for these ESUs.

4.1.1 Lower Columbia River Coho

NMFS' consideration of the effects of harvest on Lower Columbia River coho and how they should be managed over the long term remains a work in progress. Since ESA listing in 2005, the states of Oregon and Washington have been working with NMFS to develop and evaluate a management plan for Lower Columbia River coho that can be used as the basis for their long-term management. The states of Oregon and Washington have focused on use of a harvest matrix for Lower Columbia River coho developed by Oregon following their listing under Oregon's State ESA. Under the matrix the allowable harvest in a given year depends on indicators of marine survival and brood year escapement. Oregon's matrix has both ocean and inriver components which can be combined to define a total exploitation rate limit for all ocean and inriver fisheries. Generally speaking, NMFS supports use of management planning tools that allows harvest to vary depending on the year-specific circumstances. Conceptually, we think Oregon's approach is a good one. Unfortunately, we do not yet have a quantitative assessment of the effects of the harvest proposal that we can rely on. Beamesderfer (2007) provided a quantitative risk assessment of Oregon's harvest matrix that included both the ocean and inriver components. The analysis concluded that the matrix is adequate to protect the majority of Lower Columbia River coho populations. The Northwest Science Center subsequently reviewed the analysis and expressed reservations about some of the methods and underlying assumptions and indicated that the conclusions were not well supported (McElhaney 2007). The next step will be to redo the risk assessment while addressing the Science Center's comments. Absent a more complete quantitative assessment, our determination must rely on more qualitative considerations.

The harvest matrix being considered for management for Lower Columbia River coho is nearly identical to the one being used for Oregon Coast coho. NMFS reviewed the harvest matrix as applied to Oregon Coast coho through a section 7 consultation and concluded that it was consistent with the no jeopardy requirements for survival and recovery (NMFS 1999a). NMFS needs to complete the analysis of the matrix as it applies to Lower Columbia River coho and the particular circumstances for this species. But our experience with Oregon Coast coho provides an example and further perspective, qualitative though it may be, regarding the adequacy of the matrix as applied to Lower Columbia River coho.

For the last two years, NMFS has taken a more conservative approach for Lower Columbia River coho because of unresolved issues related to application of the matrix. NMFS has relied on the matrix, but limited the total harvest impact rate to that allowed for ocean fisheries through its guidance to the Council. Given the particular circumstances regarding marine survival and escapement, the allowable exploitation rates in 2006 and 2007 were 15% and 20%, respectively.

The matrix is currently keyed to the status of Clackamas and Sandy populations. However, it remains unclear whether reliance on these two indicators is adequately protective of other populations in the ESU. The state of Oregon is currently engaged in recovery planning for all listed species in the lower Columbia River, and Washington is updating their interim Recovery Plan to address coho. NMFS expects that the necessary planning can be completed this year. Through recovery planning we expect the states will identify recovery objectives for all populations, and identify those populations that will be prioritized for high viability. Once completed, the information can then be used to refine the matrix to ensure that it addresses the needs of priority populations in particular and all populations in general. NMFS also thinks that it is appropriate to review the information related to seeding capacity that sets the abundance criteria in the matrix for each population. Until these issues are resolved and we can revisit details of the current matrix, NMFS indicated in its Guidance to the Council for 2008 that they would continue to apply the matrix as we have in recent years. NMFS will apply the matrix, in 2008 and for the foreseeable future, but limit the total harvest in Council and inriver fisheries to that specified in the ocean portion of the harvest matrix (Tables 3a). In 2008, the total allowable exploitation rate for the specified fisheries is 8%. In future years, the allowable exploitation rate may vary, but will be set using the matrix and applicable brood year escapement and marine survival indicators.

4.1.2 Lower Columbia River Chinook

Before describing the effects of the proposed fisheries on Lower Columbia River Chinook, it will be useful to provide some background on two subjects. First, to understand the context for the current consultation, it is necessary to describe how information has evolved in recent years and the status of developing information that is relevant to this consultation. It is also appropriate to describe how and why we anticipate circumstances to continue to evolve over the next few years. Second, it is important that we provide some background regarding the analytical methods that are used, at least in part, for analyzing the effects of the proposed action.

Status of Developing Information Related to Harvest and Hatchery Reform

As indicated above, the Lower Columbia River Chinook ESU includes spring-run and fall-run "bright" and "tule" life history types. Although we consider spring and bright populations in this consultation, the focus is on our ongoing consideration of management for tule fall Chinook.

Lower Columbia River Chinook were first listed in 1999. As is often the case with a new listing, the kind of information that one would like to have for a section 7 consultation is limited. For example, information about the population structure of the ESU, the status of each of the populations, recovery objectives, and the relative effects of different limiting factors is often incomplete. NMFS is nonetheless required to conduct section 7 consultation on proposed actions based on best available information. Early consultations on a newly listed species are therefore often for one year, or short duration at least, to provide time to develop the information needed to consider a more programmatic action that would extend longer in time. The circumstances related to Lower Columbia River coho described elsewhere in this opinion provide a good example of this sort of sequenced and developmental approach.

When Lower Columbia River Chinook were first listed in 1999, NMFS applied the recently developed VRAP and RER method described below for analyzing effects of harvest actions on the Coweeman population as part of an opinion on the Pacific Salmon Treaty (NMFS 1999b). The Coweeman population was used as an index stock to represent fishery effects on all tule populations in the ESU. Coweeman was chosen because it was one of the few tule natural-origin populations in the ESU that was not greatly influenced by hatchery strays, and because the necessary data was readily available. The initial estimate of the rebuilding exploitation rate (RER) for Coweeman was 65%. This RER was used for consultation purposed until 2001. In 2002, NMFS updated and reanalyzed the data and revised the RER to 49%. The 49% RER was used as a consultation standard for 5 years through 2006.

In the meantime, better information regarding the status and structure of the ESU has been developed, most notably by the WLC TRT and through recovery planning by the LCFRB. By 2006 it was apparent that there was enough new information on the population structure of the ESU, which populations were considered priority population of the ESU, and critical and viable criteria that could be used for assessing population status to warrant another review. The VRAP procedure itself calls for periodic review of the data and resulting metrics. The prospects for refining the data necessary for analyzing additional tule populations were also improved.

In the 2006 Guidance Letter to the Council, NMFS indicated their intention to review the 49% standard understanding that this would take some time (Lohn and McInnis 2006). The LCFRB Recovery Plan had also called for a review of the 49% standard and the associated effects of fishing on other Lower Columbia River tule populations. In response, NMFS organized an ad hoc Work Group that included staff from the Northwest Fisheries Science Center and Washington Department of Fish and Wildlife (hereafter "the Work Group"). The Work Group worked on the project for several months. By February 2007, NMFS was again required to provide its guidance to the Council for 2007. Although there was more work to do, the Work Group had made significant progress. Results from the first phase of the analysis provided the basis for the 2007 guidance to the Council and NMFS consultation on the 2007 inriver fisheries (Lohn and McInnis 2007).

One thing that became apparent during the review was that it is difficult to evaluate populations whose natural escapement consists largely of stray hatchery fish, such as the Kalama, Washougal, and Lower Cowlitz populations. In particular, estimates of natural productivity in these populations are often very low, and it is not always clear if these estimates reflect the state of the natural population or are biased downward due to the large number of hatchery strays. The Work Group analyzed all populations for which it could obtain data, but because of uncertainty in how to evaluate harvest effects on hatchery dominated populations, the Work Group focused much of its attention on tule populations in the Coweeman, East Fork Lewis, and Grays rivers, all of which have relatively little hatchery influence and recently updated escapement data. These populations are also designated as primary populations in the LCFRB's recovery plan and are thus prioritized for high viability. The Work Group focused on developing rebuilding exploitation rates for the three populations based on the method used previously to calculate the 49% exploitation rate used for the Coweeman. The Work Group also made use of several recovery planning documents and analyses that have become available since 2002, including the LCFRB's Recovery Plan and several WLC TRT reports on population viability. In particular, in addition to estimating RERs, the team also considered the viability assessment methods developed by the WLC TRT to evaluate the effects of alternative exploitation rates on population viability. Based on the available information, NMFS specified a total exploitation rate limit of 42% which was used for consultation purposes for the 2007 PFMC and inriver fisheries (NMFS 2007a, NMFS 2007d).

After the 2007 consultations, the Work Group continued their analysis to address outstanding issues. The Work Group finalized a report in October 2007 that summarized their findings from the first phase of the analysis, and provided some additional information that was not available in February when NMFS provided its guidance for the 2007 season (Ford et al. 2007). Since the February report the Work Group has incorporated a marine survival covariate into the spawner recruit analysis. Use of the marine survival indicators improved the fit of the models. The Work Group also developed a new composite harvest indicator stock that included seven coded wire tag groups. In the previous analysis, one tag group was used to analyze the Coweeman population, and three were used for analysis of the Lewis and Grays. The Work Group determined that the composite stock would better represent the distribution and thus harvest impacts of tule populations in the ESU. The change was also designed to improve the compatibility between the RER estimates and the FRAM model used by the Council for management planning. The results of this more recent analysis are reported in an Addendum to the October 2007 report (LCTCWG 2008).

In the meantime, the states of Oregon and Washington and other co-managers had initiated a substantial review of hatchery management practices through the Hatchery Scientific Review Group (HSRG). The HSRG was established and funded by Congress to provide an independent review of current hatchery programs in the Columbia River Basin. Recent developments related to the HSRG review, and implementation of recommendations resulting from that review, are discussed in more detail in section 2.2.3.

Briefly here, recall that NMFS articulated in its 2007 Guidance Letter increased focus on integrating its harvest rate analysis with other efforts to rebuild and recover tule populations (Lohn and McInnis 2007). With regard to hatchery production, NMFS highlighted a choice in the Guidance Letter framed by the results of the HSRG report that emphasized the need to reduce the effect of hatchery-origin fish on natural-spawning populations. The two general options for addressing the problem were to either substantially reduce or eliminate existing hatchery programs, or to reprogram existing production to reduce straying, increase the ability of fisheries to differentially harvest hatchery fish, and install a system of weirs in key locations that can be used to manage the interactions between hatchery and natural-origin fish. In either case, it remains clear that hatchery programs and the fisheries they support must change significantly over the next several years. In response, the states have considered the HSRG recommendations, the LCSRP and other information, and have developed a comprehensive and integrated hatchery and harvest reform program (Anderson and Bowles 2008).

In reviewing the effects of the proposed action, it is important to consider the results of the ongoing research and progress on reforms. In this opinion, we focus on the effects of the fisheries in 2008. This short term perspective allows us to continue to assess progress in implementing the reforms. It also recognizes that the reforms and resulting benefits will accrue over the next several years. It has taken decades for the populations to decline to their current status and will take years for them to recover. A successful recovery strategy will require steady progress and patience. In this case, we must ensure that the near term risks associated with an orderly implementation of harvest and hatchery reforms are small, and that there is a high likelihood of recovery associated with the overall recovery strategy.

Analytical Methods and Results

Viability Risk Assessment Procedure

NMFS analyzes the effects of harvest actions on populations using quantitative analyses where possible and more qualitative considerations where necessary. The Viable Risk Assessment Procedure (VRAP) is an example of a quantitative risk assessment method that was developed by NMFS, and applied so far primarily for analyzing harvest impacts on Puget Sound and Lower Columbia River tule Chinook. VRAP provides estimates of population-specific exploitation rates (called Rebuilding Exploitation Rates or RERs) that are designed to be consistent with ESA-related survival and recovery requirements. Proposed fisheries are then evaluated, in part, by comparing the RERs to rates that can be anticipated as a result of the proposed harvest plan. Where impacts of the proposed plan are less than or equal to the RERs, NMFS considers the harvest plan to present a low risk to that population. (The context and basis of NMFS' conclusions related to RERs is discussed in more detail below.) The results of this comparison, together with more qualitative considerations for populations where RERs cannot be calculated, are then used in making the jeopardy determination for the ESU as a whole. A brief summary of VRAP and how it is used to estimate an RER is provided below. For a more detailed explanation see NMFS (2000d) and NMFS (2004b).

The Viable Risk Assessment Procedure:

- quantifies the risk to survival and recovery of individual populations,
- accounts for total fishing mortality throughout the migratory range of the ESU,
- explicitly incorporates management, data, and environmental uncertainty, and
- isolates the effect of harvest from mortality that occurs in the habitat and hatchery sectors.

The result of applying the VRAP to an individual population is an RER which is the highest allowable ("ceiling") exploitation rate that satisfies specified risk criteria related to survival and recovery. Calculation of RERs depend on the selection of two abundance-related reference points (referred to as critical and upper escapement thresholds (CET and UET)), and two risk criteria that define the probability that a population will fall below the CET and exceed the UET. Considerations for selecting the risk criteria and thresholds are discussed briefly here and in more detail in NMFS 2000d.

The selection of risk criteria for analytical purposes is essentially a policy decision. For jeopardy determinations, the standard is to not "...reduce appreciably the likelihood of survival and recovery ..." (50 CFR section 402.2). In this context, NMFS used guidance from earlier biological opinions to guide the selection of risk criteria for VRAP. NMFS' 1995 biological opinion on the operation of the Columbia River hydropower system (NMFS 1995) considered the biological requirements for Snake River spring/summer Chinook to be met if there was a high likelihood, relative to the historic likelihood, that a majority of populations were above lower threshold levels2 and a moderate to high likelihood that a majority of populations would achieve their recovery levels in a specified amount of time. High likelihood was considered to be a 70% or greater probability, and a moderate-to-high likelihood was considered to be a 50% or greater probability (NMFS 1995). The Cumulative Risk Initiative (CRI) has used a standard of 5% probability of absolute extinction in evaluating the risks of management actions to Columbia River ESUs. The different standards of risk, i.e., 50% vs 5%, were based primarily on the thresholds that the standard was measured against. The CRI threshold is one of absolute extinction, i.e., 1 spawning adult in a brood cycle. The Biological Requirements Work Group (BRWG 1994) threshold is based on a point of potential population destabilization, i.e., 150-300 adult spawners, but well above what would be considered extinction. In fact, several of the populations considered by the BWRG had fallen below their thresholds at some point and rebounded, or persisted at lower levels. Since the consequences to a species of the CRI threshold are much greater than the consequences of the BWRG thresholds, the CRI standard of risk should be much higher (5%). Scientists commonly define high likelihood to be ≥95%. For example, tests of significance typically set the acceptable probability of making a Type I error at 5%. The basis of the VRAP critical threshold is more similar to the BWRG lower threshold in that it represents a point of potential population destabilization. However, given the uncertainties in the data, especially when projected over a long period of time, we chose a conservative approach both for falling below the critical threshold, i.e., 5%, and exceeding the recovery threshold, i.e., 80%.

The risk criteria were chosen within the context of the jeopardy standard. They measure the effect of the proposed action against the baseline condition, and require that the proposed action not result in a significant negative effect on the status of the species over the conditions that already exist. We determined that the risk criteria consistent with the jeopardy standard would be that 1) the percentage of escapements below the critical threshold differs no more than 5% from that under baseline conditions; <u>and</u>, 2) the viable

[2] The Biological Requirements Work Group defined these as levels below which uncertainties about processes or population enumerations are likely to become significant, and below which qualitative changes in processes are likely to occur (BRWG 1994). They accounted for genetic risk, and some sources of demographic and environmental risk.

threshold must be met 80% of the time, or the percentage of escapements less than the viable threshold differs no more than 10% from that under baseline conditions. Said another way, these criteria seek to identify an exploitation rate that will not appreciably increase the number of times a population will fall below the critical threshold and also not appreciably reduce the prospects of achieving recovery. For example, if under baseline conditions, the population never fell below the critical threshold, escapements must meet or exceed the critical threshold 95% of the time under the proposed harvest regime.

As described above, VRAP uses and critical escapement and upper escapement thresholds as benchmarks for calculating the RERs. The CET represents a boundary below which uncertainties about population dynamics increase substantially. In the rare cases where sufficient stock-specific information is available, we can use the population dynamics relationship to define this point. Otherwise, we use alternative population-specific data, or general literature-based guidance. NMFS has provided some guidance on the range of critical thresholds in its document, *Viable Salmonid Populations* (McElhaney et al. 2000). The VSP guidance suggests that effective population sizes of less than 500 to 5,000 per generation, or 125 to 1,250 per annual escapement, are at increased risk. For the Lower Columbia River tule analyses, we generally used CETs corresponding to the WLC TRT's quasi-extinction thresholds (QET): 50/year for four years for 'small' populations, 150/year for four years for medium populations, and 250/year for four years for large populations (McElhany et al., 2006).

The UET may represent a higher abundance level that would generally indicate recovery or a point beyond which ESA type protections are no longer required. The UET could also be an estimate of the spawners needed to achieve maximum sustainable yield or for maximum recruits, or some other designation. It is important to recognize, though, that the UET is not an escapement goal but rather a threshold level that is expected to be exceeded most of the time (≥ 80%). It should also be noted that, should the productivity and/or capacity conditions for the population improve, the UET should be changed to reflect the change in conditions.

There is often some confusion about the relationship between upper escapement thresholds used in the VRAP analysis, and abundance related recovery goals. The UET is sometimes less than recovery goals that are specified in recovery plans. VRAP seeks to analyze a population in its existing habitat given current conditions. As the productivity and capacity of the habitat improves, the VRAP analysis will be adjusted to reflect those changes. Thus the UET serves as a step in the progression to recovery, which will occur as the contributions from recovery action across all sectors are realized. In this application of the VRAP for Lower Columbia Chinook populations, we explored a variety of UETs, including the spawner escapement that would produce maximum sustained yield (MSY) associated with the spawner/recruit function used in the VRAP analysis, the mean of natural-origin spawner escapement, and the mean of natural spawner escapement (mean calculated over the available time series).

There are two phases to the VRAP process for determining an RER for a population. The first, or model fitting phase, involves using data from the target population itself, or a representative indicator population, to fit a spawner-recruit relationship representing the performance of the population over time period analyzed. Population performance is modeled as

$$R = f(S, \mathbf{e}),$$

where S is the number of fish spawning in a single return year, R is the number of adult equivalent recruits3, and **e** is a vector of environmental, density-independent indicators of annual survival.

Several data sets are necessary for this: a time series of natural spawning escapement, a time series of total recruitment by cohort, and time series for the environmental correlates of survival. In addition, one must assume a functional form for f, the spawner-recruit relationship. Given the data, one can numerically estimate the parameters of the assumed spawner-recruit relationship to complete the model fitting phase.

The data are fitted using three different models for the spawner recruit relationship: the Ricker (Ricker 1975), Beverton-Holt (Ricker 1975), and Hockey stock (Barrowman and Meyers 2000). The simple forms of these models can be augmented by the inclusion of environmental variables correlated with brood year survival. The VRAP is therefore flexible in that it facilitates comparison of results depending on assumptions between production functions and any of a wide range of possible environmental co-variates.

Equations for the three models are as follows:

$R = (aSe^{-bS})(M^c e^{dF})$ [Ricker]

$R = (S/[bS + a])(M^c e^{dF})$ [Beverton-Holt]

$R = (\min[aS, b])(M^c e^{dF})$ [hockey stick]

In the above, M is the index of marine survival and F is the freshwater correlate.

The second, or projection phase, of the analysis involves using the fitted model in a Monte Carlo simulation to project the probability distribution of the near-term future performance of the population assuming that current conditions of productivity continue. Besides the fitted values of the parameters of the spawner-recruit relationships, one needs estimates of the probability distributions of the variables driving the population dynamics, including the process error (including first order autocorrelation) of the spawner-recruit relationship itself and each of the environmental correlates. Also, since fishing-related mortality is modeled in the projection phase, one must estimate the

3 Equivalently, this could be termed "potential spawners" because it represents the number of fish that would return to spawn absent harvest-related mortality.

distribution of the deviation of actual fishing-related mortality from the intended ceiling. This is termed "management error" and its distribution, as well as the others are estimated from available recent data.

For each trial RER the population is repeatedly projected for 25 years. From the simulation results we computed the fraction of years in all runs where the escapement is less than the critical escapement threshold and the fraction of runs for which the final year's escapement is greater than the upper escapement threshold. Trial RERs for which the first fraction is less than 5% and the second fraction is greater than 80% satisfy the identified risk criteria are thus used to define the population specific ceiling exploitation rates for harvest management.

As discussed above the ad hoc Work Group focused on review and analysis of the Coweeman, Grays, and East Fork Lewis populations using the VRAP and SPAZ models. The VRAP provided a range of estimates for rebuilding exploitation rates for the three populations (Ford et al., 2007; LCTCWG 2008). The results varied depending on the spawner-recruit model used (Ricker, Beverton-Holt, Hockey Stick), and assumptions about age structure, and the abundance thresholds used in the analysis. Only results from models that incorporated estimates of marine survival as a covariate are reported because they substantially improved the fit to the data.

The Work Group provides RER estimates for a broad range of model runs under varying assumptions, but selects a subset of estimates derived from models that best fit the data (LCTCWG 2008). These can be compared to estimates that were available when NMFS developed their guidance in February 2007. Current estimates for the Coweeman population range from 34% to 58% depending on the spawner-recruit model used in the analysis. This compares to estimates of 40% to 64% from last year (Table 32). Differences between years related primarily to the use of the marine covariate and the composite CWT indicator stock.

Current estimates for the East Fork Lewis range from 44% to 52% and also depended on the spawner-recruit model used in the analysis. The current range of estimates is higher than the range reported in February 2007 (Table 32). Current estimates for the Grays River range from 0% to 20%, although the report includes a qualitative comment related to the choice of age data in the analysis that a range of 0% to 8% might be preferred (LCTCWG 2008). These results are significantly different from those available last year at this time when the RER estimates ranged from 16% to 54%. The difference is most directly related to the use of the marine survival covariate.

Table 32. Rebuilding exploitation rates calculated for three tule Chinook populations from analysis completed in February 2007 and 2008 (Ford et al., 2007; LCTCWG 2008).

Population	February 2007	February 2008
Coweemen	0.40 – 0.64	0.34 – 0.58
East Fork Lewis	0.40 – 0.44	0.44 – 0.52
Grays	0.16 – 0.54	0.00 – 0.20

Salmon Population Analyzer

The Salmon Population AnalyZer (SPAZ) is a program designed for analyzing salmon population data and is used for fitting population growth models to data, and assessing population viability or extinction risk. Although the SPAZ was not designed specifically to assess the effects of harvest on population viability, it can be used to estimate how various levels of harvest affect the related metrics. The SPAZ has not been used previously for analyzing the effects of harvest in a section 7 consultation for other populations or ESUs. The relationship between VRAP and SPAZ and resulting outputs is still an area of active research. The concepts and methods underlying SPAZ are described in detail in the most recent WLC TRT viability report (McElhany et al. 2006), which builds on the basic framework in the NOAA Technical Memoradum on Viable Salmonid Populations (VSP) (McElhany et al. 2000). A brief summary of the program and its applications is provided below.

The abundance and productivity evaluation conducted by the SPAZ model is predicated on two basic observations: 1) all else being equal, a larger population is less likely to go extinct than a small one, and 2) all else being equal, a more productive population is less likely to become extinct than a less productive population. Productivity in this context refers to "intrinsic" productivity, and is an indication of a populations "resilience" or tendency to return to high abundance if perturbed to low abundance. Intrinsic productivity is broadly defined as the number of offspring per parent when there are few parents.

The quantity and quality of data available to evaluate the abundance and productivity varies among WLC populations. We can divide the populations into two basic groups; those with sufficient time series of abundance and related parameters for a quantitative evaluation and those without sufficient time series. For those with a sufficient time series, we conducted a viability assessment under several alternative harvest rates as described below.

The primary approach the WLC TRT applied to the analysis of populations with an adequate time series is viability curve analysis. A viability curve describes a relationship between population abundance, productivity and extinction risk (WLC TRT, 2003). Extinction risk is defined as the probability that the population will fall below the critical escapement threshold, based on a four year average, any time during a 100 year forward projection. All of abundance and productivity combinations defined by the curve indicate the same level of risk. Populations with productivity and abundance combinations above and to the right of the viability curve have a lower extinction risk than those that fall on the curve, while those below and to the left have a higher risk than those that fall on the curve.

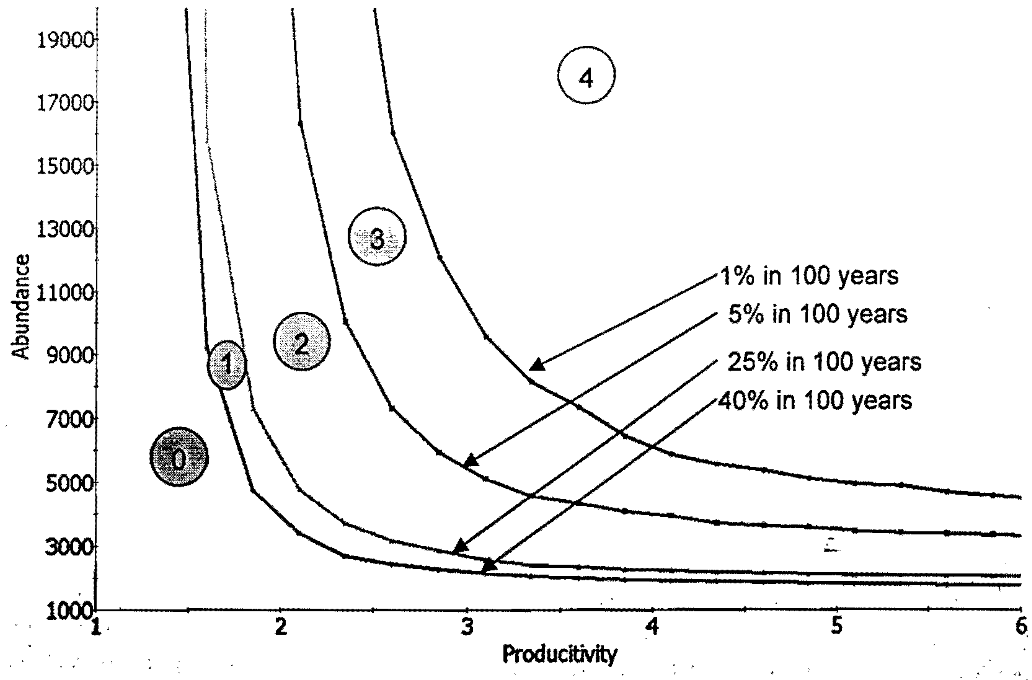


Figure 16 – Viability curves showing relationship between risk levels and population persistence categories (example based on Chinook curve). Each of the curves indicates a different risk level. The numbers in circles are the persistence categories associated with each region of the chart (i.e. the area between the curves). A population with a risk category 0 is described as a population that is nearly extinct and population with a risk category of 3 is described as "viable" (McElhany et al. 2006)

The mathematical models used to construct the viability curve (Hockey-stick with autocorrelation) and to assess the status of a population relative to the curve (Mean RS Method) are described in the TRT's viability reports (McElhany et al. 2004; McElhany et al. 2006). A key issue in the analysis is how we incorporate uncertainty in the estimation of a population's current abundance and productivity. We can not precisely estimate abundance and productivity so we present probability contours for these parameters (Figure 17). See McElhany et al. (2006 – available at: http://www.nwfsc.noaa.gov/trt/viability_report_revised.cfm) for a detailed description of the methods (see especially pp. 12-39 for a description of how current population status is assessed relative to the viability curves).

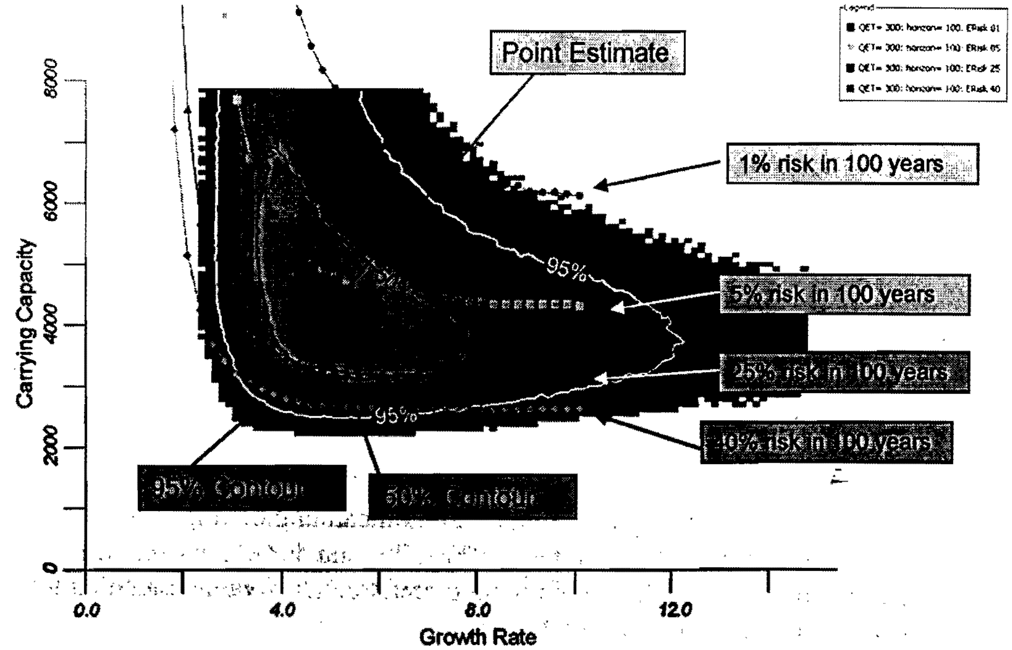


Figure 17 — Example of current status contours combined with viability curves. In this example, the point estimate of the population indicates a persistence category of 2 (i.e. between 25% and 5% viability curves). To ensure at least a 50% chance that the population exceeds a given viability curve we would examine the 50% contour, which in this example suggests the population is in persistence category 1 (the bottom of the 50% contour is between the 40% and 25% viability curves). To ensure at least a 95% chance that the population exceeds a given viability curve we would examine the 95% contour (McElhany et al. 2006)

If a population has a high intrinsic productivity, the viability curve analysis may indicate that the population is expected to be viable even if at relative low abundance level. If average abundance is too low, however, the population may be at risk from phenomena that are not incorporated into the SPAZ analyses. For example, very small populations are more likely to suffer from inbreeding depression or may not be able to maintain sufficient genetic variability for long-term survival (reviewed by McElhany et al. 2000). The results of the SPAZ analyses should therefore be interpreted carefully, and in some cases it may be appropriate to specify a viability floor higher than the viability curve alone would indicate.

The VRAP and SPAZ analysis procedures are similar in that they use available data to estimate the production dynamics of a population based on a time series of abundance data. Both models incorporate uncertainty and are used to project future outcomes. VRAP is designed to identify an exploitation rate (RER) that is associated with a small increase (5%) in the frequency of escapements that are below the critical escapement threshold relative to no harvest, and a high probability (80%) that the upper escapement threshold will be met by the end of a 25 year projected time series. SPAZ on the other hand focuses on extinction risk where extinction is defined as the probability that the population will fall below the critical escapement threshold, based on a four year average, any time during a 100 year forward projection. SPAZ can be used to assess the effects of harvest by estimating how the extinction risk changes for various levels of assumed harvest (e.g., 0%, 25%, 50%). SPAZ does not directly address the prospect of recovery.

Results from the SPAZ analysis are best displayed by the color contour graphics as shown, for example, in Figure 17 above. The graphical results of the most recent SPAZ analysis for the three principle tule populations are shown in the latest Work Group report (LCTCWG 2008). The results can also be summarized in tabular.

Results of the SPAZ analysis are sensitive to the QET value used. As expected, probabilities associated with meeting viability criteria decreased as exploitation rates increase. Differences in the results between the February 2007 (Table 33) and February 2008 (Table 34) reports are relatively minor, but probabilities were generally a bit higher in the more recent report for a given set of assumptions. For example, for the Coweeman and a QET of 150 and exploitation rate of 50%, the probability of meeting the viability criteria increased from 0.42 to 0.56.

Table 33. SPAZ analysis results from February 2007 indicating the probability of persistence associated with exploitation rates of 0%, 25%, and 50%. Persistence is defined as the probability of not falling below the specified QET value, based on a four year average, any time in a 100 year projection.

Population	**Probability of meeting viability criteria**					
	QET = 50			**QET = 150**		
	0 harvest	**25% harvest**	**50% harvest**	**0 harvest**	**25% harvest**	**50% harvest**
Coweeman	0.99	0.98	0.89	0.98	0.91	0.42
EF Lewis	NA	NA	NA	0.98	0.72	0.03
Grays	0.38	0.09	0.00	0.00	0.00	0.00

Table 34. SPAZ analysis results from February 2008 indicating the probability of persistence associated with exploitation rates of 0%, 25%, and 50%. Persistence id defined as the probability of not falling below the specified QET value, based on a four year average, any time in a 100 year projection.

Population	**Probability of meeting viability criteria**					
	QET = 50			**QET = 150**		
	0 harvest	**25% harvest**	**50% harvest**	**0 harvest**	**25% harvest**	**50% harvest**
Coweeman	1.00	0.99	0.95	0.99	0.95	0.56
EF Lewis	1.00	0.99	0.80	0.99	0.80	0.05
Grays	0.43	0.10	0.00	0.00	0.00	0.00

Finally, both VRAP and SPAZ analyze future outcomes based on estimates of population abundance and productivity from the time series of available information representing past and present conditions. The VRAP procedure projects 25 years into the future while

SPAZ utilizes and 100 year forward analysis. If conditions change in the future for better or worse the projections may likewise be either too optimistic or pessimistic. The HSRG analysis takes a different approach and provides an alternative perspective about future outcomes including those associated with harvest. The HSRG analysis is structured to consider alternative future scenarios. For example, if actions are taken to reduce adverse hatchery interactions, the HSRG assumes associated improvements in population productivity consistent with related scientific evidence.

The HSRG analysis results in population specific scenarios (HSRG 2007). One of the assumptions underlying the HSRG analysis is that population productivity (defined as spawner-to-spawner return) will increase if the influence of hatchery fish on natural-origin spawners can be reduced (HSRG 2007). For the Grays River, for example, the HSRG assumes that population productivity will double over the long term, if hatchery influence is eliminated. Productivity improvements are also assumed to occur as a result of habitat and harvest related actions. For the Coweeman, Grays, and East Fork Lewis populations, that HSRG analysis assumed 10% improvements in productivity associated with habitat actions couple, and that the exploitation rate on natural origin fish would be reduced to 32% once mark selective fisheries are implemented.

The Interim Recovery Plan described alternative scenarios for achieving recovery (LCFRB 2004). Some of the related analysis in the Interim Plan has been updated (LCFRB 2007). The scenario described in the updated Interim Plan for the Grays River assumes an improvement in productivity for habitat of 42% coupled with a 38% exploitation rate on natural origin fish. Survival improvements required for the Coweeman and East Fork Lewis in particular, and other tule populations in general, are substantially less than those required for the Grays. The scenarios described in the Interim Plan were developed for planning purposes and as an initial step that seeks to allocate necessary survival improvements across various actions and sectors. The scenarios are not predictions representing presumed final solutions, but do reflect the general goal to spread the conservation burden and maintain fishing opportunity to the degree possible.

4.2 Effects of the Proposed Actions

4.2.1 Lower Columbia River Coho

Prior to 2006, ocean fishery impacts to Lower Columbia River coho were estimated using Oregon Coast coho as a surrogate. The implicit assumption was that fish from the two ESUs had similar distributions and were thus subject to similar fishing mortality. However, as described in Section 2.2.4, Lower Columbia River coho populations have early and late run timing, with somewhat different patterns of ocean distribution. Although the distributions are broadly overlapping, the early components tend more to the south and the late component more to the north. For these and other reasons, using Oregon Coast coho as a surrogate for ocean harvest impacts to Lower Columbia River coho seemed less than ideal. Because of the need for harvest information more specific to Lower Columbia River coho, the Council's Salmon Tehnical Team (STT) changed their assessment method. Beginning in 2006, the STT estimated the ocean exploitation rate on Lower Columbia River coho using a weighted average of the rates from the two

Lower Columbia River indicator stocks in the Council's coho model. Because the coho accounts for landed catch and mortality associated with catch-and-release, the estimates are of total fishery-related mortality.

Lower Columbia River coho are caught in low numbers in Canadian fisheries and other fisheries to the north of the Council area, in Fraser Panel and other Puget Sound fisheries, in the Council area, and in fisheries in the Lower Columbia River. Plans for fisheries in the lower Columbia River are still under development and will be subject to a later consultation on the pending 2008 *U.S. v. Oregon* Agreement. In 2008, the Council proposes to manage ocean salmon fisheries in the Council's jurisdiction, in combination with fisheries in the mainstem Columbia River, subject to a total exploitation rate not to exceed 8%. The expected exploitation rate in Council fisheries is 5.9%. Some additional harvest occurs in marine fisheries outside the Council area including those in Fraser Panel fisheries inside Puget Sound. The combined exploitation rate from all marine fisheries is expected to be 6.2% (Table 35) (PFMC 2008b).

Table 35. Expected exploitation rates on natural-origin Lower Columbia River coho in 2008 marine area fisheries (PFMC 2008b).

South East Alaska	0.0
British Columbia	0.1
Puget Sound	0.2
PFMC	5.9
Total	6.2

In 2009 and thereafter, the Council is required to manage fisheries subject to the ocean portion of the harvest matrix. Exploitation rates may therefore vary based on year specific circumstances.

NMFS also considers the effect of fisheries on listed hatchery origin coho, and the complex role that hatchery fish play when evaluating the effects of harvest on the ESU. Lower Columbia River coho hatcheries are managed to meet site specific hatchery escapement goals, and thus restrict the practice of using returns from other hatcheries to back fill short falls in escapement. When evaluating harvest actions, NMFS considers whether hatchery programs will meet their escapement objectives. This is particularly important for hatchery programs that preserve the genetic legacy of key components of the ESU, or for programs used for recovery related supplementation efforts. Escapement shortfalls have not been a concern with the abundant returns in recent years even with higher exploitation rates. This is particularly true for those programs involved in supplementation or re-introduction of natural production (Table 36). All hatcheries have exceeded their escapement goals in at least 5 of the past 9 years (1998-2006). The five programs marked for supplementation or re-introduction met their goals in all of the last 9 years, except for the Sandy River program, which met the goal in 8 of the last 9 years (Table 36).

Table 36. Lower Columbia River coho hatchery programs, escapement goals and escapement, by program for the last 9 years. Shading highlights programs that are used, at least in part, to support supplementation or reintroduction activities. Numbers in bold/red font indicate years in which the escapement goal was not met for that program.

Facility		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Big Creek	Goal	828	828	700	700	700	700	525	700	700	700
	Escapement	1,949	1,684	4,034	10,047	8,365	7,946	3,545	6,555	6,175	3,938
Bonneville	Goal	8,751	8,751	6,000	6,000	5,143	6,074	6,074	6,074	6,000	6,000
	Escapement	6,076	4,512	18,116	45,163	25,888	36,318	24,438	25,609	38,001	33,954
Sandy	Goal	1,382	1,382	1,300	1,300	1,207	1,000	1,000	1,200	1,300	1,300
	Escapement	5,476	**1,013**	12,506	20,454	6,979	8,921	16,126	10,015	8,507	7,555
Grays R.	Goal	861	1,362	1,246	1,341	1,341	1,341	1,341	1,341	600	600
	Escapement	**62**	**710**	12,910	6,483	**600**	**683**	1,676	4,838	835	969
Elochoman early	Goal	669	876	510	823	823	823	823	823	420	420
	Escapement	**19**	2,131	6,851	11,729	7,953	7,738	5,124	2,784	2,652	2,113
Elochoman late	Goal	496	788	788	997	997	997	776	450	450	450
	Escapement	567	2,693	4,536	7,401	4,161	2,800	1,024	761	**324**	979
Cowlitz	**Goal**	7,483	7,438	7,483	5,740	4,715	3,000	3,000	4,200	2,700	2,700
	Escapement	18,378	40,321	50,395	75,744	82,876	31,165	44,622	33,655	54,283	37,111
Toutle	**Goal**	1,250	1,250	1,480	1,168	1,168	1,168	1,168	1,168	700	700
	Escapement	6,506	12,508	28,774	15,730	18,828	30,207	25,462	8,055	6,523	17,680
Kalama Complex early	Goal	477	638	700	460	460	460	460	460	350	350
	Escapement	4,274	6,726	4,289	15,680	4,774	4,697	1,487	1,694	3,354	5,130
Kalama Complex late	Goal	1,405	1,310	1,533	671	671	671	671	671	300	300
	Escapement	**282**	1,095	10,110	15,522	4,351	3,198	3,156	1,233	5,344	1,768
Lewis Complex early	Goal	2,713	2,937	1,526	1,583	1,583	1,583	1,583	1,583	1,583	900
	Escapement	6,882	17,466	17,037	38,656	17,316	37,904	21,853	19,686	18,451	17,163
Lewis Complex late	Goal	2,517	2,517	4,954	5,968	4,756	5,000	5,000	3,257	2,000	2,000
	Escapement	16,130	17,717	23,199	60,812	6,170	20,803	10,750	16,164	18,071	15,818
Washougal	Goal	4,565	4,906	742	748	748	748	748	748	2,450	2,450
Late	Escapement	**1,605**	**2,581**	5,597	18,457	19,282	6,085	4,023	3,277	11,016	5,175
Eagle Creek	Goal	3,300	3,300	3,300	3,300	3,300	3,300	3,300	3,300	3,300	3,300
	Escapement	12,612	11,779	33,106	30,146	6,285	4,812	7,776	8,921	14,153	11,128

NMFS' guidance regarding Lower Columbia River coho limits the total exploitation rate of natural-origin coho to 8%. To provide greater access to harvestable hatchery fish while limiting impacts on natural-origin fish, some of Council area fisheries are mark-selective. Marked (adipose fin clipped) hatchery fish can be retained, but unmarked natural-origin fish must be released. As a consequence, the exploitation rate on hatchery-origin fish is generally higher. The exploitation rate on marked hatchery Lower Columbia River coho in PFMC fisheries in 2008 is proposed to be on the order of 19.0% (Simmons 2008). The expected abundance of Lower Columbia River hatchery coho in 2008 is 196,000 (PFMC 2008c). Although the forecast is low relative to past years, escapement goals for hatcheries, including those used for supplementation purposes, are expected to be met.

4.2.2 Lower Columbia River Chinook

Council area fisheries are not subject to specific management constraints for Lower Columbia River spring Chinook populations (Lohn and McInnis 2007). As described above the spring populations are managed to meet hatchery program escapement goals and, inriver, through the use of mark selective fisheries that are designed to limit the impacts to natural origin fish. Because of the collective conservation restrictions for several other Chinook populations, hatchery escapement goals have been met with ease and exceeded in recent years. NMFS expects that escapement goals will be met in 2008 as well.

The anticipated exploitation rate on Lower Columbia River spring Chinook populations in Council fisheries is 12.2% (Table 37). The exploitation rate in Puget Sound fisheries, which included Fraser Panel fisheries, is 0.2%. Some additional harvest occurs in the environmental baseline in ocean fisheries outside the Council area. The combined exploitation rate from all marine fisheries is expected to be 17.0%.

Table 37. Expected exploitation rates on Lower Columbia River spring Chinook in 2008 marine area fisheries (Simmons 2008).

Southeast Alaska	0.7%
British Columbia	3.9%
Puget Sound	0.2%
PFMC	12.2%
Total	17.0%

Two extant natural-origin bright populations have been identified in the Lower Columbia River Chinook ESU. The North Lewis River stock is used as a harvest indicator for ocean and in-river fisheries. The escapement goal used for management purposes for the North Lewis River population is 5,700, based on estimates of maximum sustained yield. The anticipated exploitation rate on Lower Columbia River bright Chinook populations in Council fisheries is 3.8% (Table 38). The exploitation rate in Puget Sound fisheries, which include Fraser Panel fisheries, is 0.1%. Some additional harvest occurs in the environmental baseline in ocean fisheries outside the Council area. The combined exploitation rate from all marine fisheries is expected to be 14.4%.

Table 38. Expected exploitation rates on Lower Columbia River bright Chinook in 2008 marine area fisheries (Simmons 2008).

Southeast Alaska	4.2%
British Columbia	6.4%
Puget Sound	0.1%
PFMC	3.8%
Total	14.4%

Unlike the spring populations or the bright component of the ESU, Lower Columbia River tule populations are caught in large numbers in Council fisheries, as well as fisheries to the north and in the Columbia River. NMFS guidance to the Council indicated that fisheries should be managed subject to a total exploitation rate of 41%. As discussed above, the Council now uses a composite stock as the indicator for Lower Columbia River natural tule Chinook rather than the Coweeman as was done in the past. The anticipated exploitation rate on Lower Columbia River tule Chinook populations in Council fisheries is 9.8% (Table 39). The exploitation rate in Puget Sound fisheries, which included Fraser Panel fisheries, is 0.3%. Some additional harvest occurs in marine fisheries in the environmental baseline in ocean fisheries outside the Council area. The combined exploitation rate from all marine fisheries is 28.7%.

Table 39. Expected exploitation rates on Lower Columbia River tule Chinook in 2008 marine area fisheries (PFMC 2008b).

Southeast Alaska	2.1
British Columbia	16.4
Puget Sound	0.3
PFMC	9.8
Total	28.7

As discussed above the ad hoc Work Group focused on review and analysis of the Coweeman, Grays, and East Fork Lewis populations using the VRAP and SPAZ models. Results from both models were considered when developing NMFS' guidance to the Council, and provide perspective relevant to assessing the effects of harvest that is discussed in more detail in the following Integration and Synthesis.

5.0 CUMULATIVE EFFECTS

Cumulative effects are those effects of future tribal, state, local or private actions that are reasonably certain to occur within the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. For the purpose of this analysis, the action area is the EEZ under the jurisdiction of the PFMC, the coastal and inland marine waters of the states of Washington, Oregon and

California, and the waters of the Strait of Juan de Fuca and San Juan Islands under the control of the U.S. Fraser Panel as described in section 1.2 above.

Future tribal, state and local government actions will likely to be in the form of legislation, administrative rules, or policy initiatives and fishing permits. Activities in the action area are primarily those conducted under state, tribal or federal government management. These actions may include changes in ocean policy and increases and decreases in the types of activities currently seen in the action area, including changes in the types of fishing activities, resource extraction, and designation of marine protected areas, any of which could impact listed species or their habitat. Government actions are subject to political, legislative and fiscal uncertainties. These realities, added to geographic scope of the action area which encompasses several government entities exercising various authorities, and the changing economies of the region, make any analysis of cumulative effects difficult and, frankly, speculative. Although state, tribal and local governments have developed plans and initiatives to benefit listed fish, they must be applied and sustained in a comprehensive way before NMFS can consider them "reasonably foreseeable" in its analysis of cumulative effects.

6.0 INTEGRATION AND SYNTHESIS OF EFFECTS

6.1 Lower Columbia River Coho

The WLC TRT has provided information relevant to this consultation, some of which is incorporated into the Recovery Plan, and some of which is more recent. The population structure of the Lower Columbia River coho ESU is described along with the applicable geographical stratification of the populations (Table 4). The Recovery Plan provides a tentative recovery scenario that associates each population with a target viability level (primary, contributing, or sustaining) (Table 5). The recovery scenario was developed based on guidance provided by the TRT. Quasi extinction thresholds (QET) and minimum viability abundance goals provide perspective for evaluating stock status with respect to abundance (Table 14). The viability objectives should be considered tentative since provisions in the Recovery Plan related to coho are draft. Oregon has also initiated their own recovery planning effort and will likely provide alternative guidance which NMFS may adopt in a final recovery plan related to Oregon-side populations. The TRT recently provided a more systematic assessment of Oregon coho populations using all four viability assessment criteria including abundance, productivity, diversity, and spatial structure (Figure 12). These generally indicate that many of the populations are currently at high risk with none being in a desirable low risk status. An earlier analysis by the TRT considered long-term and short-term trends and growth rates for the Clackamas and Sandy populations (Tables 8-11). These provide a mix of results suggesting that the populations were either slightly increasing or slightly decreasing. However, the analysis only included data through 2002 and therefore did not include the higher returns observed in recent years.

The Clackamas and Sandy coho populations are the primary strongholds for natural production in the ESU. Escapements for both have been have been higher in recent years, averaging over 1,900 and 800, respectively since 2002 (Tables 7 and 12) even though they have experience harvest rates that as high or higher than those being proposed. Returns for both are thus well above the preliminary minimum viable abundance levels of 600 that are tentatively recommended in the Recovery Plan (Table 5). Annual abundance of populations has been variable, and without apparent trend for some time (Figures 5 and 7).

At the time of listing it was generally believed that there was little natural production by other populations in the ESU and that many were likely extirpated. Figures 8-11 provided the general picture that led to that conclusion. However, as concerns for coho increased, the effort to look for coho increased as well. As a consequence it is apparent that there has been more natural spawning and natural production, in recent years at least, than was previously believed. There are six populations identified on the Oregon side, in addition to the Clackamas and Sandy (Table 13) with natural spawners now being observed in all six. (In Table 13 the Astoria Area, and Gorge and Hood columns combine estimates for two populations each.) The recent spawning surveys indicate that there have been several hundred spawners in each basin (Table 13). These populations have all been above the QETs suggested by the TRT.

On the Washington side the state has concentrated on collecting smolt out-migration data rather than estimates of adult spawning. It is apparent that there are consistent and significant levels of smolt production in several population areas that are now surveyed (Table 15). The state used this information to estimate the total natural-origin smolt production from Washington side tributaries (Table 16), and used related estimated of total smolt production to predict an adult return of natural-origin coho of 9,500 for 2008. An additional 3,900 natural-origin coho are expected to return to Oregon side populations (PFMC 2008c).

There are two areas of uncertainty related to this recent abundance data. First, it is not clear how much of the natural spawning and smolt production is from hatchery origin strays. There is some limited data regarding hatchery fraction from the spawning surveys on the Oregon side in 2002. The hatchery fraction on the Scappoose was 0%, but was 60% to 91% in the other survey areas. It is also not clear whether the apparent increase in recent years in natural spawning and production is really a new phenomenon, or simply the result of more extensive monitoring. In either case, it does provide a somewhat different perspective regarding the status of the ESU than we had at the time of listing. The Clackamas and Sandy populations are clearly the strongest populations in the ESU, but where ever we have looked in recent years we have found natural spawning or natural production. It is not the case that all other populations are essentially extirpated as was suggested by, for example, Figures 8-11. That said the abundances are low and it is unclear how much of the production is from natural-origin spawners. It is still apparent that the status of many of these populations is uncertain and likely at high risk.

One of the key factors affecting the status of LCR coho under the environmental baseline is hatchery production. As indicated above, the ESU is dominated by hatchery production. The 25 hatchery programs in the ESU contain much of the remaining genetic legacy of the ESU. With hundreds of thousands of hatchery fish returning each year, Lower Columbia River coho are not likely to decline to critically low levels of abundance. But the long term consequences of hatchery production will be a reduction in viability, particularly has it relates to the diversity of the ESU. The future of the ESU therefore depends on eventually reconfiguring the hatchery system to be consistent with recovery.

Hatchery reforms may occur associated with recovery processes. However, there are currently at least three additional initiatives underway designed to review hatchery programs including an EIS related to Mitchell Act production, a Congressionally mandated review of hatchery programs in the Columbia Basin, referred to as the Hatchery Scientific Review Group, and a review by the U.S. Fish and Wildlife Service of production programs under their jurisdiction. NMFS expects that decisions from these processes will be made in the next year or two, and that resulting changes will provide long-term benefits that will improve the status of the species.

A paradoxical characteristic of the Lower Columbia River coho salmon ESU is the relative scarcity of natural origin fish compared to the high abundance of hatchery origin fish that are part of the ESU. The existence of these hatchery populations results in both risks and benefits to the species. The loss of naturally spawning populations, the low abundance of extant populations, diminished diversity, and fragmentation and isolation of the remaining naturally produced fish confer considerable risks on the ESU. The relatively low abundance of naturally produced spawners in this ESU is contrasted by the very large number of hatchery produced adults. The abundance of coho returning to the Lower Columbia River from 2001-2007 ranged from 318,000 to 1,108,000 (PFMC 2008a). The magnitude of hatchery production continues to pose significant genetic and ecological threats to the extant natural populations in the ESU. However, these hatchery stocks collectively represent a significant portion of the ESU's remaining genetic resources. The 25 hatchery stocks in the ESU, if appropriately managed, may prove essential to the restoration of more widespread naturally spawning populations. At present, the Lower Columbia River coho hatchery programs reduce risks to ESU abundance and spatial structure, provide uncertain benefits to ESU productivity, and pose risks to ESU diversity. Overall, artificial propagation mitigates the immediacy of ESU extinction risk in the short-term, but over the long term will reduce viability, especially the diversity of the ESU (70 FR 37160, June 28, 2005).

A second key factor affecting the environmental baseline is historical harvest. Until the mid-1990's the exploitation rates in salmon fisheries on Lower Columbia River coho have been very high, contributing to their overall decline. The combined ocean and inriver exploitation rates averaged 91% from 1970-1983, 69% from 1984-1993, and 17% from 1994-2007 (Table 28). The reductions in harvest have been significant and have helped reduce the effects of harvest as a limiting factor. Despite these significant reductions in harvest, there seems to have been relatively little response in terms of change in abundance for the Clackamas and Sandy populations (Figures 5 and 7). Earlier exploitation rates were clearly too high and had to be reduced. But the lack of response in escapements for the Clackamas and Sandy suggests that other factors may be limiting, and that further reductions in harvest for the purpose of providing more fish for escapement to the Clackamas and Sandy may contribute little to the recovery of these populations. However, harvest reductions almost certainly provided the opportunity for other populations to achieve greater escapement and begin to rebuild.

Between 2002 and 2005, ocean and inriver fisheries were managed for Lower Columbia River coho using the harvest matrix developed by ODFW (Table 3a-3c). In 2006 and 2007, after the listing of Lower Columbia River coho, ocean fisheries were managed using Oregon's harvest matrix, but limited to the ocean portion of the matrix (Table 3a). The resulting exploitation rate limits in 2006 and 2007 were 15% and 20%, respectively. NMFS' guidance to the Council indicated that the combined ocean and inriver mortality rates should not exceed 8% in 2008 and should be determined using the ocean portion of the harvest matrix thereafter (Lohn and McInnis 2008). NMFS supports use of abundance based harvest approaches such as that proposed by Oregon, but has been conservative in applying the matrix in this case pending completion of more quantitative analysis that may address outstanding concerns.

Fraser Panel fisheries are also considered as part of this consultation. However, the catch of Lower Columbia River coho is quite limited with an expected exploitation rate of less than 0.1%.

In considering the question of jeopardy as it relates to a proposed action, NMFS is required to consider the best available information regarding the status of the species, the environmental baseline, and cumulative effects, and the effects of the proposed action. In making these determinations, NMFS relies on quantitative analyses where possible, and more qualitative considerations where necessary (NMFS 2004b). In doing so, it is necessary to consider the effects of the proposed action on both survival and recovery. In this opinion, as it relates to Lower Columbia River coho, we do not yet have the tools necessary to conduct a quantitative assessment of the effects of the harvest proposal. Beamesderfer (2007) provided a quantitative risk assessment of Oregon's harvest matrix that included both the ocean and inriver components. The analysis concluded that the matrix is adequate to protect the majority of Lower Columbia River coho populations. The Northwest Science Center subsequently reviewed the analysis and expressed reservations about some of the methods and underlying assumptions and indicated that the conclusions were not well supported (McElhaney 2007). The next step will be to redo the risk assessment while addressing the Science Center's comments. Absent a more complete quantitative assessment, our determination must rely on more qualitative considerations.

One way to assess the effect of the fishery on hatchery components of the listed ESU in the short term is to consider whether hatchery programs will meet their respective escapement goals. For programs that support supplementation activities in particular, meeting escapement goals is essential to the continuation of those programs. For other programs, meeting escapement goals maintains the genetic legacy contain therein and the option for using those fish for recovery if and when they may be identified as necessary. Hatcheries producing listed Lower Columbia River coho have consistently exceeded their goals in recent years under exploitation rates similar to or greater than those anticipated in 2008, particularly for those programs involved in supplementation or re-introduction of natural production (Table 36). Under the proposed harvest matrix, harvest will be reduced and modulated based on the status of natural-origin fish and estimates of marine survival. Given the circumstances, NMFS expects that hatchery programs will continue to meet their escapement goals and thus continue to mitigate the short term risk of extinction.

With respect to survival we note that the stronghold populations in the Clackamas and Sandy rivers have generally been stable over the long term and higher in recent years. For other Oregon and Washington populations it is apparent that there is more spawning and natural production than previously believed. Coho spawning has been observed in all population areas on the Oregon side of the ESU, and smolt production has been observed in all population areas surveyed on the Washington side. The circumstance regarding the distribution and abundance of the species are therefore much improved relative to what we thought them to be at the time of listing. Whether the apparent increase is the result of higher escapements or improved monitoring is unclear. Hatchery fish which are part of the listed ESU are abundant with expected returns on the order of hundreds of thousands in most years. There are concerns about long term risks associated with the effects of these hatchery fish, but these fish clearly mitigate the near term survival risk. Harvest rates in recent years are comparatively low and similar to those that would be allowed under the proposed action. As described above, harvest impacts have been reduced significantly from the rates observed under the baseline in past decades. These harvest reductions have thus helped alleviate harvest as a limiting factor. Based on these considerations NMFS concludes that the proposed harvest matrix is consistent with the species survival.

Survival is obviously a prerequisite for recovery, but the effects of the action on recovery need to be addressed as well. From a broad perspective, NMFS evaluates long term harvest strategies when possible using quantitative risk assessment techniques. As discussed above we do not yet have a quantitative assessment of the harvest matrix that can be relied on. However, the harvest matrix being considered for management for Lower Columbia River coho is nearly identical to the one being used for Oregon Coast coho. NMFS reviewed the harvest matrix as applied to Oregon Coast coho through a section 7 consultation and concluded that it was consistent with the no jeopardy requirements for survival and recovery. NMFS needs to complete the analysis of the matrix as it applies to Lower Columbia River coho and the particular circumstances for this species. But our experience with Oregon Coast coho provides an example and further perspective, qualitative though it may be, regarding the adequacy of the matrix as applied to Lower Columbia River coho.

From a more immediate perspective, recovery will presumably occur over the long term, a period that will likely be on a scale of decades, as a result of concerted efforts to address all of the limiting factors that affect the species. Harvest impacts on the Clackamas and Sandy populations have been reduced substantially from past decades, but there have not been proportional increases in abundance. This suggests that other factors are limiting production and highlights the need for a comprehensive approach to recovery. NMFS has reviewed the species status, the environmental baseline, and cumulative effects. In this opinion we consider, in particular, the additional effects of the harvest matrix on Lower Columbia River coho as it would be applied in 2008 and for the foreseeable future. In 2008, the harvest matrix allows for a total exploitation rate of 8% which must be distributed between Council and inriver fisheries. In 2009 and thereafter, the total exploitation rate may vary depending on the year specific circumstances. Given our qualitative assessment of the harvest matrix strategy, NMFS concludes that the prospects for recovery are not appreciably reduced by the proposed actions.

Based on the above described considerations, NMFS concludes that the proposed actions are not likely to appreciably reduce the likelihood of survival or recovery of the Lower Columbia River coho ESU.

6.2 Lower Columbia River Chinook

The Lower Columbia River Chinook ESU has a complex structure consisting of three life history types, each with multiple populations that are distributed across three ecological regions or MPGs (Table 18). Consideration of the jeopardy decision requires a review of the various components of the ESU. The contribution of hatchery fish and their affect on various populations is also an important consideration for various components of the ESU. Consideration of jeopardy as it pertains to the proposed action also requires an understanding of the scope and status of the ongoing review of information, and of reform and recovery related activities. For tule populations in particular consideration of jeopardy is made in the context of a rapidly evolving set of circumstances.

Spring Chinook Populations

There are four extant spring Chinook populations remaining in the ESU. The return of spring Chinook to the Cowlitz, Kalama, Lewis, and Sandy river populations have all numbered in the thousands in recent years (Table 22). The Cowlitz and Lewis populations on the Washington side are managed for hatchery production since most of the historical spawning habitat is inaccessible due to hydro development in the upper basins. A supplementation program is now operated on the Cowlitz River that involves trap and haul of adults and juveniles. A supplementation program is also being developed on the Kalama with fish being passed above the ladder at Kalama Falls. Historically, the Kalama was a relatively small system compared to the other three (Table 20). A supplementation program is also being developed for the Lewis River, but population is still dependent on hatchery production. The Cowlitz, Lewis, and Kalama systems have all met their respective hatchery escapement goals in recent years, and are expected to do so again in 2008 based on the forecasts and proposed harvest rates. The existence of the hatchery programs mitigates the risk to these populations. Because of passage constraints, the Cowlitz and Lewis populations, in particular, would be extinct but for the hatchery programs.

The Sandy River is managed with an integrated hatchery supplementation program that incorporates natural-origin brood stock. There is some spawning in the lower river, but the area above Marmot Dam is preserved for natural-origin production. The return of natural-origin fish to Marmot Dam has averaged almost 1,700 since 2000. This does not account for the additional spawning of natural-origin fish below the dam. The tentative viable abundance goal for Sandy River spring Chinook is 2,600, although the goal is subject to reconsideration through Oregon's ongoing recovery planning process. The total return of spring Chinook to the Sandy including hatchery fish has averaged more than 6,000 since 2000 (Table 22).

The effects of harvest to spring Chinook populations have decreased significantly since 1980. Total exploitation rates from all fishing averaged about 51% from 1980 to 1994 (Table 29). Beginning in 1995 exploitation rates averaged about 28%. Exploitation rates in Council area fisheries averaged about 10% since 1995, but 15% over the last five years.

The anticipated exploitation rate on Lower Columbia River spring Chinook populations in Council fisheries is 12.2%. The exploitation rate in Puget Sound fisheries, which included Fraser Panel fisheries, is 0.2%. In combination, these include the combined effect of the proposed actions. The total exploitation rate in marine area fisheries of 17.0% (Table 37).

Given the circumstances the survival needs of the spring populations of the Lower Columbia River Chinook ESU are best protected by meeting the hatchery escapement goals, something that has been done consistently in past years and is expected again in 2008. These hatchery programs are essential for preserving the genetic legacy of these populations. For the Sandy population the return of natural origin fish to Marmot Dam has averaged almost 1,700 in recent years, well above the quasi-extinction threshold. These returns have occurred during years when harvest impacts have been similar to those being proposed. Reductions in harvest in recent years and in 2008 relative to past years support the conclusion that the proposed actions considered in this biological opinion are not likely to appreciably reduce the prospects of survival or recovery of the Lower Columbia River spring Chinook populations.

Bright Chinook Populations

There are two bright Chinook populations in the Cascade Late Fall MPG of the Lower Columbia River Chinook ESU in the Sandy and North Fork Lewis rivers. There is no hatchery production of bright Chinook in the lower Columbia River so neither is significantly affected by hatchery strays. The Sandy population is currently less robust. The escapement of natural-origin fish has been variable, but without apparent trend over the last 14 years and averaged about 900 since 2002 (Table 23). The viable abundance goal is 5,100 from the LCFRB Recovery Plan, but is being reviewed as Oregon proceeds with its recovery planning process. The North Fork Lewis population is the principal indicator stock. The maximum sustained yield escapement goal is 5,700. The viable abundance goal from the Recovery Plan is 6,500. The North Fork Lewis population has exceeded its escapement goal and viable abundance criteria in most years, generally by a wide margin. The escapement in the North Fork Lewis was below goal in 2007. This is consistent with a pattern of low escapements for other far north migrating bright populations including Washington and Oregon coastal stocks and upriver brights that return to the Hanford Reach area. This pattern of low escapements for a diverse range of stocks suggests that they are all affected by poor ocean conditions. Escapement to the North Fork Lewis is expected to be below goal again in 2008.

Because of the low anticipated returns in 2008, WDFW has implemented a management policy to limit the exploitation rate in southern U.S. fisheries (including Fraser, Council area, and Columbia River) to less than 10%. The anticipated exploitation rate on Lower Columbia River bright Chinook populations in Council fisheries is 3.8% with a total exploitation rate in marine area fisheries of 14.4% (Table 38). The exploitation rate in Puget Sound fisheries, which included Fraser Panel fisheries, is 0.1%. Inriver fisheries will be managed to meet the escapement goal for the North Fork Lewis population which will require further restrictions in 2008.

Despite lower escapements, the North Fork Lewis population is general healthy. Steps are being taken in 2008 to limit harvest to provide additional protection during a year of low return. The proposed actions therefore pose little risk to the prospects for either survival or recovery of the population. The abundance of the Sandy population is lower relative to the viability objective, but escapements are still averaging hundreds of fish per year and thus well above a low abundance threshold that would indicate an immediate survival concern. Expected mortality in the proposed fisheries is low (3.8%) with further protection applied inriver to meet escapement objectives, and thus are not likely to appreciably reduce the likelihood of survival or recovery for the population.

Tule Chinook Populations

NMFS Guidance to the Council in 2008 required that Council area and Columbia River fisheries be managed subject to a total exploitation rate of 41%. Because of fishery constraints for other stocks, the Council has proposed fisheries that are expected to result in a total exploitation rate of 35.8% (PFMC 2008b). Exploitation rates in 2009 and thereafter will be developed through NMFS ongoing analysis and provided through NMFS annual guidance to the Council. For purposes of analysis, NMFS assumed that harvest impacts in the future would be no greater than 41%. Both the VRAP and SPAZ analyses implicitly assume constant future harvest. However, NMFS indicated in their guidance that further reductions may be required as a result of ongoing review.

Harvest was identified as a limiting factor when the ESU was listed under the ESA in 1999. The effects of harvest were reduced both before and since their listing. The total exploitation rate on Lower Columbia River tule populations averaged 73% during the 1980's, 46% during the 1990's, and 49% since 2000 (Table 31). NMFS has also reduced the allowable take of Lower Columbia River tule Chinook through subsequent consultations from 65% prior to 2002, to 49% through 2006, to 42% in 2007. NMFS' guidance for 2008 is that the exploitation rate be reduced further to 41%. These reductions in harvest have help to reduce the effects of harvest as a limiting factor.

The LCFRB Recovery Plan provides an overview of the status of populations in the ESU based on TRT recommendations for assessing viability using criteria for abundance, productivity, spatial structure, and diversity (Table 26). The persistence category used in Table 26 integrates abundance and productivity criteria. This overview for tule populations suggests that risk related to abundance and productivity are higher than those for spatial structure and diversity. Lower scores indicate higher risk. The scores for persistence for most populations range between 1.5 and 2.0. The scores for spatial structure generally range between 3 and 4, and for diversity between 2 and 3, respectively.

There are 21 tule populations in the Lower Columbia River Chinook ESU distributed across three MPGs (Table 18). Several of these populations were designated through recovery planning as primary populations that are targeted for high viability through the recovery planning process. These include the Grays, Elochoman, and Clatskanie in the Coastal Fall MPG, and the Coweeman, East Fork Lewis, Kalama, and Washougal in the Cascade MPG (Table 19). Other populations are still important to the overall status of the ESU, but the viability criteria used to assess their status are less stringent.

These designations regarding population priorities are preliminary and some are likely to change as Oregon completes its recovery planning process and integrates their conclusions with the Interim Recovery Plan for Washington populations. For example, some changes in the priority designations have already been proposed through the HSRG process (HSRG 2007). Finalizing these population priority designations is relevant to consideration of a comprehensive recovery strategy, including developing provisions related to a long term harvest management strategy.

The considerations and results of the Lower Columbia River Work Group over the last two years are discussed at length in this biological opinion. The Work Group focused much of their attention on analysis of the Coweeman, East Fork Lewis, and Grays river populations. These populations were chosen because the necessary data were available, they were designated as primary populations, and subject to relatively little hatchery influence.

Generally, the Coweeman and East Fork Lewis populations are considered indicators of larger natural-origin populations in the Cascade MPG. The Grays is representative of smaller populations that are more typical of the Coastal MPG. Results from the Work Group analysis of these populations were used in part to establish exploitation rate limits that are articulated in the Guidance to the Council.

It is less clear how the results of the anlaysis for the three indicator populations applies to other populations in the respective MPGs that are subject to greater hatchery influence. The question of applicability of results of related indicator populations is discussed in the Work Group report (Ford et.al. 2007). For example, the escapement to the Grays River has been just a few hundred fish in recent years (Table 24). The Work Group's analysis suggests that the Grays is at risk even with little or no harvest (Tables 32-34). The risk is high largely because the abundance is low so there is a relatively high probability that the population will fall below the low abundance threshold in the future if nothing is done to improve the productivity of the population. The Elochoman and Mills/Abernathy/Germany populations are in the Coastal MPG too, but escapements to those populations have numbered in the thousands in recent years, largely due to hatchery strays (Table 24). These populations may be at risk because of hatchery influence or other considerations, but their status is not directly comparable to that of the Grays. They are not currently at risk because of low abundance. The Grays may be more representative of populations like the Clatskanie or Scappoose, but there is less information on escapement levels or hatchery contributions for these populations. Big Creek and Youngs Bay populations are contiguous with large hatchery net pen programs designed to support terminal area fisheries. They are therefore also likely recipients of large numbers of hatchery strays.

The Coweeman and East Fork Lewis are more representative of populations in the Cascade MPG. The analytical results for the Coweeman and East Fork Lewis are more optimistic compared to those for the Grays River. Escapements to these have been several 100 to a thousand fish or more in recent years (Table 24). Escapements to other populations in the MPG including the Cowlitz, Kalama, and Washougal have been thousands of fish per year, again largely due to hatchery influence.

The three indicator populations are natural-origin populations that are essential to the recovery of the ESU. Their status as primary populations is not likely to change. It is therefore appropriate that we use results from the Work Group analysis for these populations to assess their status and the effects of the proposed action. However, it is also important to understand the pervasive effects of hatchery production on tule populations in the ESU, and how it complicates the analysis and the application of results from the indicator populations to other populations in the ESU. It also underscores the need for a more comprehensive solution that addresses hatchery and harvest reform simultaneously, and other factors that may affect the status and productivity of the populations over the long term.

The VRAP analysis provides estimates of Recovery Exploitation Rates (RER) that are designed to meet specified survival and recovery criteria. Results from the VRAP analysis depend on the particular model used and various assumptions. The results are therefore expressed as a range. For the Coweeman and East Fork Lewis populations the RER estimates ranged from 34% to 58% and 44% to 58%, respectively (Table 32). These results suggest for the Coweeman, for example, that total exploitation rates on the order of 34% to 58% are consistent with expectations of survival and recovery. For the Grays population the results were more pessimistic with RER estimates ranging from 0 to 20%.

The SPAZ analysis used that same data, but took a somewhat different analytical approach. SPAZ analyzed extinction risk over the next 100 years. Extinction in this case is defined as falling below the quasi extinction threshold (QET of either 50 or 150) over a four year period sometime in the next 100 years. Results of the SPAZ analysis were generally similar to those of VRAP. For the Coweeman and East Fork Lewis populations, depending in part on the QET values used, exploitation rates in the range of 25% to 50% were consistent with viability criteria. But for the Grays population the probability of meeting viability criteria was low, even with no harvest (Table 34).

NMFS' guidance to the Council was to limit the total exploitation rate for tule Chinook in 2008 to 41%. Because of management constraints for other stocks, the Council recommended fisheries that were actually lower with an anticipated total exploitation rate of 35.8%. The fishery impacts would be distributed among fisheries in Alaska and Canada (18.5%), Council and Fraser area fisheries (10.1%), and those that would occur inriver (7.1%). Proposed fishing levels are consistent with NMFS' guidance and at the lower end of the range of analytical results for the Coweeman and East Fork Lewis indicator populations, but were above those recommended for the Grays.

A common characteristic of the VRAP and SPAZ methods is that they rely on observations of abundance from recent years and resulting estimates of population productivity. The current circumstances are then projected into the future for 25 years (for VRAP) or 100 years (for SPAZ) to estimate risk. A key assumption of both models is that productivity and the associated variability will not change in the future. A number of actions have been taken that would improve the status of populations in the ESU. If productivity is higher than presumed, the results from the VRAP and SPAZ analyses may be conservative. In the following discussion, we use the Grays as an example, but the general point applies to other populations as well. In going through the list of beneficial actions we need to be careful to distinguish those that either have occurred or are reasonable certain to occur, from those that are more speculative and therefore cannot be relied upon.

One of the assumptions underlying the HSRG analysis is that population productivity (defined as spawner-to-spawner return) will increase if the influence of hatchery fish on natural-origin spawners can be reduced (HSRG 2007). For the Grays River, the HSRG assumes that population productivity will double over the long term, if hatchery influence on natural-origin spawners is eliminated. Steps have already been taken to reduce the effect of hatchery spawning on the Grays population. The Chinook hatchery on the Grays was closed with last releases in 1997 and last returns in 2000 or 2001. The states' program designed to address the adverse effects of hatcheries calls for construction of a weir on the lower Grays to further reduce the effects of out of basin hatchery strays. The design and permitting phase of the weir project is funded and scheduled for completion in 2008 with construction scheduled for 2009 (Anderson and Bowles 2008). NMFS concludes that completion of the weir is reasonably likely to occur.

There have been several habitat restoration activities specific to the Grays River. A comprehensive assessment and restoration plan, conducted by the Pacific Northwest National Laboratory (PNNL) in cooperation with Washington Department of Fish and Wildlife (WDFW) and Pacific States Marine Fisheries Commission (PSMFC), was completed in 2006. There have been several additional design related and implementation projects and site specific restoration programs (see attachment to Lohn and McInnis 2008). The site specific restoration projects referred to are either complete or already underway. The Washington Department of Fish and Wildlife recently drew the attention of the LCFRB to the importance of the Grays River and asked that they continue to support habitat related improvement activities (Anderson 2008). The occurrence of future projects is uncertain, but the intention is clear. Because this consultation is specific to 2008, progress related to future projects can be evaluated through subsequent consultations.

Other survival benefits can be attributed to actions taken in conjunction with the FCRPS. NMFS is currently consulting with the Action Agencies regarding operation of the FCRPS. That consultation is due to be completed in early May 2008. Several actions either have been taken or are proposed as part of the Reasonable and Prudent Alternative (RPA) that would benefit fall Chinook populations in the lower river. NMFS released a draft FCRPS biological opinion on October 30, 2007 that describes activities in the Environmental Baseline and those that are part of the RPA (NMFS 2007c). Those in the baseline can be counted on as reasonably certain to occur. Those in the RPA must be considered speculative until the consultation is completed. In some cases, the magnitude of the expected survival improvements are qualitative; in other cases, survival benefits are quantified and specific to particular life history types (NMFS 2007c). Nonetheless, it is apparent that actions have been taken to improve conditions in the lower river. Survival improvements that will benefit tule Chinook are expected to accrue from tributary habitat activities, improvements in the estuary habitat, and efforts to reduce predation from birds and fish predators.

The prevailing theme in this biological opinion, particularly as it relates to Lower Columbia River tule populations, is one of change. NMFS is using the best available information to evaluate the effects of the proposed action in 2008. But consideration of the proposed action also requires an understanding of ongoing recovery and reform activities that affect the species status. NMFS articulated in its Guidance letter to the Council, increased focus on integrating its harvest analysis with other efforts to rebuild and recover tule populations. With regard to hatchery production, NMFS highlighted a choice to the Council framed by the results of the HSRG report that emphasized the need to reduce the effect of hatchery-origin fish on natural-spawning populations. The two general options for addressing the problem were to either substantially reduce or eliminate existing hatchery programs, or to reprogram existing production to reduce straying, increase the ability of fisheries to differentially harvest hatchery fish, and install a system of weirs in key locations that can be used to manage the interactions between hatchery and natural-origin fish. In either case, it remains clear that hatchery programs and the fisheries they support must change significantly over the next several years.

In response, the states have considered the HSRG recommendations, the Interim Recovery Plan and other information in order to develop a comprehensive and integrated hatchery and harvest reform program. A framework of that reform plan was provided to NMFS in January and includes (Anderson and Bowles 2008):

- mass marking hatchery produced tule Chinook to allow for brood stock management, assessment and control of hatchery strays, and implementation of mark selective fisheries;
- developing a system of weirs and hatchery intake improvements to manage returning fish;
- reducing some programs and transferring hatchery releases between programs to

maximize production and minimize the adverse effects of hatchery strays on priority populations, and
- developing techniques to enable commercial scale mark selective fisheries.

NMFS appreciates the scale and complexity of the reforms proposed by the states and commends them for their undertaking.

To be effective the program obviously must be implemented. The states propose that changes be phased in over time. Much of the program is currently unfunded and there will be complexities related to the design, permitting, and construction of each project. However, NMFS is aware that substantive and essential steps already have been taken to implement elements of the program. First, the program depends fundamentally on the requirement that all hatchery fish be mass marked with an adipose fin clip so they can be distinguished visually. Visual identification of hatchery fish allows for mark selective fisheries, sorting of hatchery fish returning to the rivers, and identification of hatchery fish in natural-origin spawning areas. Federal legislation requires that all hatchery fish intended for harvest, and produced in federal hatcheries or supported by federal funding, be marked with an adipose fin clip. NMFS' recent letter reiterates the marking requirement and reminds the states who manage the hatcheries that marking is required regardless of funding limitations. If necessary, production will have to be reduced to meet the marking requirement (Turner 2007). The marking phase of the reform initiative can be counted on as reasonably certain to occur.

The states' proposal also calls for the design, permitting, and construction of eight hatchery weirs or hatchery intake modifications (Anderson and Bowles 2008). The associated work schedule calls for completion in 2012. Much of the work is contingent on future funding, but several elements of the project are either completed or already funded. Funding proposals have been submitted for subsequent steps. For example, the weir on the Lower Elochoman, and design of the weir on the upper Elochoman, were completed in 2007. Design and permitting phases for the Washougal and Grays weirs were funded with work scheduled for completion in 2008. Funding proposals have been submitted for other design, permitting, and construction elements of the project. Potential sources for funding include, but are not limited to, Pacific Coastal Salmon Recovery Funds and Mitchell Act money. NMFS concludes that substantive and essential steps have been taken to implement elements of the program. NMFS will continue to monitor progress related to the program and support the states' effort to ensure it is implemented.

Based on the above described considerations NMFS concludes that the proposed actions are not likely to appreciably reduce the likelihood of survival or recovery of the Lower Columbia River tule Chinook populations.

Throughout this biological opinion and in the Integration and Synthesis, NMFS has structured its review by considering separately the effects on the spring, brights, and tule life history types and the component populations. In the end, our conclusion relates to the ESU as a whole.

The Lower Columbia River Chinook ESU is made up of multiple populations and MPGs. As described above, it is unlikely that the ESU will go extinct at least in the near future because of the high abundance of hatchery fish, which preserve genetic resources and ensure in most cases that abundance is well above extinction thresholds. Hatchery fish do increase the risk to the species over the long term. Additionally, most of the key populations for which information on wild abundance is available indicate that spawner abundance is and will remain well above extinction thresholds. The SPAZ analysis indicates that extinction risk for indicator populations in the Cascade MPG is relative low. Smaller populations in the Coastal MPG represented by the Grays are likely at greater risk.

As described above, recovery will be a long process for most of the populations in this ESU. Hatchery, harvest, and habitat policies and recovery strategies are inter-related. The proposed harvest rates, however, represent a significant decrease from historical harvest rates. This suggests that the trend in harvest rates is consistent with the direction needed for recovery. Specific harvest rates needed for recovery have yet to be determined and will rely, in part, on the degree to which improvements are made in other sectors.

Furthermore, for the key populations representing Cascade MPG tule Chinook, the RER analysis indicates that the likelihood of survival and recovery for these populations will not be appreciably reduced by the proposed action. As with extinction risk, notable exceptions to this result are the smaller coastal populations represented in the analysis by the Grays River.

In summary, although we cannot demonstrate that every population will be certain to survive and recover under the proposed action, based on the above considerations NMFS concludes that the impacts associated with the proposed PFMC and Fraser panel fisheries for 2008 are not likely to appreciably reduce the likelihood of survival or recovery of the Lower Columbia River Chinook ESU. This conclusion takes into account the possibility that the 2008 harvest rates could continue indefinitely into the future, if so determined through subsequent consultations, and does not rely on the short term of the proposed action to reach this conclusion.

Based on the above described considerations, NMFS concludes that the impacts associated with the proposed PFMC and Fraser panel fisheries for 2008 are not likely to appreciably reduce the likelihood of survival or recovery of the Lower Columbia River Chinook ESU.

7.0 CONCLUSION

After reviewing the current status of the listed ESUs considered in this biological opinion, the environmental baseline for the action area, the effects of the proposed fisheries, and the cumulative effects, it is NMFS' biological opinion that the proposed 2008 PFMC and U.S. Fraser Panel Fisheries are not likely to jeopardize the continued existence of Lower Columbia River Chinook. Similarly, it is NMFS' biological opinion that the PFMC and U.S. Fraser Panel Fisheries managed consistent with the proposed action in 2008 and for the foreseeable future are not likely to jeopardize the continued existence of Lower Columbia River coho ESU.

Critical habitat has not yet been designated for the Lower Columbia River Coho Salmon ESU, so it is not addressed in this opinion. The designated critical habitat for the Lower Columbia River Chinook ESU does not include offshore marine areas of Puget Sound and the Pacific Ocean. The activities considered in this consultation will therefore not result in the destruction or adverse modification of any of the essential features of designated critical habitat for the Lower Columbia River Chinook ESU.

8.0 INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. " Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns, including breeding, feeding, or sheltering. "Harass" is defined 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 limited 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 (ITS).

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

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

8.1 Amount or Extent of Incidental Take Anticipated

NMFS anticipates that Lower Columbia River coho and Lower Columbia River Chinook will be taken as a result of proposed PFMC and U.S. Fraser Panel Fisheries. The incidental take occurs as a result of catch and retention, or mortalities resulting from catch and release, or mortalities resulting from encounter with fishing gear, as a consequence of fishing activity. The amount of anticipated take is expressed below in terms of exploitation rates that include all sources of harvest mortality.

The total allowable exploitation rate for Lower Columbia River coho in Council area and inriver fisheries will be determined annually using year specific circumstances applied to the ocean portion of Oregon's harvest matrix (Table 3a). The distribution of harvest impacts between Council area and inriver fisheries may vary between years and inseason so long as the total does not exceed the year specific limit. In 2008, for example, the total allowable exploitation rate of Lower Columbia River coho in the specified fisheries is 8%. The expected exploitation rate in Council area fisheries is 5.9%. As indicated above, the distribution of harvest impacts in 2008 between Council and inriver fisheries may vary inseason so long as the total does not exceed 8%. The expected exploitation rate in Fraser Panel fisheries is 0.2%.

The expected exploitation rates for Lower Columbia River spring Chinook in Council and Fraser Panel fisheries in 2008 are 12.2% and 0.2%, respectively. The expected exploitation rates for Lower Columbia River bright Chinook in Council and Fraser Panel fisheries in 2008 are 3.8% and 0.1%, respectively. The take of Lower Columbia River tule Chinook in 2008 is subject to a total exploitation rate limit of 41% for all ocean and inriver fisheries. The harvest impacts are distributed between Alaskan and Canadian fisheries, those in the Council and Fraser Panel areas, and those that occur in the Columbia River. The expected exploitation rate from all fisheries is 35.8%, well below the 41% limit. The expected exploitation rates in Council and Fraser Panel fisheries in 2008 are 9.8% and 0.3%, respectively. The expected exploitation rate in fisheries in the Columbia River is 7.1%. The distribution of impacts between the Council and Fraser Panel fisheries, and those that occur inriver, may change inseason so long as the total exploitation rate for all fisheries does not exceed 41%.

8.2 Effect of the Take

In this biological opinion, NMFS has determined that the level of anticipated take is not likely to jeopardize the continued existence of listed Lower Columbia River coho or Lower Columbia River Chinook ESUs. Critical habitat for the Lower Columbia River coho ESU has not been proposed. Critical Habitat for Lower Columbia River Chinook was designated on September 2, 2005 (70 FR 52630), but does not include offshore marine areas of Puget Sound and the Pacific Ocean. The bounds of the action area are therefore outside the bounds of critical habitat for Lower Columbia River Chinook. The activities considered in this consultation will therefore not result in the destruction or adverse modification of any of the essential features of designated critical habitat for the Lower Columbia River Chinook ESU.

8.3 Reasonable and Prudent Measures

NMFS concludes that there are two reasonable and prudent measures necessary or appropriate to minimize the impacts from fisheries considered in this biological opinion to listed Lower Columbia River coho and Lower Columbia River Chinook salmon ESUs.

1. Inseason management actions taken during the course of the fisheries shall be consistent with the take limits defined in Section 8.1 of the Incidental Take Statement above. NMFS shall consult with the PFMC, states and tribes to account for the catch of coho and Chinook in PFMC area fisheries as these occur through the season. NMFS will track the results of these monitoring activities, in particular, and any anticipated or actual increases in the incidental exploitation rates of listed Lower Columbia River coho and Lower Columbia River Chinook from those expected preseason.

2. Harvest impacts on listed salmon stocks shall be monitored using best available measures. Although NMFS is the federal agency responsible for seeing that this reasonable and prudent measure is carried out, in practical terms, it is the states and tribes that conduct monitoring of catch and non-retention impacts.

8.4 Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, NMFS must ensure that the PFMC, states, and tribes comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

1a. NMFS shall confer with the affected states and tribes, the PFMC chair and the U.S. Fraser Panel, as appropriate, to ensure that inseason management actions taken during the course of the fisheries are consistent with the take specified in Section 8.1 of the Incidental Take Statement above.

1b. NMFS shall confer with the affected states and tribes, the PFMC chair, and the U.S. Fraser Panel to account for the catch of the PFMC and U.S. Fraser Panel fisheries throughout the season. If it becomes apparent inseason that any of the specified expectations regarding exploitation rates may be exceeded then NMFS, in consultation with the PFMC, and states and tribes, shall take additional management measures to reduce the anticipated catch as needed to conform to those expectations.

2a. NMFS shall ensure that monitoring of catch in the PFMC and U.S. Fraser Panel commercial and recreational fisheries by the PFMC, states, and tribes is sufficient to provide statistically valid estimates of the catch of salmon. The catch monitoring program shall be stratified by gear, time and management area. Sampling of the commercial catch shall entail daily contact with buyers regarding the catch of the previous day. The recreational fishery shall be sampled using effort surveys and suitable measures of catch rate.

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

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

2d. The use of non-retention in both commercial and recreational fisheries is becoming more prevalent in fisheries management, as a way to decrease impacts on stocks of concern and/or increase fishing opportunity. NMFS shall ensure that postseason harvest assessment by the states, tribes and PFMC include estimates of mortality in non-retention fisheries and a description of the methods used in the estimation.

9.0 CONSERVATION RECOMMENDATIONS

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

1. NMFS, in collaboration with the PFMC, states, and tribes, should evaluate the ability of the ESU to survive and recover, given the totality of impacts affecting the Lower Columbia River coho and Lower Columbia River Chinook salmon ESUs during all phases of its life cycle, including freshwater, estuarine and ocean life stages. For this effort, NMFS should collaborate with the affected co-managers to evaluate and improve the life cycle models on which the matrix type management approach for Lower Columbia River coho is based and to continue working with Chinook models or new models for coho as they become available.

2. NMFS, in collaboration with the PFMC, states, and tribes, should evaluate, where possible, improvement in gear technologies and fishing techniques that reduce the mortality of listed species, e.g., use of live tanks, net configuration, release methods.

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

4. NMFS, in collaboration with the PFMC, states, and tribes, should continue to improve the quality of information gathered on ocean rearing and migration patterns to improve the understanding of the utilization and importance of these areas to listed Pacific salmon, particularly coho and Chinook salmon.

5. NMFS, in collaboration with the PFMC, states, and tribes, should continue to evaluate the potential selective effects of fishing on the size, sex composition, and age composition of salmon populations.

10.0 RE-INITIATION OF CONSULTATION

This concludes the biological opinion on the 2008 PFMC and U.S. Fraser Panel Fisheries. 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 agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect on to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, section 7 consultation must be immediately reinitiated.

11.0 MAGNUSON-STEVENS ACT ESSENTIAL FISH HABITAT CONSULTATION

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

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

EFH means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (Magnuson-Stevens Act §3). For the purpose of interpreting this definition of EFH: Waters include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; substrate includes sediment, hard bottom, structures underlying the waters, and associated biological communities; necessary means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle (50 CFR 600.10). Adverse effect means any impact which reduces quality and/or quantity of EFH, and may include direct (e.g., contamination or physical disruption), indirect (e.g., loss of prey or reduction in species fecundity), site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810).

EFH consultation with NMFS is required regarding any Federal agency action that may adversely affect EFH, including actions that occur outside EFH, such as upstream and upslope activities that may adversely affect EFH.

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

11.1 Identification of Essential Fish Habitat

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

Pursuant to the Magnuson-Stevens Act, the PFMC has designated EFH for five coastal pelagic species (Casillas et al. 1998, PFMC 1998), over 80 species of groundfish (PFMC 2005) and three species of federally-managed Pacific salmon: Chinook (O. tshawytscha); coho (O. kisutch); and Puget Sound pink salmon (O. gorbuscha)(PFMC 1999). The PFMC has not identified EFH for chum salmon (O. keta), or steelhead (O. mikiss), but the areas used by chum and steelhead for "spawning, breeding, feeding, or growth to maturity" overlap with those identified for coho and Chinook salmon as encompassed by the actions considered in this biological opinion.

EFH for groundfish includes all waters, substrates and associated biological communities from the mean higher high water line, the upward extent of saltwater intrusion in river mouths, seaward to the 3500 m depth contour plus specified areas of interest such as seamounts. EFH for coastal pelagic species includes all waters, substrates and associated biological communities from the mean higher high water line, the upriver extent of saltwater intrusion in river mouths, and along the coast extending westward to the boundary of the EEZ. Marine EFH for Chinook and coho in Washington, Oregon, and California includes all estuarine, nearshore and marine waters within the western boundary of the EEZ, 200 miles offshore. Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other water bodies currently, or historically accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable man-made barriers (as identified by the PFMC 1999), and longstanding, naturally-impassable barriers (i.e., natural waterfalls in existence for several hundred years). Detailed descriptions and identifications of EFH are found for groundfish in the Final Environmental Assessment/Regulatory Impact Review for Amendment 19 to the Pacific Coast Groundfish Management Plan (PFMC 2005); for coastal pelagic species in Amendment 8 to the Coastal Pelagic Species Fishery Management Plan (PFMC 1998); and for salmon in Appendix A to Amendment 14 to the Pacific Coast Salmon Plan (PFMC 1999). Assessment of potential adverse effects to these species' EFH from the proposed action is based, in part, on this information.

11.2 Proposed Action and Action Area

For this EFH consultation, the proposed actions and action area are as described in detail above. The proposed actions are (1) NMFS' promulgation of ocean fishing regulations within the Exclusive Economic Zone (EEZ) of the Pacific Ocean and, (2) NMFS' regulation of U.S. Fraser Panel fisheries in northern Puget Sound under the Pacific Salmon Treaty (PST). The action area includes the EEZ, which is directly affected by the federal action, and the coastal and inland marine waters of the states of Washington, Oregon and California, which may be indirectly affected by the federal action. For the U.S. Fraser Panel Fisheries, the action area includes the U.S. waters of the Strait of Juan de Fuca and the San Juan Islands in northern Puget Sound. The estuarine and offshore marine waters are designated EFH for various life stages of groundfish and five coastal pelagic species. The action area also encompasses the Council-designated EFH for Chinook and coho salmon.

11.3 Effects of the Proposed Action

While harvest related activities do affect passage in that fish are intercepted, those impacts are accounted for explicitly in the ESA analyses regarding harvest related mortality. The harvest-related activities of the proposed actions considered in this consultation involve boats using hook-and-line gear and commercial purse seines, reef nets and gill nets. The use of these gears affects the water column and the shallower estuarine and nearshore substrates, rather than the deeper water, offshore habitats. The PFMC assessed the effects of fishing on salmon EFH and provided recommended conservation measures in Appendix A to Amendment 14 to the Pacific Coast Salmon Plan (PFMC 1999). The PFMC also assessed the effects of fishing activities, including ghost fishing by gillnets, on EFH for groundfish and provided recommended conservation measures that were adopted for Amendment 19 the Pacific Coast Groundfish Management Plan (PFMC 2005). The final rule implementing Amendment 19 will provide measures necessary to conserve EFH for groundfish. Therefore, no additional EFH recommendations are necessary for this proposed action.

Of the three types of impact on EFH identified by the PFMC for fisheries in Council waters, the concern regarding gear-substrate interactions and removal of salmon carcasses are also potential concerns for the fisheries in U.S. Fraser Panel waters. The types of salmon fishing gear that are used in U.S. Fraser Panel Fisheries - purse seine, reef net, and gillnet - actively avoid contact with the substrate because of the resultant interference with fishing and potential loss of gear. Consequently, there will be minimal disturbance to vegetation, and negligible harm to rearing habitat, or to water quantity and water quality. The PFMC conservation recommendations to address the concern regarding removal of salmon carcasses were to manage for maximum sustainable spawner escapement and implementation of management measures to prevent overfishing. Both of these conservation measures are basic principles of Fraser Panel management (PST 1999; Puget Sound Salmon Management Plan 1985). Thus, there will be minimal effects on the essential habitat features of the affected species from the action discussed in this biological opinion, certainly not enough to contribute to a decline in the values of the habitat.

11.4 Conclusion

The PFMC concluded fishing activities of the type included in the proposed actions considered in this opinion are likely to adversely affect EFH and it provided recommended conservation measures (Casillas et al. 1998; PFMC 1998; PFMC 1999). The PFMC adopted these conservation measures for fishing activities under its jurisdiction at the June 2000 Council meeting, and they were approved by the Secretary of Commerce as part of the package on Amendment 14 on September 27, 2000. These conservation measures remain in effect for the PFMC Fisheries. The U.S. Fraser Panel fisheries are unlikely to adversely affect EFH as described in Subsection 10.3 above. Therefore, NMFS concludes that EFH has been adequately addressed for the PFMC and U.S. Fraser Panel Fisheries.

11.5 EFH Conservation Recommendation

Pursuant to Section 305(b)(4)(A) of the Magnuson-Stevens Act, NMFS is required to provide EFH conservation recommendations to Federal agencies regarding actions which may adversely affect EFH. However, because NMFS concluded that (1) conservation recommendations have been made and adopted for the PFMC Fisheries and (2) the proposed U.S. Fraser Panel Fisheries would not adversely affect the EFH, no additional conservation recommendations beyond those identified and already adopted are needed.

11.6 Statutory Response Requirement

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

11.7 Consultation Renewal

NMFS must reinitiate EFH consultation if the proposed 2008 PFMC or U.S. Fraser Panel Fisheries are substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for the EFH conservation recommendations (50 CFR Section 600.920(k)).

12.0 Data Quality Act Documentation and Pre-Dissemination Review

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

Utility: This ESA section 7 biological opinion on proposed 2008 PFMC and U.S. Fraser Panel Fisheries will not jeopardize the Lower Columbia River Coho or Lower Columbia River Chinook Salmon ESUs. NMFS can therefore write a no-jeopardy Biological Opinion for the incidental take of ESA-listed Lower Columbia River coho and Lower Columbia River Chinook during conduct of 2008 PFMC and U.S. Fraser Panel Fisheries. The intended users are the members of the PFMC, the U.S. Fraser Panel and their respective communities. Tribal members, recreational fishers and associated businesses, commercial fishers, fish buyers and related food service industries, and the general public benefit from the consultation.

Copies of the Biological Opinion will be provided to the chairs of the PFMC and U.S. Fraser Panel. This biological opinion will be posted on the NMFS NW Region web site (www.nwr.noaa.gov). The format and naming adheres to conventional standards for style.

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

Objectivity:

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

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the literature cited section. The analyses in this Biological Opinion/EFH consultation contain more background on information sources and quality.

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

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

13.0 References

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