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

Effects of the Pacific Coast Salmon Plan Fisheries on the Lower Columbia River Chinook Evolutionarily Significant Unit

NMFS Consultation Number: F/NWR/2011/06415

Action Agency: National Marine Fisheries Service (NMFS)

Affected Species and Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species or Critical Habitat?	Is Action Likely to Jeopardize the Species?	Is Action Likely to Destroy or Adversely Modify Critical Habitat?
Lower Columbia River Chinook Salmon (*O. tshawytscha*)	Threatened	Yes	No	No

Fishery Management Plan That Describes EFH in the Project Area	**Does Action Have an Adverse Effect on EFH?**	**Are EFH Conservation Recommendations Provided?**
Pacific Coast Salmon	No	No
Pacific Council's Coastal Pelagic Species	No	No
Pacific Coast Groundfish	No	No
U.S. West Coast Fisheries for Highly Migratory Species	No	No

Consultation Conducted by: National Marine Fisheries Service, Northwest Region

Issued by:

William W. Stelle, Jr.
Regional Administrator

Date: April 26, 2012

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Acronyms and Abbreviations

CFR	Code of Federal Regulations
CR	Columbia River
CRITFC	Columbia River Inter-Tribal Fisheries Commission
CTC	Chinook Technical Committee
CWT	coded-wire tag (or tagged)
DIP	demographically independent population
DPS	distinct population segment
EEZ	exclusive economic zone
EFH	essential fish habitat
ER	exploitation rate
ESA	Endangered Species Act
ESU	evolutionarily significant unit
FR	Federal Register
FRAM	Fisheries Regulation Assessment Model
LCR	Lower Columbia River
MMPA	Marine Mammal Protection Act
MPG	major population group
MSA	Magnuson-Stevens Fishery Conservation Act
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPFMC	North Pacific Fisheries Management Council
NWIFC	Northwest Indian Fisheries Commission
OC	Oregon Coast
ODFW	Oregon Department of Fish and Wildlife
PFMC	Pacific Fisheries Management Council
PSC	Pacific Salmon Commission
PST	Pacific Salmon Treaty
RER	recovery exploitation rate
RMP	resource management plan
SFA	Sustainable Fisheries Act
TAC	Technical Advisory Committee
TRT	Technical Recovery Team
UCR	Upper Columbia River
USFWS	U.S. Fish and Wildlife Service
UWR	Upper Willamette River
VSP	viable salmonid population
VRAP	Viability Risk Assessment Procedure
WDFW	Washington Department of Fish and Wildlife

1 ▪ INTRODUCTION

This Introduction section provides information relevant to the other sections of this document and is incorporated by reference into Sections 2 and 3 below.

The National Marine Fisheries Service (NMFS) promulgates ocean fishing regulations within the Exclusive Economic Zone (EEZ) of the Pacific Ocean (Figure 1). There are 28 listed salmonid species in the action area that are potentially affected by the action considered in this biological opinion (Table 1). The take of salmon from 27 Endangered Species Act (ESA) listed salmon Evolutionary Significant Units (ESU) and steelhead Distinct Population Segments (DPS) 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') on the Lower Columbia River Chinook ESU beginning May 1, 2012 and extending for the foreseeable future until consultation is reinitiated by NMFS. We have reviewed information from other biological opinions that considered the effects of PFMC Fisheries on other listed species and confirmed that those opinions all remain valid.

1.1 Background

The National Marine Fisheries Service (NMFS) prepared the biological opinion (opinion) and incidental take statement portions of this document in accordance with section 7(b) of the ESA of 1973, as amended (16 U.S.C. 1531, *et seq*.), and implementing regulations at 50 CFR 402.

We also completed an Essential Fish Habitat (EFH) consultation on the proposed action, in accordance with section 305(b)(2) of the Magnuson-Stevens Fishery Conservation Act (MSA)(16 U.S.C. 1801, *et seq*.) and implementing regulations at 50 CFR 600.

The opinion, incidental take statement, and EFH conservation recommendations are each in compliance with the Data Quality Act (44 U.S.C. 3504(d)(1) et seq.) and they underwent pre-dissemination review.

1.2 Consultation History

The following summary describes the consultation history for NMFS' consideration of the effects of PFMC Fisheries to all ESA listed salmon and steelhead species and other non-salmonid species. The summary provides additional detail regarding the sequence of biological opinions that considered the effects of PFMC Fisheries to Lower Columbia River Chinook salmon. NMFS' last opinion on Lower Columbia River Chinook salmon expired April 30, 2012 (NMFS 2010). This opinion is the successor and considers the effects on Lower Columbia River Chinook salmon for fisheries beginning May 1, 2012 and extending until consultation is reinitiated.

NMFS is both the action agency and consulting agency on this opinion. NMFS establishes limits to harvest in PFMC Fisheries through its opinions which are conveyed through its annual guidance to the PFMC (see for example Stelle and McInnis 2012). NMFS establishes those limits through consideration of the essential elements of an opinion that include species status, environmental baseline, effects of the action, and cumulative effects. There are three sources of information that are particularly relevant to this consultation. First, there is a body of analytical work that has been developed over recent years that focused on the effects of harvest within a broader context that included the diversity of circumstances for populations within the ESU and anticipated recovery actions. Key references describing that work include Northwest Fisheries Science Center (NWFSC) (2010), Walton (2010), and responses to the list of tasks that were developed through the 2010 opinion (NMFS 2010). The second source of information is NMFS' proposed ESU-level recovery plan (hereafter 'roll-up recovery plan') (NMFS 2012a) that consolidates information contained in three management unit recovery plans (ODFW 2010, LCFRB 2010, NMFS 2011c) and the Columbia River Estuary Module (NMFS 2007b). NMFS completed the roll-up recovery plan in April 2012 and expects to publish it in the Federal Register for public comment in May 2012. Finally, NMFS considered a report that proposed a new abundance based framework for managing the harvest of Lower Columbia River tule Chinook salmon populations (Beamesdorfer et al. 2011). Consideration of an abundance based management framework was called for in the management unit recovery plans (ODFW 2010, LCFRB 2010). The PFMC volunteered to organize an ad hoc work group to facilitate the process. The Ad Hoc Tule Chinook Work Group (TCW) spent eighteen months on the project and completed their report in October 2011 (Beamesdorfer et al. 2011). At its November 2011 meeting, the PFMC adopted the report and requested that NMFS consider a particular abundance based framework in this opinion and for use in managing fisheries in 2012 and beyond (McIsaac 2011a). All of these references are discussed in more detail below.

NMFS provided its annual guidance letter to the PFMC prior to the March Council meeting (Stelle and McInnis 2012). The letter summarized harvest limits for Lower Columbia River Chinook salmon and other ESA listed species. The PFMC used this guidance throughout the preseason management process to develop alternatives and make its final recommendation regarding 2012 regulations (PFMC 2012 c,d,e).

Since 1991, 28 salmon ESUs and steelhead 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 and other species listed under the ESA resulting from PFMC Fisheries and issued biological opinions based on the regulations implemented each year or in the underlying Pacific Coast Salmon Fishery Management Plan (FMP) itself. In an opinion dated March 8, 1996, NMFS considered the impacts on all salmon species then listed under the ESA resulting from implementation of the FMP including spring/summer Chinook salmon, fall Chinook salmon, sockeye salmon from the Snake River, and Sacramento River winter Chinook salmon (NMFS 1996). Subsequent 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 2001a, NMFS 2004). NMFS has developed new consultations or 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. Table 2 lists the biological opinions and 4(d) Limit determinations currently in effect that consider effects of PFMC Fisheries on each of the listed salmonid species. The current opinion for Sacramento winter-run Chinook salmon expires April 30, 2012. A new opinion is in preparation and will be completed prior to May 1, 2012.

Other non-salmonid species have also been listed under the ESA in recent years including Southern Resident killer whales (*Orcinis orca*), the southern DPS of North American green sturgeon (*Acipenser medirostris*), three Puget Sound/Georgia Basin Rockfish species (*Sebastes spp.*), Stellar Sea Lions (*Eumetopias jubatus*), and Pacific Eulachon (*Thaleichthys pacificus*) (Table 1). NMFS has also previously considered the effects of PFMC Fisheries on these species and determined either that the fishery would have no effect, was not likely to adversely effect, or was not likely to jeopardize the species, and made necessary determinations related to designated critical habitat. The related biological opinions are listed in Table 2. A complete record of this consultation is on file at the Salmon Management Division (SMD) in Seattle, Washington.

Figure 1. Pacific Fisheries Management Council Exclusive Economic Zone

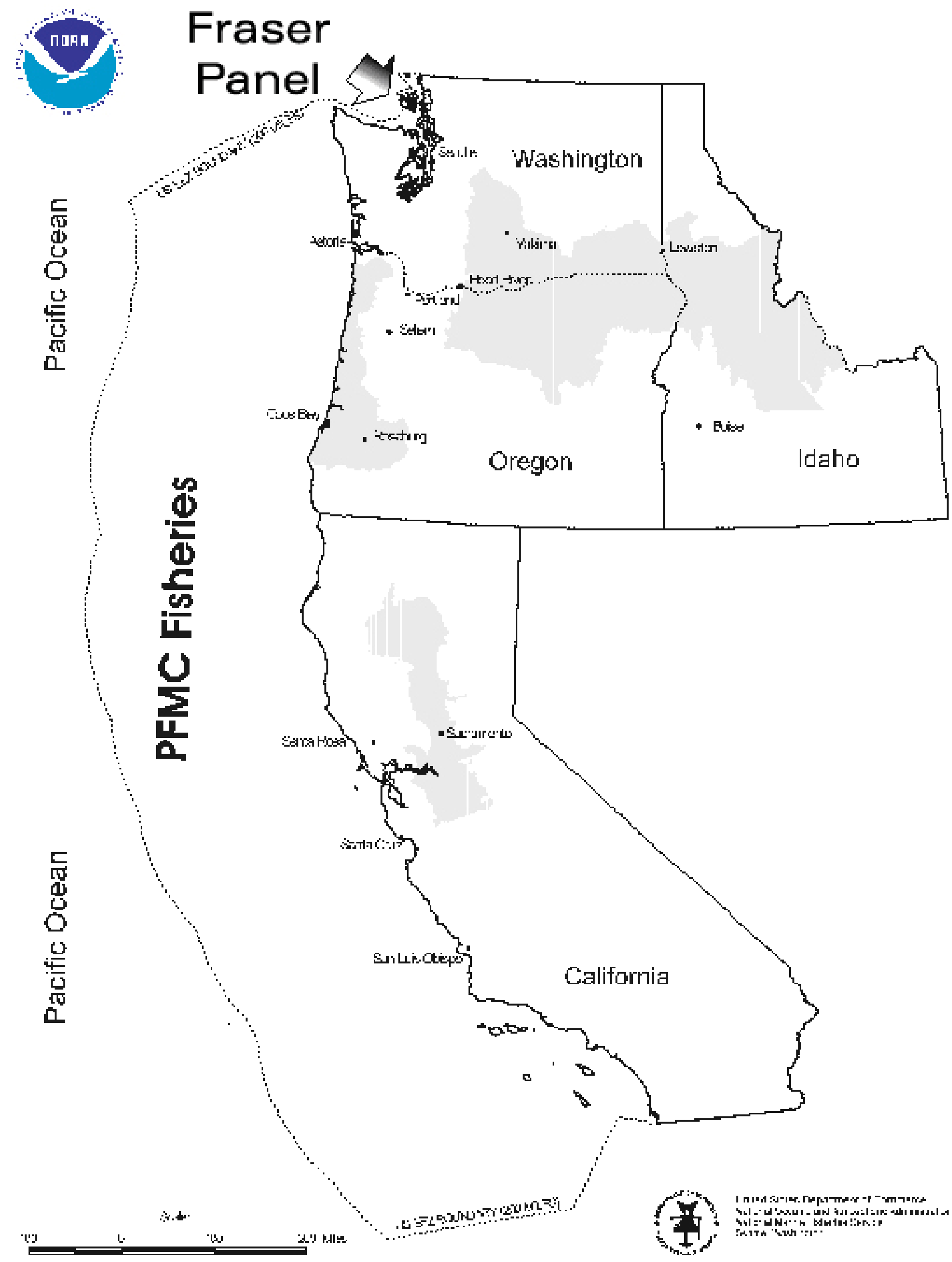


Table 1. Status and critical habitat designations for ESA listed species (Listing status: 'T' means listed as threatened under the ESA; 'E' means listed as endangered).

Species	Listing Status, Federal Register Notice	Critical Habitat Designated
Chinook salmon (*Oncorhynchus tshawytscha*)		
Sacramento River winter-run	E: 70 FR 37160 6/28/05	06/16/93 (NMFS 1993a)
Snake River fall-run	T: 70 FR 37160 6/28/05	12/28/93 (NMFS 1993b)
Snake River spring/summer-run	T: 70 FR 37160 6/28/05	10/25/99 (NMFS 1999b)
Puget Sound	T: 70 FR 37160 6/28/05	09/02/05 (NMFS 2005a)
Lower Columbia River	T: 70 FR 37160 6/28/05	09/02/05 (NMFS 2005a)
Upper Willamette River	T: 70 FR 37160 6/28/05	09/02/05 (NMFS 2005a)
Upper Columbia River spring-run	E: 70 FR 37160 6/28/05	09/02/05 (NMFS 2005a)
Central Valley spring-run	T: 70 FR 37160 6/28/05	09/02/05 (NMFS 2005a)
California Coastal	T: 70 FR 37160 6/28/05	09/02/05 (NMFS 2005a)
Chum salmon (*O. keta*)		
Hood Canal Summer-run	T: 70 FR 37160 6/28/05	09/02/05 (NMFS 2005a)
Columbia River	T: 70 FR 37160 6/28/05	09/02/05 (NMFS 2005a)
Coho Salmon (*O. kisutch*)		
Central California Coast	E: 70 FR 37160 6/28/05	05/05/99 (NMFS 1999c)
S. Oregon/N. California Coasts	T: 70 FR 37160 6/28/05	05/05/99 (NMFS 1999c)
Lower Columbia River	T: 70 FR 37160 6/28/05	Not yet designated
Oregon Coast	T: 76 FR 35755 6/20/11	02/11/08 (NMFS 2008a)
Sockeye Salmon (*O. nerka*)		
Snake River	E: 70 FR 37160 6/28/05	12/28/93 (NMFS 1993b)
Ozette Lake	T: 70 FR 37160 6/28/05	09/02/05 (NMFS 2005a)
Steelhead (*O. mykiss*)		
Southern California	E: 71 FR 834 1/05/06	09/02/05 (NMFS 2005a)
South-Central California Coast	T: 71 FR 834 1/05/06	09/02/05 (NMFS 2005a)
Central California Coast	T: 71 FR 834 1/05/06	09/02/05 (NMFS 2005a)
Northern California	T: 71 FR 834 1/05/06	09/02/05 (NMFS 2005a)
Upper Columbia River	T: 71 FR 834 1/05/06	09/02/05 (NMFS 2005a)
Snake River Basin	T: 71 FR 834 1/05/06	09/02/05 (NMFS 2005a)
Lower Columbia River	T: 71 FR 834 1/05/06	09/02/05 (NMFS 2005a)
California Central Valley	T: 71 FR 834 1/05/06	09/02/05 (NMFS 2005a)
Upper Willamette River	T: 71 FR 834 1/05/06	09/02/05 (NMFS 2005a)
Middle Columbia River	T: 71 FR 834 1/05/06	09/02/05 (NMFS 2005a)
Puget Sound Steelhead	T: 72 FR 26722 5/11/07	Not yet designated
North American Green Sturgeon (*Acipenser medirostris*)		
Southern DPS of Green Sturgeon	T: 71 FR 17757 4/07/06	10/09/09 (NMFS 2009a)
Killer Whales (*Orcinus orca*)		
Southern Resident DPS Killer Whales	E: 70 FR 69903 11/18/05	11/29/06 (NMFS 2006a)
Steller Sea Lion (*Eumetopias jubatus*)		
Western DPS	E: 62 FR 24345 5/05/97	08/27/93 (NMFS 1993c)
Eastern DPS	T: 55 FR 49204 11/26/90	08/27/93 (NMFS 1993c)
Eulachon (*Thaleichthys pacificus*)		
Columbia River Eulachon (Smelt)	T: 75 FR 13012 3/18/10	10/20/11 (NMFS 2011a)
Puget Sound/Georgia Basin Rockfish (*Sebastes spp.*)		
Bocaccio, Yelloweye, Canary	E: Boccacio T: Yelloweye, Canary 75 FR 22276 4/28/10	Not yet designated

As a result of the previous consultation history, the effects of PFMC Fisheries on all but one of the 27 listed salmonid ESUs and DPSs have been considered for ESA compliance in long-term biological opinions or 4(d) limit approvals (Table 2). NMFS reviewed the effect of the 2010 and 2011 PFMC Fisheries on Lower Columbia River Chinook salmon, but NMFS' review was limited in duration to the end of the 2011 fishing season that extended through April 30, 2012. As mentioned above, this opinion considers the effect of PFMC Fisheries on Lower Columbia River Chinook salmon beginning May 1, 2012 and extending until consultation is reinitiated by NMFS.

Table 2. NMFS ESA decisions regarding ESUs and DPS 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	Species Considered
Salmonid Species			
March 8, 1996 (BO)	until reinitiated	NMFS 1996	Snake River spring/summer and fall Chinook, and sockeye
April 28, 1999 (BO)	until reinitiated	NMFS 1999a	S. Oregon/N. California Coasts coho Central California Coast coho Oregon Coast coho
April 28, 2000 (BO)	until reinitiated	NMFS 2000b	Central Valley Spring-run Chinook California Coastal Chinook
April 27, 2001 (BO, 4(d) Limit)	until withdrawn	NMFS 2001b	Hood Canal summer-run chum
April 30, 2001 (BO)	until reinitiated	NMFS 2001a	Upper Willamette River Chinook Columbia River chum Ozette Lake sockeye Upper Columbia River spring-run Chinook Ten listed steelhead DPSs
June 13, 2005 (BO)	until reinitiated	NMFS 2005b	California Coastal Chinook
April 29, 2008 (BO)	until reinitiated	NMFS 2008b	Lower Columbia River coho
April 2012 (BO)	until reinitiated	NMFS 2012b	Sacramento River winter-run Chinook
May 24, 2011 (BO)	until April 2014	NMFS 2011b	Puget Sound Chinook Puget Sound steelhead
Non Salmonid species			
April 30, 2007 (BO)	until reinitiated	NMFS 2007a	North American Green Sturgeon
December 22, 2008 (BO)	until December 2018	NMFS 2008c	Eastern and Western DPS Steller Sea Lion
May 5, 2009 (BO)	until reinitiated	NMFS 2009b	Southern Resident Killer Whales
April 30, 2011 (BO)	until reinitiated	NMFS 2010	Puget Sound/Georgia Basin Rockfish
April 30, 2011 (BO)	until reinitiated	NMFS 2010	Pacific Eulachon

This opinion considers the effect of PFMC Fisheries on Lower Columbia River Chinook salmon. 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. Prior consultations have considered the effects of the proposed action on all components of the Lower Columbia River Chinook ESU, but because of related complexities have focused on the tule component in greater detail. That relative emphasis continues in this opinion.

Lower Columbia River Chinook salmon were first listed as threatened under the ESA on April 24, 1999 (64 FR 14308) and its threatened status was reaffirmed on June 28, 2005 (Table 1). NMFS issued results of a five-year review on Aug. 15, 2011 (76 FR 50448), and concluded that this species should remain listed as threatened. 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 salmon. NMFS did not set specific harvest constraints in the 1999 opinion as it sought to develop the necessary information for the just listed species (NMFS 1999d). In 2000 and 2001 NMFS required that the total brood year exploitation rate for the Coweeman stock (representing the Lower Columbia River tule component of the ESU), in all fisheries combined, not exceed 65 percent (NMFS 2000c and 2001a). The exploitation rate limit was derived at the time using the Viability Risk Assessment Procedure (VRAP), which provided an estimate of an associated Rebuilding Exploitation Rate (RER). An 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 1999e) and the 2000 opinion on PFMC Fisheries (NMFS 2000a). (For a more detailed discussion of VRAP and the related RER calculations see NMFS 2009c). The 65 percent RER was subsequently reviewed and replaced in 2002 with an RER of 49 percent (Simmons 2002). The 49 percent RER was used as the consultation standard for the tule component of the Lower Columbia River Chinook ESU from 2002 to 2006 (NMFS 2001a, NMFS 2004).

In the 2006 Guidance Letter to the PFMC, NMFS indicated our intention to review the 49 percent RER (Lohn and McInnis 2006). After five years NMFS concluded that a periodic review was warranted. The Lower Columbia River Salmon Recovery Plan (LCRFRB 2004) also called for a review of the 49 percent 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 (WDFW).

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 data was subject to less review and was therefore less reliable. The Work Group reviewed available data and updated the RER estimates for the three populations based on the method used to calculate the 49 percent exploitation rate used for the Coweeman in 2002. The Work Group sought to integrate their review with several recovery planning documents and analyses that had 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 persistence, and used information in the LCFRB Plan to evaluate which populations are most important to focus on for recovery. The general conclusion from the array of analytical 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 Chinook salmon populations from 49 percent to 42 percent. The Work Group provided a report in October 2007 along with an associated addendum in February 2008 (Ford et al. 2007, LCRTWG 2008). In 2008 the exploitation rate was reduced again to 41 percent (NMFS 2008b). In both years, NMFS' guidance to the Council, the Work Group analysis, and other related information, provided the basis for NMFS' consultation on Lower Columbia River Chinook salmon which was described in detail in the associated opinions.

In 2008, after completing the opinion for that year, the U.S. completed a new ten-year agreement with Canada pursuant to the PST. The new agreement resulted in reductions in the Alaskan and Canadian fisheries for the next ten years that reduced impacts to Lower Columbia River tule Chinook salmon (NMFS 2008c). NMFS' guidance to the Council for the 2009 fishing season took advantage of the anticipated savings from the new PST Agreement and required that the exploitation rate on Lower Columbia River tule Chinook salmon be reduced in 2009 to 38 percent (Thom and McInnis 2009). NMFS further indicated their intention to review the information that had accumulated over the last several years and conduct further analysis that would provide the basis for a biological opinion that would set harvest limits for the next several years. The goal of the multi-year approach was to reduce the uncertainty associated with recovery, and add predictability to recreational, commercial and tribal fisheries. Although NMFS, the co-managers and recovery planners made significant progress over the recent years and during the time leading up to the decision for 2010 in developing additional information to inform recovery, the effort did not meet the conditions necessary to support a long term harvest regime. Instead, NMFS provided guidance through their annual letter to the Council that applied to fisheries in 2010 and 2011 only (Thom and McInnis 2010), resulting in an exploitation rate of 38 percent in 2010, and a conditional 37 percent in 2011 if a series of tasks were completed that reduced uncertainties related to recovery.

As mentioned above, NMFS' 2010 guidance letter included a list of tasks that were relevant to NMFS' decision regarding the applicable exploitation rate in 2011. The purpose of those tasks was to reduce the uncertainty related to the recovery strategy. From recovery planning and other assessments, NMFS has a good understanding of the sorts of survival improvements that must occur to achieve recovery. The tasks were designed to accelerate the recovery process by identifying and promoting actions that benefited the tule Chinook salmon populations. Four of the tasks addressed habitat activities. The other tasks focused on hatchery and harvest reforms and methods for improving our understanding of the escapement of primary populations. The tasks were also designed to bring greater certainty that actions would occur as quickly as possible. The eight tasks, listed a through h, needed to be met in order to allow for a total exploitation rate limit in 2011 of 37 percent rather than 36 percent. The tasks were:

a) Describe the primary funding sources for habitat improvement projects, and existing data bases and/or summaries of all past and present projects that benefit Lower Columbia River tule Chinook salmon populations. The report should include an assessment of the feasibility and utility of developing a more coordinated and centralized reporting system. The report will also comment on how to best improve coordination and reporting of all future projects.

b) Identify the amount and distribution of extant marsh type habitats currently inaccessible for juvenile rearing. The report will focus specifically on lower tributary and mainstem

Columbia juvenile rearing habitats used by Lower Columbia River tule Chinook salmon populations. The report should also identify ongoing efforts to gather additional data on current and potential juvenile rearing habitat distribution in the Lower Columbia River.

c) Identify milestones or expected trends in improved habitat conditions in high priority tributary and intertidal areas for tule Chinook salmon populations.

d) Describe a recovery plan implementation schedule that identifies specific actions for a 3 to 5 year period, potential implementing entities, costs, location and duration of actions, funding sources, viable salmon populations (VSP) and limiting factors affected, and linkages to milestones for improved habitat conditions.

e) Describe the transition strategy for reducing the proportion of hatchery fish in natural spawning areas for primary tule Chinook salmon populations in a manner that addresses short term demographic risks while promoting progress to recovery objectives.

f) Analyze options for implementing mark selective fisheries. The report should include an analysis of the feasibility of mark selective fisheries, the magnitude of differential harvest impacts to marked and unmarked fish, and the relative benefits of efforts to reduce the harvest mortality to natural origin fish and reduce the proportion of hatchery fish on the spawning grounds. The report should also provide a schedule for assessing selective fishing gear and mortality rates of released fish.

g) Analyze options for incorporating abundance driven management principles into Lower Columbia tule Chinook salmon management.

h) Review and update existing escapement estimate time series for selected primary tule populations with particular attention to estimates of hatchery contribution. The report should also describe current escapement monitoring programs and how they are designed to address key uncertainties.

Based on the guidance from NMFS and the 2010 biological opinion, work groups were formed and worked through February 2011 to address each task. The work groups included staff with the necessary expertise from the state fishery management agencies, those directly involved with recovery planning, and from NMFS' Northwest Regional Office and Science Center. Reports were completed that address each task. These reports are posted on NMFS' website at http://www.nwr.noaa.gov/Salmon-Recovery-Planning/Recovery-Domains/Willamette-Lower-Columbia/LC/index.cfm. NMFS reviewed these reports and concluded that the tasks were addressed adequately and that the condition of the 2010 biological opinion was satisfied. Based on that finding NMFS concluded that fisheries in 2011 should be managed subject to an exploitation rate for Lower Columbia River tule Chinook salmon of 37 percent.

1.3 Proposed Action

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. For the purpose of future proposed fisheries in 2012 and beyond, NMFS determined that no interrelated or interdependent actions exist.

As described in more detail below, the proposed action is to manage PFMC Fisheries consistent with specified harvest limits for Lower Columbia River spring, bright, and tule Chinook salmon populations. Spring populations are managed to meet particular hatchery escapement goals. Bright populations are managed to meet the escapement goal for North Fork Lewis Chinook salmon. Tule populations are managed using an abundance based harvest schedule that allows the total exploitation rate for all fisheries to vary from year-to-year between 30 percent and 41 percent as defined in Table 3 below.

NMFS also proposes to reevaluate the assumptions and conclusions of the opinion every five years at a minimum (referred to subsequently as the five year check in), and more frequently if new information becomes available that may affect NMFS' conclusion in this opinion. This opinion relies significantly on the assumption that harvest will be managed consistent with the interim strategies and provisions described in the roll-up recovery plan (NMFS 2012a) and that progress will be made over time addressing the full range of other limiting factors. Conclusions about harvest and related expectations about the species survival and recovery therefore depend on the success of the all-H strategy described in the recovery plan and in more detail below. The purpose of this review therefore is to reconsider the status of the species, the effect of the action, key assumptions in the all-H strategy, and other information that may lead to a reconsideration of NMFS' conclusion in this opinion.

This opinion considers the effects of NMFS' promulgation of annual regulations developed in accordance with the Pacific Coast Salmon Plan on ESA-listed Lower Columbia River Chinook salmon. Because the extent of allowable impacts each year in the PFMC Fisheries will be constrained by an exploitation rate limit that includes all fisheries impacting Lower Columbia River tule Chinook salmon, the PFMC's calculation of specific harvest rates each year is the remainder of the total exploitation rate after taking into account estimated impacts on Lower Columbia River Chinook salmon that have or are expected to occur that year in those other fisheries. Those other fisheries include fisheries in Southeast Alaska, Canada, Puget Sound and the Strait of Juan de Fuca (particularly including the fisheries directed at Fraser River sockeye and pink salmon managed by the Fraser River Panel pursuant to the PST), Buoy 10, and the Lower Columbia River.

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 MSA (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 MSA, NMFS proposes to promulgate ocean salmon fishing regulations developed in accordance with the FMP along with the FMP's associated amendments. These ocean fisheries include recreational and commercial troll fisheries, and tribal fisheries targeting coho and Chinook salmon. 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 MSA and other applicable law including 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 options considered by the Council include various time and area openings, catch quotas, non-retention requirements related to species and size, and other regulations that are designed to meet all of the conservation and allocation objectives of the FMP. Specifics about the final option recommended by the Council are described in their final planning report for the year referred to as Preseason Report III. The Council's analysis of the options includes assumptions regarding the levels of harvest for Lower Columbia River Chinook salmon and other listed species in fisheries to the north of the U.S. border, and in state marine, estuarine, and freshwater areas.

Fisheries in Southeast Alaska and Canada are managed subject to the terms of the PST Agreement (Pacific Salmon Commission, May, 2008) that commenced on January 1, 2009 and will be in place through 2018 (PST 2009). 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. State, Tribal, and Federal parties to *U.S. v. Oregon* completed a new management agreement that applies to non-Treaty and treaty Indian fisheries in the Columbia River for the next ten years through 2017. The agreement is titled 2008-2017 United States v. Oregon Management Agreement and is referred to here as the 2008 Management Agreement (*U.S. v. Oregon* Parties 2008). The agreement applies to fisheries in the mainstem Columbia River from its mouth upstream to the Wanapum Dam and in the Snake River up to Lower Granite Dam. NMFS completed opinions on the 2008 PST Agreement and 2008 Management Agreement (NMFS 2008c, NMFS 2008d). The opinions considered the effects of fisheries covered by those agreements on the listed salmon and steelhead species including Lower Columbia River Chinook salmon. Though the fisheries to the north are covered under the PST opinion, their impact on Lower Columbia River Chinook salmon must be included in the total exploitation rate limit established by NMFS. As a consequence, the PFMC and co-managers must account for the harvest expected to occur in fisheries to the north, and propose how the remaining allowable catch (exploitation rate) will be distributed among southern U.S. ocean and in-river fisheries. The necessary allocation choices are made concurrent with the Council's annual preseason planning process. This close association between fisheries managed subject to the PST Agreement, PFMC Fisheries, and those in the Columbia River is also discussed in the aforementioned opinions (NMFS 2008b, NMFS 2008c, NMFS 2008d, NMFS 2010).

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 opinions that considered consultation standards for 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 cases, NMFS provides consultation standards that apply for only one year or a few years. 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.

Information related to Lower Columbia River Chinook salmon has been developed to a point where NMFS believes it can move from the annual or short term consultation standards provided in recent years to a multi-year framework as we have done for other listed species. NMFS will continue to reiterate these consultation standards to the Council through its annual Guidance Letter. For Lower Columbia River Chinook salmon, the subject of this consultation, NMFS recommends a standard that would begin May 1, 2012 and apply until consultation is reinitiated by NMFS.

The Lower Columbia River Chinook ESU includes populations with spring, bright and tule life history types.

Of nine historical spring Chinook salmon populations the White Salmon and Hood River populations are considered extinct, both located in the Columbia River Gorge above Bonneville Dam. Condit Dam on the White Salmon was removed in 2011. The river will be monitored for the next four or five years to allow for natural recolonization before deciding whether to proceed with a reintroduction program. Spring Chinook salmon from the Deschutes River, an out of ESU stock, are being used to reestablish natural production in Hood River. Four of the remaining seven populations are targeted to achieve high viability including the Upper Cowlitz, Cispus (a tributary of the Cowlitz), North Fork Lewis, and Sandy river populations. The historic spawning habitat for the Upper Cowlitz, Cispus, and Lewis populations in Washington is now largely inaccessible to salmon due to impassable dams. These populations are therefore dependent, for the time being, on the associated hatchery programs. The Lower Columbia Salmon Recovery Plan specifies actions to be taken to facilitate recovery of spring Chinook salmon populations in Washington State. The Cowlitz and Lewis river hatcheries are being used, for example, for reintroduction of spring Chinook salmon into the upper basins above the existing dams. The hatchery programs are therefore critical to the overall recovery effort. The status of the Sandy River population is better than that of the other spring populations. The average escapement of natural origin fish in Sandy has exceeded the target abundance objective of 1,230 in recent years. The Sandy River hatchery is currently being managed as a segregated program for fishery augmentation. Although additional progress is required to meet the high viability objective for the Sandy, harvest objectives specified for the population through recovery planning are being met. Given the circumstances, maintaining the hatchery brood stocks for the Cowlitz and Lewis river hatcheries is essential for implementation of specified recovery actions. The hatcheries have met their escapement objectives in recent years with few exceptions, and are expected to do so again in 2012 and for the foreseeable future, thus ensuring that what remains of the genetic legacy is preserved and can be used to advance recovery. NMFS expects that the management agencies will continue to manage in-river fisheries to meet hatchery escapement goals.

There are two extant natural-origin bright populations in the Lower Columbia River Chinook ESU including the North Fork Lewis and Sandy river populations. Both populations are considered to be relatively healthy. The North Fork Lewis River population is used as a harvest indicator for ocean and in-river fisheries. The escapement goal used for management purposes for the Lewis population is 5,700, based on estimates of maximum sustained yield derived from spawner-recruit analysis. Escapements have averaged 9,500 over the last ten years and, with few exceptions, have met or exceeded the goal since at least 1980. The Sandy River population is considered in Oregon's Recovery Plan (ODFW 2010) to be at low risk and viable under current harvest conditions. NMFS expects that the states of Washington and Oregon will continue to monitor the status of the Lower Columbia River bright populations, and take the specific actions necessary through their usual authorities to deliver spawning escapement through the fisheries they manage sufficient to maintain the health of these populations.

NMFS proposes to manage Lower Columbia River tule Chinook salmon beginning in 2012 using the abundance based exploitation rate schedule described in Table 3. The total allowable exploitation rate would be set each year depending on the preseason forecast of abundance. The proposed schedule was developed in direct response to a Conservation Recommendation in the 2010 opinion that last considered the effects of fisheries on Lower Columbia River Chinook salmon (NMFS 2010). The abundance based initiative was referred to as Task G in the opinion and was one of a series of tasks (discussed in more detail in the preceding section) designed to accelerate the recovery process by identifying and promoting actions that will benefit the Lower Columbia tule Chinook salmon populations. Use of an abundance based management framework is also consistent with recommendations of the roll-up recovery plan (NMFS 2012).

The Council took responsibility for establishing the Ad Hoc Tule Chinook Work Group (TCW) to explore the options for an abundance based management system. The TCW spent approximately eighteen months on the project and completed their report in October 2011 (Beamesderfer et al. 2011). At its November 2011 meeting, the Council recommended to NMFS a particular abundance based management approach for its consideration in this biological opinion for 2012 with the intention that it be used when formulating consultation standards in 2012 and future years (McIsaac 2011a).

Consistent with the Council's recommendation, NMFS proposes to manage fisheries subject to a total exploitation rate limit that would be set each year based on the preseason forecast of Lower River Hatchery Chinook salmon. As explained in Beamesderfer et al. (2011), the abundance of hatchery fish is used as a surrogate for the relative abundance of natural-origin tule Chinook salmon. The exploitation rate would range from 30 percent to 41 percent as described in Table 3.

Table 3. Variable fishing exploitation rate limits based on abundance tier as proposed by PFMC (McIsaac 2011a).

Lower River Hatchery Abundance Forecast	Total Exploitation Rate Limit
0 – 30,000	0.30
30,000 – 40,000	0.35
40,000 – 85,000	0.38
>85,000	0.41

PFMC Fisheries would be managed each year such that the total exploitation rate on Lower Columbia River tule Chinook salmon in all fisheries in the ocean and in the Columbia River below Bonneville Dam does not exceed the year specific exploitation rate limit. The year specific limits, based on the abundance forecast and corresponding exploitation rate in Table 3, would be defined in NMFS' annual guidance letter to the Council. NMFS proposes to use this approach in 2012 and for the foreseeable future until consultation is reinitiated. The Council recommended and NMFS concurs that the abundance based schedule should be reviewed periodically beginning after the third year of implementation. The purpose of the review would be to assess performance, and assumptions and expectations described in the Beamesderfer et al. (2011) analysis. This risk analysis compared various abundance based management alternatives to the risk that would occur under a fixed exploitation rate strategy. Abundance based alternatives that had risk levels that were less than or equal to a fixed exploitation rate of 36 percent were considered viable. The risk metrics for the proposed abundance based framework are equivalent to those of a fixed exploitation rate of 36 percent. This provides a point of reference for comparing the proposed abundance based framework to fixed exploitation rates that were anticipated in the management unit recovery plans, and those used in recent years.

After completing their preseason planning process in April of each year, the Council recommends fisheries that are designed to comply with NMFS' ESA take limit guidance. For a description of the proposed PFMC Fisheries, refer to the current PFMC Preseason Report III published each year at the conclusion of the preseason planning process. The amount of fishing and associated catch allowed in PFMC Fisheries will vary from year to year depending on stock specific run sizes, catches anticipated in other fisheries, and fishery allocation decisions, but proposed fisheries in the PFMC Preseason Report III will be consistent with the overall limits and guidance provided by NMFS through its annual guidance letter to the Council.

Successful management of the Council area salmon fisheries requires monitoring to collect information on the fish stocks, the amount of effort for each fishery, the harvests that occurs in each fishery, the timing of harvest, and other biological and fishery statistics. In general, the information can be divided into that needed for in-season management and that needed for annual and long-term management. The data needs and reporting requirements for the fishery are described in the Salmon FMP (PFMC 2012). Catch, escapement, and compliance with conservation objectives are reported annually in the Council's preseason documents including, in particular, the annual Review of Ocean Salmon Fisheries (see for example PFMC 2012a).

1.4 Action Area

In developing its annual recommendations for ocean salmon fisheries, the PFMC analyzes management options for fisheries occurring in the EEZ off the states of Washington, Oregon and California (i.e., west coast EEZ). This analysis includes assumptions regarding the levels of harvest in state marine, estuarine, and freshwater areas, which are regulated under authority of the states and federally recognized tribes with fishing rights. Due to the mixed stock nature of the fishery, the scope of the west coast EEZ that is open to salmon fishing and the length of time the areas are open in any one year depends on salmon stock abundances in excess of the conservation objectives and the spatial distribution of constraining stocks. NMFS establishes fishery management measures for ocean salmon fisheries occurring in the west coast EEZ based on the PFMC recommendations. Because Washington, Oregon, and California are members of the PFMC, they generally manage their marine waters to conform with the regulations approved by NMFS. If a state's actions substantially and adversely affect the carrying out of the FMP, the Secretary may, under the MSA, assume responsibility for the regulation of ocean fishing in state marine waters; however that authority does not extend to a state's internal waters. For the purposes of this Opinion, the action area is the U.S. west coast EEZ (which is directly affected by the proposed federal action) and the marine waters, other than internal, of the states of Washington, Oregon, and California (which may be indirectly affected by the federal action) (Figure 1).

Indirect effects also occur as a result of fish that are caught and released alive to comply with non-retention requirements related to species, size, or mark-selective fishery requirements. Some of the fish that are released may by injured and subsequently die. These indirect effects are explicitly considered and accounted for in the Effects section of this opinion.

2 ▪ ENDANGERED SPECIES ACT: BIOLOGICAL OPINION & INCIDENTAL TAKE STATEMENT

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat on which they depend. Section 7(a)(2) of the ESA requires Federal agencies to consult with the United States Fish and Wildlife Service, NMFS, or both, to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or adversely modify or destroy their designated critical habitat. Section 7(b)(3) requires that at the conclusion of consultation, the Service provide an opinion stating how the agencies' actions will affect listed species and their critical habitat. If incidental take is expected, Section 7(b)(4) requires the provision of an incidental take statement (ITS) specifying the impact of any incidental taking, and including reasonable and prudent measures to minimize such impacts.

2.1 Introduction to the Biological Opinion

Section 7(a)(2) of the ESA requires Federal agencies, in consultation with NMFS, to insure that their actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. The jeopardy analysis considers both survival and recovery of the species. The adverse modification analysis considers the impacts on the conservation value of the designated critical habitat.

"To jeopardize the continued existence of a listed species" means to engage in an action that would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR 402.02).

This biological opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 C.F.R. 402.02. Instead, we have relied upon the statutory provisions of the ESA to complete the following analysis with respect to critical habitat.[1]

We will use the following approach to determine whether the proposed action described in Section 1.3 is likely to jeopardize listed species or destroy or adversely modify critical habitat:

- *Identify the rangewide status of the species and critical habitat likely to be adversely affected by the proposed action*. This section describes the current status of each listed species and its critical habitat relative to the conditions needed for recovery. For listed salmon and steelhead, NMFS has developed specific guidance for analyzing the status of the listed species' component populations in a "viable salmonid populations" paper (VSP; McElhany et al. 2000). The VSP approach considers the abundance, productivity, spatial structure, and diversity of each population as part of the overall review of a

[1] Memorandum from William T. Hogarth to Regional Administrators, Office of Protected Resources, NMFS (Application of the "Destruction or Adverse Modification" Standard Under Section 7(a)(2) of the Endangered Species Act) (November 7, 2005).

species' status. For listed salmon and steelhead, the VSP criteria therefore encompass the species' "reproduction, numbers, or distribution" (50 CFR 402.02). In describing the range-wide status of listed species, we rely on viability assessments and criteria in technical recovery team documents and recovery plans, where available, that describe how VSP criteria are applied to specific populations, major population groups, and species. We determine the rangewide status of critical habitat by examining the condition of its physical or biological features (also called "primary constituent elements" or PCEs in some designations) - which were identified when the critical habitat was designated. Species and critical habitat status are discussed in Section 2.2.

- *Describe the environmental baseline in the action area*. The environmental baseline includes the past and present impacts of Federal, state, or private actions and other human activities *in the action area*. It includes the anticipated impacts of proposed Federal projects that have already undergone formal or early section 7 consultation and the impacts of state or private actions that are contemporaneous with the consultation in process. The environmental baseline is discussed in Section 2.3 of this opinion.
- *Analyze the effects of the proposed action on both thespecies and their habitat*. In this step, we consider how the proposed action would affect the species' reproduction, numbers, and distribution or, in the case of salmon and steelhead, their VSP characteristics. We also evaluate the proposed action's effects on critical habitat features. The effects of the action are described in Section 2.4 of this opinion.
- *Describe any cumulative effects in the action area.* Cumulative effects, as defined in NMFS' implementing regulations (50 CFR 402.02), are the effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area. Future Federal actions that are unrelated to the proposed action are not considered because they require separate section 7 consultation. Cumulative effects are considered in Section 2.5 of this opinion.
- *Integrate and synthesize the above factors to assess the risk that the proposed action poses to species and critical habitat.* In this step, we add the effects of the action (Section 2.4) to the environmental baseline (Section 2.3) and the cumulative effects (Section 2.5) to assess whether the action could reasonably be expected to: (1) appreciably reduce the likelihood of both survival and recovery of the species in the wild by reducing its numbers, reproduction, or distribution; or (2) reduce the value of designated or proposed critical habitat for the conservation of the species. These assessments are made in full consideration of the status of the species and critical habitat (Section 2.2). Integration and synthesis occurs in Section 2.6 of this opinion.
- *Reach jeopardy and adverse modification conclusions*. Conclusions regarding jeopardy and the destruction or adverse modification of critical habitat are presented in Section 2.7. These conclusions flow from the logic and rationale presented in the Integration and Synthesis section (2.6).
- *If necessary, define a reasonable and prudent alternative to the proposed action.* If, in completing the last step in the analysis, NMFS determines that the action under consultation is likely to jeopardize the continued existence of listed species or destroy or adversely modify designated critical habitat, NMFS must identify a reasonable and prudent alternative (RPA) to the action in Section 2.8. The RPA must not be likely to jeopardize the continued existence of ESA-listed species nor adversely modify their designated critical habitat and it must meet other regulatory requirements.

2.2 Rangewide Status of the Species and Critical Habitat

This opinion examines the status of each species that would be affected by the proposed action. The status is the level of risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. The species status section helps to inform the description of the species' current "reproduction, numbers, or distribution" as described in 50 CFR 402.02. The opinion also examines the condition of critical habitat throughout the designated area, evaluates the conservation value of the various watersheds and coastal and marine environments that make up the designated area, and discusses the current function of the essential physical and biological features that help to form that conservation value.

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 DPS of a species to be listed as threatened or endangered. Lower Columbia River Chinook salmon constitute an ESU (a salmon DPS) of the taxonomic species *Oncorhynchus tshawytscha*, and as such are considered a "species" under the ESA. The discussion in this opinion is limited to the Lower Columbia River Chinook ESU.

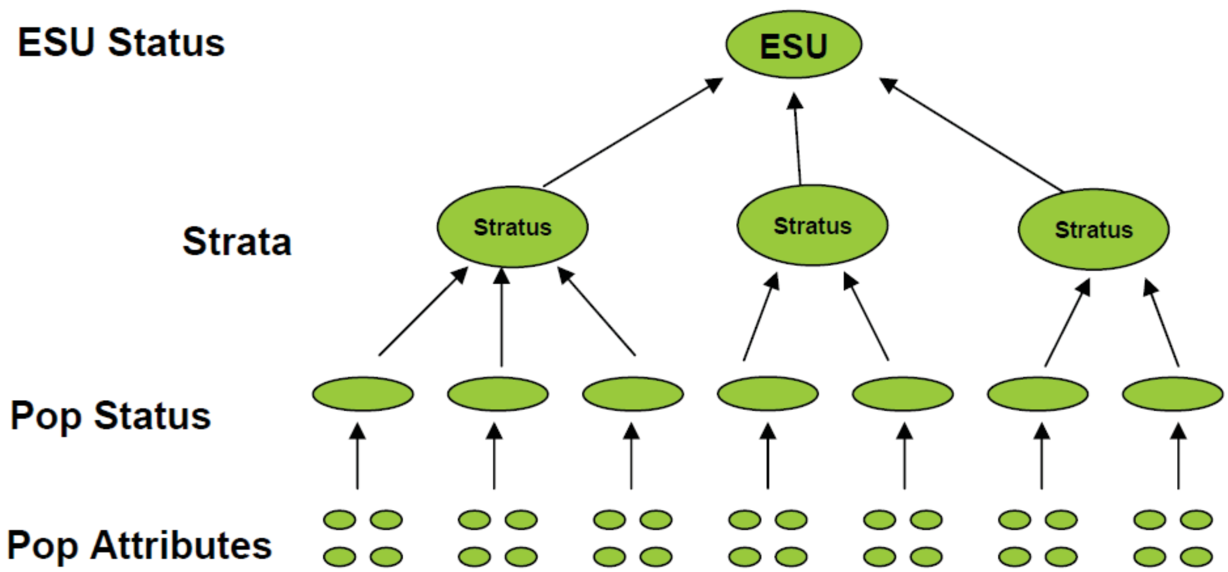
Lower Columbia River Chinook salmon were first listed as threatened under the ESA in 1999 (NMFS 1999f). The threatened status was reaffirmed on June 28, 2005 (Table 1). NMFS issued results of a five-year review on Aug. 15, 2011 (76 FR 50448), and concluded that this species should remain listed as threatened. Critical Habitat for Lower Columbia River Chinook salmon was designated on September 2, 2005 (NMFS 2005a; Table 1). Critical habitat for Lower Columbia River Chinook salmon 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 salmon.

In this step of the section 7 analysis, NMFS defines the biological requirements and current status of the affected listed species and the conservation role and current function of any designated critical habitat. 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 [MPG] 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). At the ESU-level the WLC TRT recommends that each of the ESU's MPGs also be viable. A viable salmonid ESU or DPS is naturally self-sustaining, with a high probability of persistence over a 100-year time period.

In assessing status, we start with the information used in its most recent decision to list for ESA protection the salmon and steelhead species considered in this opinion, and also considers more recent data, where applicable, that are relevant to the species' rangewide status. Recent information from recovery plans is often relevant and is used to supplement the overall review of the species' status. This step of the analysis tells us how well the species is doing over its entire range in terms of trends in abundance and productivity, spatial distribution, and diversity. It also identifies the potential causes of the species' decline.

The status review starts with a description of the general life history characteristics and the population structure of the ESU including the strata or MPGs where they occur. We review available information on the VSP criteria including abundance, productivity and trends (information on trends supplements the assessment of abundance and productivity parameters), and spatial structure and diversity. We also summarize available estimates of extinction risk that are used to characterize the viability of the populations and ESU, and the limiting factors and threats. This section concludes by commenting on the status of critical habitat.

Figure 2. Hierarchical approach to ESU viability criteria



Recovery plans are an important source of information that describe, among other things, the status of the species and its component populations, limiting factors, recovery goals and actions that are recommended to address limiting factors. Recovery plans are not regulatory documents. Consistency of a proposed action with a recovery plan therefore does not by itself provide the basis for determining that an action does not jeopardize the species. However, recovery plans do provide a perspective encompassing all human impacts that is important when assessing the effects of an action. Information from the recovery plans for Lower Columbia River Chinook salmon is discussed where it applies in various sections of this opinion. It is therefore useful to summarize the status of the recovery planning process.

As indicated in Section 1.2 NMFS has completed a roll-up recovery plan (NMFS 2012a) that addresses the entire Lower Columbia River Chinook ESU (as well as Lower Columbia River coho salmon, Lower Columbia River steelhead, and Columbia River chum salmon) through incorporation of management unit recovery plans and an Estuary Module. Among the functions of the roll-up recovery plan are the following: (1) endorse three management unit plans and make any needed additions or qualifications; (2) synthesize and summarize content from management unit plans, along with other relevant information (e.g., NMFS's recent life-cycle modeling effort for tule fall Chinook salmon); (3) describe ESU- and MPG-scale recovery strategies; (4) incorporate the Columbia River Estuary ESA Recovery Plan Module for Salmon and Steelhead (NMFS 2007b); and (5) define ESA de-listing criteria for the four Lower Columbia River ESUs. Prior to completion of the roll-up recovery plan NMFS prepared an internal memo that addressed ESU-level recovery criteria and strategies for the tule and spring components of the Lower Columbia River Chinook ESU (referred to in this opinion as the NMFS memo (Walton 2010)). The memo provided a concise summary of the overall recovery strategy and considerations. Although the content of the NMFS memo was preliminary, it addressed key points and summarized NMFS' preliminary conclusions related to the overall recovery strategy and was used as such in the 2010 opinion on Lower Columbia River Chinook salmon (NMFS 2010). We expect to have the roll-up recovery plan available for public comment in May 2012.

The management unit recovery plans and components used to construct the roll-up recovery plan were:

- The Oregon Lower Columbia plan, developed by the Oregon Department of Fish and Wildlife (ODFW), with the Oregon Lower Columbia Stakeholder Team (ODFW 2010), included as Appendix A of the roll-up recovery plan;
- The Lower Columbia Fish Recovery Board (LCFRB) plan, which covers most of the Washington portion of the ESU (LCFRB 2010), included as Appendix B of the roll-up recovery plan;
- The White Salmon Basin plan, developed by NMFS with participation from Klickitat County, the Yakama Nation, and other stakeholders (NMFS 2011c), included as Appendix C of the roll-up recovery plan;
- The Columbia River Estuary ESA Recovery Plan Module for Salmon and Steelhead, which was prepared for NMFS by the Lower Columbia River Estuary Partnership (NMFS 2007b), included as Appendix D of the roll-up recovery plan.

In February 2006, NMFS approved an Interim Regional Recovery Plan for the Washington portions of Lower Columbia Chinook salmon, steelhead, and chum salmon (LCFRB 2004, Lohn 2006). NMFS also issued a supplement to the Interim Plan that provided context related to the use of that Plan (NMFS 2005c). Washington's Lower Columbia Fish Recovery Board (LCFRB) updated and modified the Interim Plan to reflect changes in available information and released the updated version on March 5, 2010 (LCFRB 2010).

The management unit recovery plan for the White Salmon River was developed for populations of Lower Columbia River spring and fall Chinook salmon, coho salmon, chum salmon, and Middle Columbia River steelhead. The plan was developed by NMFS with the cooperation of the Yakama Nation, Klickitat County, Washington Department of Fish and Wildlife, the Washington State Governor's Salmon Recovery Office, and other Federal and state agencies, local governments, and the public.

Oregon also engaged in a full-scale recovery planning effort that focused on the Oregon portion of the Lower Columbia for Chinook salmon, steelhead, chum salmon, and coho salmon. The initial draft of Oregon's recovery plan was released in 2007 (ODFW 2007). Oregon updated that draft on December 18, 2009 (ODWF 2009). The Oregon Fish and Wildlife Commission provided comments on that draft at its June 4, 2010 meeting in Salem and approved a final version at its August 6, 2010 meeting (ODFW 2010).

2.2.1 Rangewide Status of the Species

Lower Columbia River Chinook salmon display three life history types including spring-runs, early fall runs ("tules"), and late fall runs ("brights") (Table 4). 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 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 salmon greatly exceeds that of the spring component.

Table 4. Life history and population characteristics of Lower Columbia River Chinook salmon.

Characteristic	Racial Features		
	Spring	Tule fall	Late fall bright
Number of extant population	9	21	2
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[a]	100,000	160,000	33,000
Recent natural spawners	800	6,500	9,000
Recent hatchery adults	12,600 (1999-2000)	37,000 (1991-1995)	NA

[a] *Historical estimates from NMFS 2012 table 7-4.*

The Lower Columbia River Chinook ESU 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 MPGs (referred to as strata by the WLC TRT) (Table 5). There are nine spring populations (Figure 3), 21 fall populations (Figure 4), and two late fall populations (Figure 5), some of which are considered extirpated or nearly so. Inside the geographic range of the ESU 28 hatchery Chinook salmon programs are currently operational. Table 5 lists the 16 programs included in the ESU and the remaining 12 programs that are excluded (Jones 2011). Populations of spring Chinook salmon in the Willamette River, including the Clackamas River population, are in a separate ESU.

Table 5. Chinook salmon ESU description and major population groups (MPGs) (Sources: Ford 2011; Jones 2011). The designations "(C)" and "(G)" identify Core and Genetic Legacy populations, respectively (Appendix B in WLC-TRT 2003).[2]

ESU Description	
Threatened	**Listed under ESA in 1999; reviewed and reaffirmed in 2010**
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
Gorge Fall	Lower Gorge, Upper Gorge (C,G), (Big) White Salmon (C,G), Hood
Cascade Late Fall	Lewis (C,G), Sandy (C,G)
Artificial production	
Hatchery programs included in ESU (16)	Sea Resources Tule Chinook, Big Creek Tule Chinook, Astoria High School (STEP) Tule Chinook, Warrenton High School (STEP) 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)
Hatchery programs not included in ESU (12)	Deep River Net-Pens spring Chinook, Clatsop County Fisheries (CCF) Select Area brights Program, CCF spring Chinook Program, Carson NFH spring Chinook Program, Little White Salmon NFH fall Chinook Program, Bonneville Hatchery fall Chinook Program, Hood River spring Chinook Program, Deep River Net Pens Tule fall Chinook, Klaskanine Hatchery Tule Fall Chinook, Bonneville Hatchery Tule Fall Chinook, Little White Salmon NFH Tule fall Chinook.

Before reviewing the details of the status of each population including consideration of their abundance, productivity, spatial structure, and diversity, it is useful to provide some broader perspective regarding two key points. First, we review ESU level recovery goals and delisting criteria that have been developed through the recovery planning process. We then discuss the relationship between hatchery and natural-origin fish and how it affects our assessment of the status of many of the populations in the ESU.

[2] 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 (WLC-TRT 2003).

Figure 3. Lower Columbia River spring Chinook salmon populations and baseline status (From NMFS 2012a).

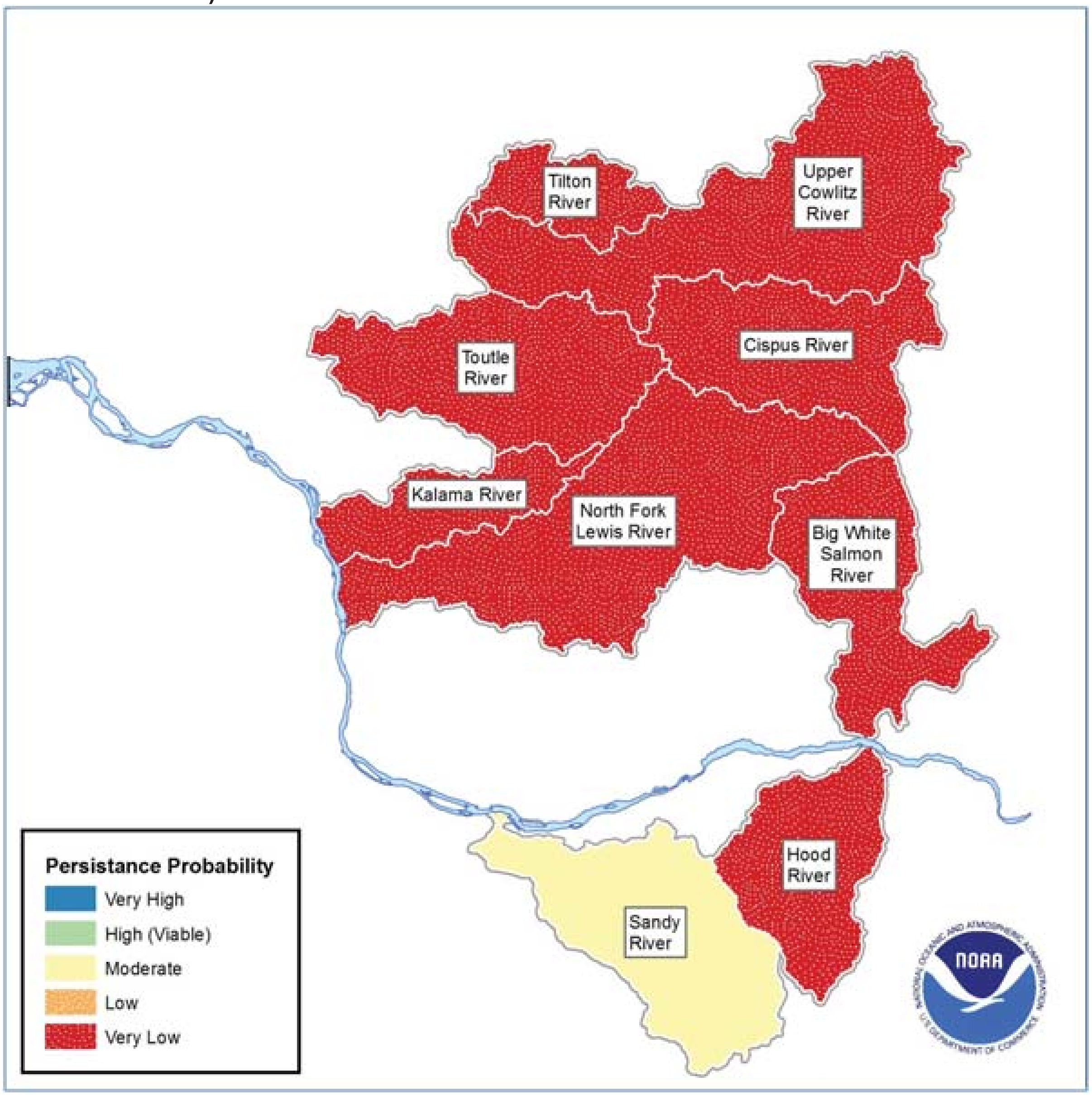


Figure 4. Lower Columbia River tule Chinook salmon populations and baseline status (From NMFS 2012a).

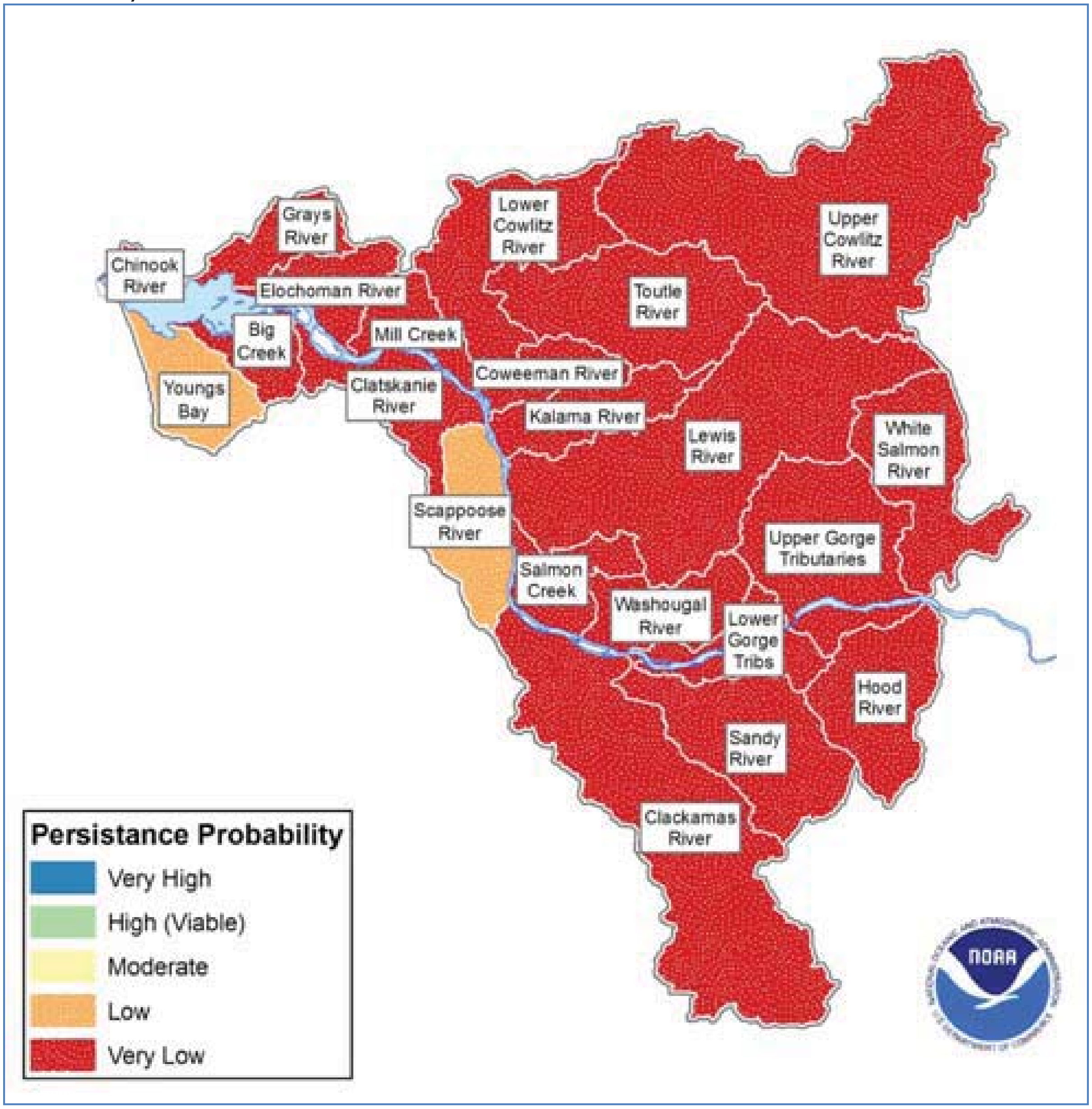
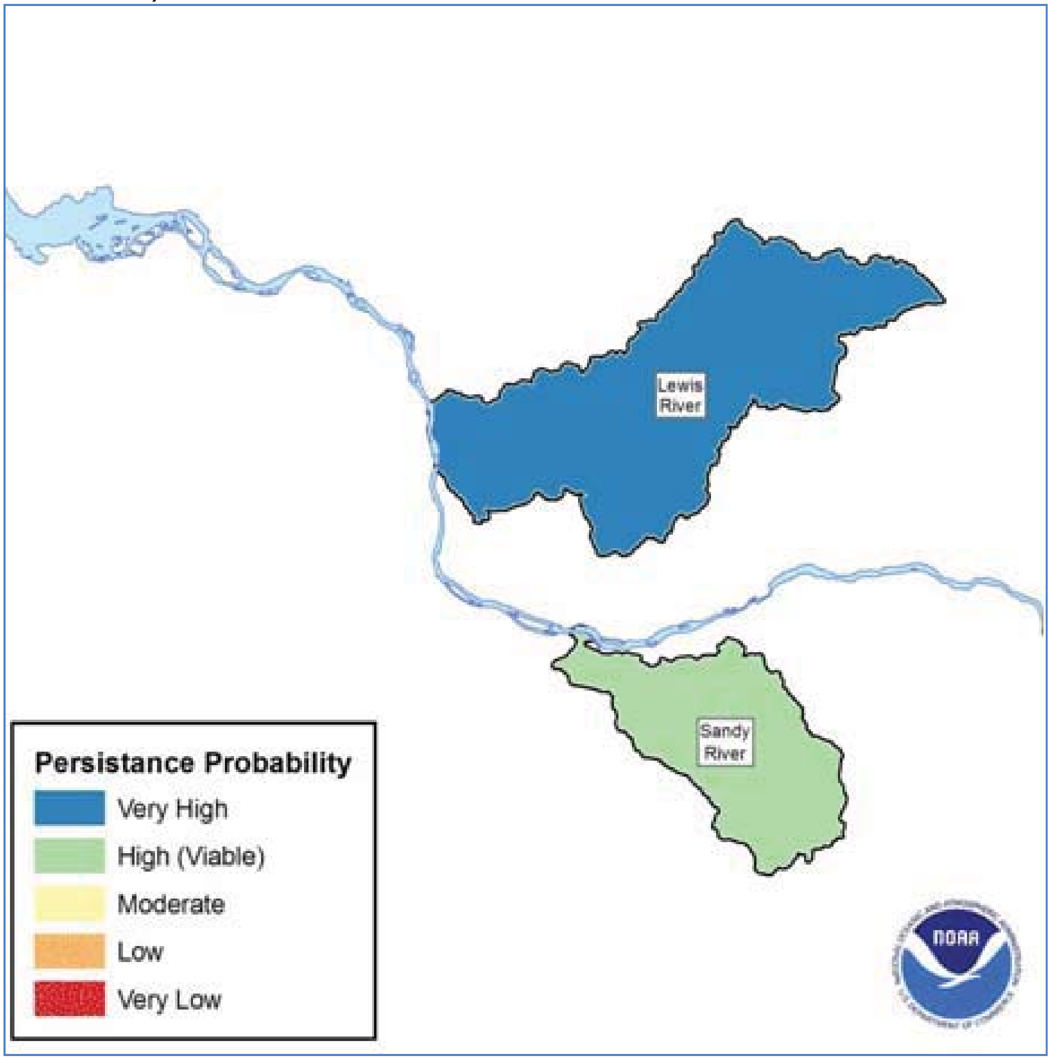


Figure 5. Lower Columbia River late fall Chinook salmon populations and baseline status (From NMFS 2012a).



2.2.1.1 Recovery Goals and Delisting Criteria

Recovery plans provide, among other things, an ESU level recovery scenario with population specific persistence probability targets, and threats criteria for each limiting factor that are designed to ensure that the underlying causes of decline have been addressed. Recovery plan recommendations regarding actions designed to address limiting factors are discussed below as part of the Environmental Baseline. Discussion related to the recovery scenario provides perspective pertinent to our consideration and understanding of the status of each population and the ESU as a whole.

Table 6 summarizes the baseline and target persistence probability for each Lower Columbia River Chinook salmon population, along with target abundance for each population that would be consistent with delisting. Persistence probability is measured over a 100 year time period and ranges from very low (probability < 40 percent) to very high (probability >99 percent).

If the scenario in Table 6 were achieved, it would exceed the WLC TRT's stratum-level viability criteria in the Coastal and Cascade fall strata, the Cascade spring stratum, and the Cascade late-fall stratum. However, the scenario for Gorge spring and Gorge fall Chinook salmon does not meet WLC TRT criteria because, within each stratum, the scenario targets only one population (the Hood) for high persistence probability. Exceeding the WLC TRT criteria, particularly in the Cascade fall and Cascade spring Chinook salmon strata, was intentional on the part of local recovery planners to compensate for uncertainties about meeting the WLC TRT's criteria in the Gorge fall and spring strata. In addition, multiple spring Chinook salmon populations are prioritized for aggressive recovery efforts to balance risks associated with the uncertainty of success in reintroducing spring Chinook salmon populations above tributary dams in the Cowlitz and Lewis systems.

NMFS (2012a) commented on the uncertainties and practical limits to achieving high viability for the spring and tule populations in the Gorge MPGs. Recovery opportunities in the Gorge were limited by the small numbers of populations and the high uncertainty related to restoration because of Bonneville Dam passage and inundation of historically productive habitats. NMFS also recognized the uncertainty regarding the TRT's MPG delineations between the Gorge and Cascade MPG populations, and that several Chinook salmon populations downstream from Bonneville Dam may be quite similar to those upstream of Bonneville Dam. As a result the roll-up recovery plan recommends improvements in more than the minimum number of populations required in the Cascade and Coastal MPGs, to provide a safety factor to offset the anticipated shortcomings for the Gorge MPGs. This was considered a more precautionary approach to recovery than merely assuming that efforts related to the Gorge MPG would be successful.

NMFS endorsed the recovery scenario and population level goals in the roll-up recovery plan as consistent with delisting. Based on the information provided by the WLC TRT and the management unit recovery planners, NMFS concluded in the roll-up recovery plan that the recovery scenario in Table 6 represents one of multiple possible scenarios that would meet biological criteria for delisting. The similarities between the Gorge and Cascade strata, coupled with compensation in the Cascade stratum for not meeting TRT criteria in the Gorge stratum would provide an ESU no longer likely to become endangered.

Table 6. Current status for Lower Columbia River Chinook salmon populations and recommended status under the recovery scenario (NMFS 2012a).

	Status Assessment		Recovery Scenario	
Population	**Baseline Persistence Probability[1]**	**Contribution[2]**	**Target Persistence Probability**	**Abundance Target[3]**
Cascade Spring				
Upper Cowlitz	VL	Primary	H+	1,800
Cispus	VL	Primary	H+	1,800
Tilton	VL	Stabilizing	VL	100
Toutle	VL	Contributing	M	1,100
Kalama	VL	Contributing	L	300
Lewis NF	VL	Primary	H	1,500
Sandy (OR)	M	Primary	H	1,230
Gorge Spring				
White Salmon	VL	Contributing	L+	500
Hood (OR)	VL	Primary[4]	VH[4]	1,493
Coastal Fall				
Youngs Bay (OR)	L	Stabilizing	L	505
Grays/Chinook	VL	Contributing	M+	1,000
Big Creek (OR)	VL	Contributing	L	577
Eloch/Skam	VL	Primary	H	1,500
Clatskanie (OR)	VL	Primary	H	1,277
Mill/Aber/Germ	VL	Primary	H	900
Scappoose (OR)	L	Primary	H	1,222
Cascade Fall				
Lower Cowlitz	VL	Contributing	M+	3,100
Upper Cowlitz	VL	Stabilizing	VL	--
Toutle	VL	Primary	H+	4,000
Coweeman	VL	Primary	H+	900
Kalama	VL	Contributing	M	500
Lewis	VL	Primary	H+	1,500
Salmon	VL	Stabilizing	VL	--
Clackamas (OR)	VL	Contributing	M	1,551
Sandy (OR)	VL	Contributing	M	1,031
Washougal	VL	Primary	H+	1,200
Gorge Fall				
L. Gorge (WA/OR)	VL	Contributing	M	1,200
U. Gorge (WA/OR)	VL	Contributing	M	1,200
White Salmon	VL	Contributing	M	500
Hood (OR)	VL	Primary[4]	H[4]	1,245
Cascade Late Fall				
Lewis NF	VH	Primary	VH	7,300
Sandy (OR)	H	Primary	VH	3,747

[1] The Washington evaluations (LCFRB 2010) used the late 1990s as a baseline period for evaluating status; the Oregon evaluations (ODFW 2010) assume average environmental conditions of the period 1974-2004 and use a reference period of roughly 1994-2004 for harvest exploitation rates. These are adopted in the roll-up recovery plan (NMFS 2012).

[2] Primary, contributing, and stabilizing designations reflect the relative contribution of a population to recovery goals and delisting criteria. Primary populations are targeted for restoration to a high or very high persistence probability. Contributing populations are targeted for medium or medium-plus viability. Stabilizing populations are those that will be maintained at current levels (generally low to very low viability), which is likely to require substantive recovery actions to avoid further degradation. The terminology of "primary," "contributing," and "stabilizing" is used in the Washington and White Salmon plans, and not Oregon. Because the terminology is useful in communicating a population's role within the recovery scenario, Oregon populations have been assigned a designation here consistent with their role.

[3] Abundance objectives account for related goals for productivity (from Table 7-4 in NMFS 2012). Spatial structure and diversity will be evaluated separately based on criteria established by the TRT (McElhany et al. 2006).

[4] Oregon analysis indicates a low probability of meeting the delisting objectives for these populations.

2.2.1.2 The Relationship Between Hatchery and Natural-Origin Fish

Consideration of the status of Lower Columbia River Chinook salmon and the tule populations in particular is complicated and requires some understanding of the relationship between hatchery and natural-origin fish in addition to information on the VSP parameters and the other common risk metrics used generally to assess population status. The Lower Columbia River tule Chinook salmon populations have been subject to high harvest rates, degraded habitat conditions, and extensive hatchery influence for decades. It is clear from the record that hatchery fish have strayed into natural spawning areas and, in most cases, dominated the natural spawning that has occurred in these systems. In some cases, hatchery populations were derived from a single stock and have been maintained through time (e.g., Cowlitz River and Spring Creek Hatchery (which is derived from the White Salmon River population)). Although these hatchery stocks may have diverged from their source populations due to the effects of hatchery domestication, they are at least associated genetically to their source population. In other cases, hatchery brood stocks have been mixed over the years and are thus an amalgam of the contributing stocks (e.g., Washougal, Elochoman, Kalama, Toutle, and Big Creek). Several populations have hatcheries located in basin, but most other populations are also subject to substantial straying from adjacent or nearby hatchery programs (e.g., Mill/Abernathy/Germany, Youngs Bay, Clatskine, and Scappoose) (NMFS 2012a). It is therefore pertinent, when considering whether an action is likely to appreciably reduce the survival and recovery of a population, or jeopardize the ESU as a whole, to consider the extent of local adaptation to natural conditions in these populations and whether it has been compromised by past practice to the point where it is no longer distinct.

Recent analysis resulted in grouping the tule populations into three basic status categories (Walton 2010), but even within these groups there is a range of circumstances. The unique circumstance of each population is important. The recovery strategy for each will require consideration of, among other things, its overall status, the nature and extent of the limiting factors, the degree of hatchery influence, and the population's prescribed role in the overall recovery scenario.

Many of the populations have been substantially affected by a combination of habitat degradation, high levels of hatchery production using nonlocal brood stock and high harvest rates that have limited natural-origin spawners to very low levels (NMFS 2012a). As a result of these effects, it is very unlikely that the tule Chinook salmon currently spawning in the coastal stratum rivers in particular represent the genetic diversity and adaptation that was originally present in these populations. A probable lack of locally adapted populations may be a contributing factor to the apparent low productivity of these populations, but there is no direct information on levels of tule Chinook salmon local adaption (Walton 2010). Current stocking practices may also have an additive effect of contributing to low productivity through ecological competition from hatchery strays (NMFS 2012a). Other populations in the ESU may be less affected by these circumstances. Two tule populations in the Cascade stratum, Coweeman and Lewis, have not had direct releases of hatchery fish and have relatively lower fractions of hatchery origin spawners than the other tule populations. These populations are more likely to have retained appreciable local adaptation to natural conditions; however, the level of hatchery fish influence even in these populations may not be trivial from a genetic standpoint. All other Cascade and Gorge stratum tule populations have likely been composed of over 50 percent hatchery origin spawners for decades, and we would expect that this has influenced the fitness of these populations as well (Walton 2010).

Populations are defined by their relative isolation from each other which allows for their demographic independence, and generally for their adaptation to unique conditions that exist in specific habitats. If there are populations in the ESU that still retain their historic genetic legacy, such as the Coweeman and Lewis populations, then the appropriate course to insure their survival and recovery is to preserve that genetic legacy and rebuild those populations. Preserving that legacy should be a high priority and, if threatened, requires a sense of urgency and implementation of actions necessary and appropriate to preserve the unique characteristics of those populations. However, if the genetic characteristics of the populations are significantly diminished and we are left with individuals that can no longer be associated with a distinct population, then the appropriate course to recover the population, consistent with the requirements of the ESA, is to use individuals that best approximate the genetic legacy of each population, reduce the effects of the factors that have limited their production, and provide the opportunity for them to readapt to the existing conditions and reestablish their demographic independence. These circumstances will require a deliberate response, but one that may be less urgent in the sense that coordinated progress can and should be made over time to address the limiting factors. For example, if the source of individuals for the rebuilding effort is a hatchery with thousands of returning fish, then recovery will have to occur through a coordinated and deliberate transition strategy that reduces the effects of hatchery straying and harvest, and improves the habitat to the degree necessary for the population to adapt and rebuild. Retaining some of the hatchery fish may be important for the near term to provide on ongoing source of brood stock during the transition and guard against catastrophic loss of the genetic line. The transition will most often involve allowing time for habitat improvements and for the population to readapt to exiting circumstances (NMFS 2012a). Given the nature of these processes, it is reasonable to expect that rebuilding and recovery will take years and perhaps decades of consistent and steady progress.

The WLC TRT identified the Coweeman and the East Fork Lewis as the only genetic legacy tule populations in the Lower Columbia River ESU (Appendix B in WLC TRT 2003). Myers et al. (2006) indicate that there are no other remnant groups that remain isolated from the hatcheries, and what remains is a mix of hatchery and naturally spawning fish. As a consequence, the appropriate course is to scale harvest actions as appropriate to sustain and recover the legacy populations and, for the other runs, to use what remains and create the conditions that allow the populations to readapt to local conditions and once again become naturally self-sustaining populations. As outlined in the roll-up recovery plan, this will require development of transition strategies, tailored to the unique circumstance and requirements of each population that address the full range of limiting factors. Transition strategies will specify (1) timelines and strategies for reducing hatchery-origin spawners, (2) benchmarks for habitat improvement, (3) expected population response, and (4) harvest adjustments as needed to ensure appropriate increases in natural-origin abundance. These strategies will include adaptive management that provides a pathway for addressing critical uncertainties and that establishes benchmarks and adaptive actions if benchmarks are not met (NMFS 2012a). Our consideration of the effects of the proposed actions on the Lower Columbia River tule populations takes these circumstances into account.

2.2.1.3 Abundance, Productivity and Trends

Recovery plans provide useful summaries of information regarding the status of populations. As discussed above, the roll-up recovery plan is referenced in the following discussion regarding species status.

Population status indicators, including measures of abundance and productivity, are all affected by available habitat. Steel and Sheer (2003) analyzed the number of stream kilometers historically and currently available to salmon populations in the lower Columbia River (Table 7). 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 and North Fork Lewis have greatly reduced or eliminated access to upstream production areas and therefore extirpated some of the affected populations. Spring populations on the Cowlitz and its tributaries (Cispus and Tilton), and the Lewis rivers that depend on headwater spawning and rearing areas are particularly affected by these barriers (Table 7).

Table 7. Current and historically available habitat located below barriers in the Lower Columbia River Chinook salmon ESU (from Steel and Shear 2003).

Population/Strata	Potential Current Habitat (km)	Potential Historical Habitat (km)	Current/ Historical Habitat Ratio (%)
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
GORGE SPRING			
White Salmon (WA)	0	232	0
Hood (OR)	150	150	99
COASTAL 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
CASCADE LATE FALL			
NF Lewis (WA)	87	166	52
Sandy (OR)	217	225	96

Condit Dam at river mile (RM) 3.3 on the White Salmon River has been in place since 1913. No passage was provided at the dam. Condit Dam was breached on October 26, 2011. PacifiCorp Energy, owner and operator of the Condit Hydroelectric Project, has a preliminary decommissioning schedule approved by the Federal Energy Regulatory Commission that completes dam removal and restores the former reservoir by October 2012 (PacifiCorp Energy 2011). The management of Lower Columbia River Chinook salmon returning to the White Salmon River in the future is discussed in more detail below.

Gorge Spring MPG

Spring Chinook salmon populations occur in both the Gorge and Cascade MPGs (Table 5). The Hood River and White Salmon populations are the only populations in the Gorge MPG. The 2005 Biological Review Team (BRT) described the Hood River spring run as “extirpated or nearly so” (Good et al. 2005) and the 2005 ODFW Native Fish Status report describes the population as extinct (ODFW 2005). NMFS confirmed its conclusion regarding the status of Hood River spring Chinook salmon in its most recent status review (Ford 2011). Most of the habitat that was historically available to spring Chinook salmon in the Hood River is still accessible, but the basin was likely not highly productive for spring Chinook salmon due to the character of the basin. Because of the apparent extirpation of the population, Oregon initiated a reintroduction program using spring Chinook salmon from the Deschutes River. The Deschutes River is the nearest source for broodstock, but the population is from the Middle Columbia River ESU.

Details related to the reintroduction program are described in the Revised Hood River Master Plan (ODFW and CTWSR 2008) which is incorporated into the roll-up recovery plan (NMFS 2012a). Although the reintroduction program has been underway since the mid-90s, it has not met its original goals for smolt-to-adult survival rates. Deficiencies are attributed to production practices (ISRP 2008, CTWSR 2009). The reintroduction program is now the subject of an interim study to provide the information necessary for co-managers to identify a long term, biologically sound and cost effective spring Chinook salmon production strategy for the Hood River Basin that can lead to recovery (ISRP 2008). The Confederated Tribes of Warm Springs Reservation (CTWSR) conducted a Hood River Production Program (HRPP) monitoring and evaluation project through 2010 and their estimates of natural spring Chinook salmon returning to the Powerdale trap prior to removal of the Powerdale Dam in 2010 are in Table 8. The Dam, commonly referred to as the Copper Dam, was located at RM 4.3 on the Hood River. The delisting persistence probability target is listed as very high, but as discussed in Section 2.2.1.1, NMFS (2012a) indicates the prospects for meeting that target are uncertain.

Table 8. Hood River Spring Chinook salmon actual returns to the Powerdale adult trap generated by CTWSR for the HRPP (from CTWSR 2011).

Year	Hatchery Origin Returns	Natural Origin Returns
1997	280	72
1998	18	80
1999	88	21
2000	20	66
2001	597	42
2002	1,304	71
2003	344	100
2004	148	131
2005	633	110
2006	920	297
2007	401	143
2008	974	60
2009	1,395	66
2010	850[a]	213[a]

[a] *Run data for 2010 is an expanded estimate based on counts at Powerdale Dam made before the fish trap was abandoned on June 30, 2010 as a result of the Dam decommissioning.*

The White Salmon River population is also considered extinct (NMFS 2012a, Appendix C). Condit Dam was completed in 1913 with no juvenile or adult passage thus precluding access to all essential habitat (Table 7). The breaching of Condit Dam in 2011 provides an option for recovery planning. The White River Recovery Plan calls for monitoring escapement into the basin for four to five years to see if natural recolonization occurs. Habitat conditions downstream of the dam site and in the area previously occupied by Northwestern Lake will need to be assessed and priority restoration actions identified. Sometime during or at the end of the interim monitoring program a decision will be made about whether to proceed with a reintroduction program using hatchery fish. The recovery scenario described in the roll-up recovery plan identifies the White Salmon spring population as a contributing population with a low plus persistence probability target (Table 6).

Cascade Spring MPG

There are seven spring Chinook salmon populations in the Cascade MPG. The most recent total abundance information for spring Chinook salmon is provided in Table 9. The return of combined hatchery origin and natural-origin spring Chinook salmon to the Cowlitz, Kalama, and Lewis river populations in Washington have all numbered in the thousands in recent years (Table 9). The Cowlitz and Lewis populations on the Washington side are managed for hatchery production since most of the historical spawning habitat has been inaccessible due to hydro development in the upper basin (LCFRB 2010). The hatcheries' escapement objectives have been met in recent years with few exceptions (Table 10). A supplementation program is now being implemented on the Cowlitz River that involves trap and haul of adults and juveniles. The reintroduction program for the upper Cowlitz and Cispus rivers above Cowlitz Falls Dam is consistent with the recommendations of the roll-up recovery plan and constitutes the initial steps in a more comprehensive recovery strategy. However, the program is limited for the time being by low collection efficiency of out-migrating juveniles at Cowlitz Falls Dam and does not involve the Tilton basin because of relatively poor habitat quality. Some unmarked adults return voluntarily to the hatchery intake, but for the time being the reintroduction programs rely primarily on use of surplus hatchery adults. (Information on the hatchery program and associated Settlement Agreement with Tacoma Power can be found at: http://www.mytpu.org/tacomapower/parks-rec/fish-wildlife/cowlitz-river-project/fisheries-programs/Default.htm) The reintroduction program facilitates the use of otherwise vacant habitat, but cannot be self-sustaining until the juvenile collection problems are solved, and other limiting factors are addressed. Efforts are underway to improve juvenile collection facilities. Given the circumstances, fisheries are managed to achieve the hatchery escapement goal and thereby preserve the genetic heritage of the population, and the option for the reintroduction program and eventual recovery of the Cowlitz population.

A supplementation program is also in place for the Lewis River as described in the Lewis River Hatchery and Supplementation Plan (Jones and Stokes 2009). Out planting of hatchery spring Chinook salmon adults will begin in 2012 after completion of downstream passage facilities. Here, too, harvest is managed to ensure that hatchery brood stock needs are met in order to support the needs of the supplementation program.

Table 9. Total annual run size of Lower Columbia River spring Chinook salmon populations (PFMC 2011, Table B-12).

Year or Average	Cowlitz River	Kalama River	Lewis River	Sandy River (Total)	Sandy River (natural-origin fish at Marmot Dam)[1]
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	4,951	
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	1,609	1,796	3,777	5,329	2,445
2002	5,208	2,924	3,511	5,903	1,277
2003	15,972	4,565	5,057	5,600	1,151
2004	16,514	4,339	7,426	12,675	2,699
2005	9,353	3,389	3,511	7,668	1,808
2006	6,967	5,482	7,311	4,382	1,383
2007	3,974	8,036	7,596	2,813	1,410
2008	2,986	1,617	2,252	5,447	2,721
2009	5,977	402	1,428	2,921	856
2010	8,849	764	2,797	8,057	1,391

[1]Marmot Dam was removed in 2007 and is thus no longer available as a counting station. Returns from 2008 on are estimates ODFW calculated using the relationship between redds and natural origin fish seen at Marmot Dam from 1996-1998 and 2002-2006.

The Cowlitz, Lewis, and Kalama river systems have all met their hatcheries escapement objectives in recent years with few exceptions, and are expected to do so again in 2012 and for the foreseeable future (Table 10), thus ensuring that what remains of the genetic legacy is preserved and can be used to advance recovery. 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 historical significance of the Kalama population was likely limited because habitat there was probably not as productive for spring Chinook salmon (NMFS 2012a). In the recovery scenario the Kalama spring Chinook salmon population is designated as a contributing population targeted for low persistence probability (Table 6). There is currently a harvest augmentation hatchery program operating in the basin that integrated local returning wild spring Chinook salmon into the program from 2005 through 2009. The brood stock is now maintained from hatchery returning fish. The prospects for improving the status for Kalama spring Chinook salmon are enhanced by the roll-up recovery plan objective of passing natural-origin spring Chinook salmon, no longer used for brood stock, above the falls to utilize inaccessible, but otherwise suitable habitat.

Table 10. Cowlitz, Lewis River, and Kalama Falls Hatchery rack escapements for Lower Columbia River Spring Chinook salmon (From WDFW Final Hatchery Escapement Reports, 1996-1997 through 2009-2010).

Year	Cowlitz Salmon Hatchery[1]	Lewis River Hatchery[2]	Kalama Falls Hatchery[3]
	Goal: 1,084	Goal: 800	Goal: 300
1996	1,869	1,054	196
1997	1,298	2,245	576
1998	812	1,188	408
1999	1,321	846	794
2000	1,408	777	1,256
2001	1,306	1,178	952
2002	2,713	1,779	1,374
2003	10,481	2,809	3,802
2004	12,596	3,999	3,421
2005	7,503	1,886	2,825
2006	5,379	3,890	4,313
2007	3,089	3,782	4,748
2008	1,895	1,355	959
2009	3,604	1,045	242

[1]*Cowlitz River Spring Chinook salmon brood origin hatchery returns are collected on station at the Cowlitz Salmon Hatchery.*
[2]*Lewis River Spring Chinook salmon brood origin hatchery returns are collected at the Merwin Dam Fish Collection Facility, Speelyai Hatchery, and on station at the Lewis River Hatchery.*
[3]*Kalama River Spring Chinook salmon brood origin hatchery returns are collected on station at the Kalama Falls Hatchery.*

Legacy effects of the 1980 Mount St. Helens eruption are still a fundamental limiting factor for the Toutle spring Chinook salmon population (NMFS 2012a). The North Fork Toutle was dramatically affected by sedimentation from the eruption. Because of the eruption, a sediment retention structure (SRS) was constructed to manage the ongoing input of fine sediments into the lower river. Nonetheless, the SRS is a continuing source of fine sediments and blocks passage to the upper river. A trap and haul system was implemented and operates annually from September to May to transport adult fish above the SRS. The transport program provides access to 50 miles of anadromous fish habitat located above the structure (NMFS 2012a). There is relatively little known about current spring Chinook salmon production in this basin. The Toutle population has been designated a contributing population targeted for medium persistence probability under the recovery scenario (Table 6).

The persistence probability of the Sandy River spring population is currently listed as medium. The Sandy River spring Chinook salmon population is designated as a primary population targeted for high persistence probability and thus will be important to the overall recovery of the

ESU (Table 6). The Sandy River spring Chinook hatchery program has been managed as an integrated hatchery supplementation program that incorporated natural-origin broodstock. Brood year 2010 was the last year that natural-origin adults were incorporated into the broodstock. Beginning in 2011, only hatchery-origin adults will be used for brood. As the wild population becomes more viable, ODFW will consider integrating wild fish back into the brood to help off-set loss of heterozygosity and effects of hatchery selection. Marmot Dam was used as a counting and sorting site in prior years, but the Dam was removed in October 2007. The return of natural origin fish to Marmot Dam prior to its removal averaged approximately 1,700 (Table 9), although this did not account for the additional spawning of natural-origin fish below the dam. The abundance component of the delisting goal for Sandy River spring Chinook salmon is 1,230 (Table 6). The return of natural-origin fish has therefore met the tentative delisting goal in recent years. The total return of spring Chinook salmon to the Sandy including listed hatchery fish has averaged more than 5,800 since 2000 (Table 9). Although the abundance criterion for delisting has been met in recent years, other aspects of the VSP criteria would have to improve for the population to achieve the higher persistence probability level that is targeted.

Cascade Late Fall MPG

There are two late fall, “bright,” Chinook salmon populations in the Lower Columbia River Chinook ESU in the Sandy and North Fork Lewis rivers. Both populations are in the Cascade MPG (Table 5). The baseline persistence probability of the Lewis and Sandy populations are listed as very high and high; both populations are targeted for very high persistence probability under the recovery scenario (Table 6).

The Technical Advisory Committee (TAC) for *U.S. v. Oregon* provides estimates of the escapement of bright Chinook salmon to the Sandy River (Table 11) (TAC 2010, LeFleur 2011), but these are estimates of spawning escapement for a 16 km index area that is surveyed directly (TAC 2008). (Estimates of peak redd counts in the index areas are expanded to estimates of spawning escapement by multiplying by a factor of 2.5.) The Oregon Plan includes an appendix that describes how index counts are expanded to estimates of total abundance (ODFW 2010, Appendix C). Appendix C provides the data set that was used in the recovery plan analysis, but the data ends in 2006. There is 67 linear km of spawning habitat. Index counts were therefore expanded using the ratio of spawning area to index area (67/16 = 4.2) to give estimates of total escapement (Table 11). There are some minor differences between the values reported in Appendix C and those shown in Table 11 that reflect revisions in prior index area estimates. The abundance target for delisting is 3,747 (Table 6). Escapements have averaged about 3,000 since 1995 (Table 11).

The North Fork Lewis population is the principal indicator stock for management. It is a natural origin population with little or no hatchery influence. The escapement goal, based on estimates of maximum sustained yield (MSY), is 5,700. The escapement has averaged 9,500 over the last ten years and has generally exceeded the goal by a wide margin since at least 1980. Escapement was below goal from 2007 through 2009 (Table 11). The shortfall is consistent with a pattern of low escapements for other far-north migrating stocks in the region and can likely be attributed to poor ocean conditions. Escapement improved in 2009 and was again well above goal in 2010 (Table 11). NMFS (2012a) identifies an abundance objective under the recovery scenario of 7,300 (Table 6). The target is estimated from population viability simulations and is assessed as a median abundance over any successive 12 year period. The median escapement over the last 12 years is 9,462 thus exceeding the abundance objective (Table 11). Escapement to the North Fork Lewis is expected to vary from year-to-year as it has in the past, but generally remain high relative to the population's escapement objectives.

Table 11. Annual escapement of Lower Columbia River bright fall Chinook salmon populations (LeFleur 2011).

Year	Sandy River Index Area	Sandy River Escapement[1]	North Fork Lewis
1995	1,036	4,338	9,718
1996	505	2,115	12,700
1997	2,001	8,379	8,168
1998	773	3,237	5,167
1999	447	1,872	2,639
2000	84	352	8,727
2001	824	3,451	11,272
2002	1,275	5,339	13,284
2003	619	2,592	13,433
2004	601	2,517	14,165
2005	770	3,224	10,197
2006	1,130	4,732	10,522
2007	178	745	3,130
2008	602	2,521	4,823
2009	264	1,106	5,410
2010	773	1,562	8,701

[1]Index Area counts are expanded to spawning escapement by multiplying by 4.2 based on method described in (ODFW 2010, Appendix C)

Gorge Fall MPG

There are twenty one populations of tule Chinook salmon with some located in each of the three MPGs (Table 5). The four populations in the Gorge MPG include the Lower Gorge, Upper Gorge, White Salmon, and Hood. The baseline persistence probability for all of these populations is listed as very low. The roll-up recovery plan (NMFS 2012a) targets the White Salmon and Lower and Upper Gorge populations for medium persistence probability, and the Hood population for high persistence although, as discussed in Section 2.2.1.1, it is unlikely that the high viability objective can be met. There is also still some question regarding the historical role of the Gorge populations in the ESU and whether they truly functioned historically as demographically independent populations (NMFS 2012a).

Populations in the Gorge Fall MPG have been subject to the effects of a high incidence of naturally-spawning hatchery fish for years. The White Salmon population, for example, as mentioned above, was limited by Condit Dam. Natural spawning occurred in the river below the Dam (NMFS 2012a, Appendix C). The number of fall Chinook salmon spawners in the White Salmon increased from low levels in the early 2000's to an average of 2,750 for the period from 1998 to 2007 (Roler 2009), but spawning is dominated by tule Chinook salmon strays from the neighboring Spring Creek Hatchery and upriver brights from the production program in the adjoining Little White Salmon River (these fish are not part of the Lower Columbia River Chinook ESU). The Spring Creek Hatchery, which is located immediately downstream from the river mouth, is the largest tule Chinook salmon production program in the basin, releasing 15 million smolts annually. The White Salmon River was the original source for the hatchery brood stock so whatever remains of the genetic heritage of the population is contained in the mix of hatchery and natural spawners. There is relatively little known about current natural fall Chinook salmon production in this basin, but it is presumed to be low.

The breaching of Condit Dam is likely to inundate the portion of the White Salmon that was being utilized for spawning with silt accumulated in the reservoir. The White Salmon Working Group (WSWG), comprised of staff from the USFWS, Yakama Nation, WDFW, NMFS, PacifiCorp and U.S. Geological Survey, out-planted adult fall Chinook salmon upstream of Condit Dam in 2011 prior to the breaching, in lieu of adult collection and subsequent propagation. This was a one-time conservation measure to mitigate for the impacts of the expected sediment released downstream. The WSWG transported 552 natural origin and 127 hatchery origin returning Chinook salmon (of which 299 were females) upstream of Northwestern Lake reservoir prior to the breaching of Condit Dam that were collected at the White Salmon weir located adjacent to the White Salmon hatchery ponds at RM 1.4 (pers. com. R. Engle, USFWS). No additional trap and haul operations are planned at this time. Natural recolonization will be monitored for the next four to five years. Thereafter, a decision will be made about future plans for recovery.

There is relatively little specific or recent information on the abundance of tule Chinook salmon for the other populations in the Gorge MPG. Stray hatchery fish are presumed to dominate the spawning in these tributaries. Hatchery strays contribute about 90 percent of the escapement to the Lower Gorge, Upper Gorge, and Hood River populations on the Oregon side of the river (NMFS 2012a, Appendix A). These populations are heavily influenced by hatchery strays from the Bonneville Hatchery located immediately below Bonneville Dam, and the Spring Creek and Little White Salmon Hatcheries located just above Bonneville Dam. The abundance of returning Chinook salmon on the Washington side of the Lower and Upper Gorge populations is presumed to be less than 50 (NMFS 2012a, Appendix B). It is reasonable to infer that tributaries in the Gorge on the Washington side of the river are similarly affected by hatchery strays. As a consequence, hatchery origin fish contribute to and likely maintain spawning levels in all of the Gorge area tributaries, but for areas like Eagle Creek, Tanner Creek and Herman Creek actual estimates are unknown.

Cascade Fall MPG

There are ten populations in the Cascade MPG. Of these only the Coweeman and East Fork Lewis are considered genetic legacy populations. The baseline persistence probability of all of these populations is listed as very low (Table 6). These determinations were generally based on assessments of status at the time of listing. Four of these populations are targeted for medium persistence probability and four for very high persistence probability in the recovery scenario. The target persistence probability for the other two populations is very low (Table 6).

Total escapements to the Coweeman and East Fork Lewis have averaged 754 and 937 (Table 12), respectively over the last ten years compared to recovery abundance targets of 900 and 1,500 (Table 6). The historical contribution of hatchery spawners to the Coweeman and East Fork Lewis populations is relatively low compared to that of other populations, although even here the contribution may not be trivial from a genetic standpoint (Table 12). All of the remaining populations are substantially affected by hatchery strays. The Kalama, Washougal, Toutle, and Lower Cowlitz populations are all associated with significant in-basin hatchery production and are thus subject to large numbers of hatchery strays (for example see Table 12 for the Kalama, Washougal and Lower Cowlitz populations). We have less information on returns to the Clackamas and Sandy rivers, but ODFW indicated for both that 90 percent of the spawners are likely hatchery-origin fish from as many as three adjacent hatchery programs (NMFS 2012a, Appendix A).

Table 12. Annual escapement of selected Lower Columbia River tule Chinook salmon Cascade Strata populations (Beamesderfer et al. 2011).

	Coweeman		Washougal		Kalama		Lewis		Cowlitz	
Year	#	% wild	#	% wild	#	% wild	#	% wild	#	% wild
1977	337	100.0	1,652	46.0	6,549	50.0	1,086	100.0	5,837	26.0
1978	243	100.0	593	46.0	3,711	50.0	1,448	100.0	3,192	26.0
1979	344	100.0	2,388	46.0	2,731	50.0	1,304	100.0	8,253	26.0
1980	180	100.0	3,437	46.0	5,850	50.0	899	100.0	1,793	26.0
1981	116	100.0	1,841	46.0	1,917	50.0	799	100.0	3,213	26.0
1982	149	100.0	330	46.0	4,595	50.0	646	100.0	2,100	26.0
1983	122	100.0	2,677	46.0	2,722	50.0	598	100.0	2,463	26.0
1984	683	100.0	1,217	46.0	3,043	50.0	340	100.0	1,737	26.0
1985	491	100.0	1,983	46.0	1,259	50.0	1,029	100.0	3,200	26.0
1986	396	100.0	1,589	46.0	2,601	50.0	696	100.0	2,474	26.0
1987	386	100.0	3,625	46.0	9,651	50.0	256	100.0	4,260	26.0
1988	1,890	100.0	3,328	46.0	24,549	50.0	744	100.0	5,327	26.0
1989	2,549	100.0	4,578	46.0	20,495	50.0	972	100.0	4,917	26.0
1990	812	100.0	2,205	46.0	2,157	50.0	563	100.0	1,833	26.0
1991	340	100.0	3,673	47.0	5,152	54.0	470	100.0	935	26.0
1992	1,247	100.0	2,399	76.0	3,683	48.0	335	100.0	1,022	26.0
1993	890	100.0	3,924	52.0	1,961	89.0	164	100.0	1,330	6.0
1994	1,695	100.0	3,888	70.0	2,014	71.0	610	100.0	1,225	19.0
1995	1,368	100.0	3,063	39.0	3,012	69.0	409	100.0	1,370	13.0
1996	2,305	100.0	2,921	17.0	10,630	44.0	403	100.0	1,325	58.0
1997	689	100.0	4,669	12.0	3,539	40.0	305	100.0	2,007	72.0
1998	491	100.0	2,971	24.0	4,294	69.0	127	100.0	1,665	37.0
1999	299	100.0	3,129	68.0	2,577	3.0	331	100.0	969	16.0
2000	290	100.0	2,155	70.0	1,284	21.0	515	100.0	2,165	10.0
2001	802	73.0	3,901	43.0	3,553	18.0	750	70.0	3,647	44.0
2002	877	97.0	6,050	47.0	18,627	1.0	1,032	77.0	9,671	76.0
2003	1,106	89.0	3,444	39.0	24,684	0.0	738	98.0	7,001	88.0
2004	1,503	91.0	10,597	25.0	6,434	11.0	1,388	29.0	4,621	70.0
2005	853	60.0	2,678	41.0	9,053	3.0	607	100.0	2,968	17.0
2006	561	100.0	1,936	14.0	10,386	1.0	1,300	82.0	2,051	47.0
2007	234	100.0	1,528	87.0	3,296	6.0	492	73.0	1,401	53.0
2008	404	52.0	2,491	93.0	3,734	4.0	567	87.0	1,259	90.0
2009	780	63.0	2,741	30.0	7,548	10.0	299	100.0	2,602	45.0
2010	421	44.0	5,212	33.0	5,576	29.0	2,198	86.0	2,489	52.0

The Coweeman and Lewis populations do not have in-basin hatchery programs and are generally subject to less straying. The recent increased straying being observed in the Coweeman is a relative new phenomenon (Table 12). Significant hatchery reforms have been implemented to reduce the effects of straying. Brood stock management practices for all hatcheries are being revised to conform to HSRG recommendations. Weirs are being operated on the Kalama to assist with brood stock management, and on the Coweeman and Washougal to further assess and control hatchery straying on that system. These are examples of actions the states have taken as part of a comprehensive program of hatchery reform to address the effects of hatcheries. The nature and scale of reform actions were described in Anderson and Bowles (2008), a letter from WDFW (Anderson 2010), and the more recent Task E reports (Frazier 2011 and Stahl 2011.

Coastal Fall MPG

There are seven populations in the Coastal MPG. None are considered genetic legacy populations. The baseline persistence probability of all of the populations in the Coastal MPG is listed as very low. Recent assessments indicate that the status of the Mill/Abernathy/Germany populations may be slightly improved from the time of listing (NWFSC 2010). All of the populations are targeted for improved persistence probability in the recovery scenario. Four are targeted for high persistence, while the Grays River is targeted for medium plus persistence probability. The Big Creek and Youngs Bay populations are targeted for low persistence probability (Table 6).

All populations in the MPG are subject to significant levels of hatchery straying (Table 13). There was a Chinook salmon hatchery on the Grays River, but that program was closed in 1997 with final returns coming a few years later. A temporary weir was installed for the first time on the Grays River in 2008 to quantify escapement and help control the number of hatchery strays that might still be returning to the system. A significant number of out-of-ESU Rogue River "brights" from the Youngs Bay net pen programs were observed at the weir, and by 2010 the weir was functionally able to remove hatchery fish from escaping above its location (Table 13). It is worth noting that the escapement data reported in Tables 12 and 13 have been updated through 2010 and estimates of the percent wild modified in some cases relative to those reported in the 2010 opinion and the 2010 status review (Ford 2011). The more recent information is reported in Beamesderfer et al. (2011).

The Elochoman had an in-basin fall Chinook salmon hatchery production program that released 2,000,000 fingerlings annually. That program was closed with the last release in 2008. Closure of the hatchery program is consistent with the overall transition and hatchery reform strategy for tule Chinook salmon. The number of natural spawners in the Elochoman has ranged from several hundred to several thousand in recent years with most being hatchery-origin (Table 13). The Mill/Abernathy/Germany population does not have an in basin hatchery program, but still has several hundred to several thousand spawners each year that are also predominately hatchery origin fish (Table 13).

The Big Creek and Youngs Bay populations are both proximate to large net pen rearing and release programs that provide for a localized, terminal fishery in Youngs Bay. ODFW estimated that 90 percent of the fish that spawn in these areas are hatchery strays.

ODFW reported that hatchery strays contributed approximately 90 percent of the fall Chinook salmon spawners in both the Clatskanie and Scappoose over the last 30 years (ODFW 2010). New information was developed regarding the status of the Clatskanie and Scappoose populations since the 2010 opinion as a result of one of the investigative tasks listed in the Conservation Recommendations (NMFS 2010). Task H, read as follows:

> *Review and update existing escapement estimate time series for selected primary tule populations with particular attention to estimates of hatchery contribution. The report*

should also describe current escapement monitoring programs and how they are designed to address key uncertainties.

Problems with the Clatskanie estimates are summarized in the Task H report (Dygert 2011). Escapement estimates for 1974 to 2006 were based on expanded index counts. If index counts were less than five they were replaced with values based on averages of neighboring years. This occurred for 11 of the 33 years in the data set. From 1991 to 1993, for example, the index counts were 1, 0, and 0, respectively. These were replaced with higher values resulting in escapement estimates of 287 for each of the three years (Table 13). From 2004 to 2006 there was also a computational error in the data reported resulting in estimates that were about twice as high as they should have been. Estimates of hatchery contribution for the Clatskanie are based on observations in Plympton Creek which, as explained in the Task Report, is likely not representative of hatchery straying in the Clatskanie River itself. Index counts in the Clatskanie since 2006 continue to show few spawners. Index counts from 2007 to 2010 were 0, 2, 4 and 1, respectively. Surveys were conducted in the Scappoose for the first time from 2008 to 2010. Two spawning adults were observed in 2008, but none were seen in 2009 or 2010. Preliminary results for the first half of 2011 have also resulted in no observed spawners. Oregon plans to continue with these surveys for the next few years and use them to reassess the status of the Clatskanie and Scappoose populations. However, recent information suggests that there are significant problems with the historical time series for the Clatskanie that have been used in the past and that there is currently very little spawning activity in either the Clatskanie or Scappoose rivers.

Apparent problems with these escapement estimates have implications for earlier analyses that relied on that data. The Clatskanie data was used in the SLAM life-cycle modeling analysis done by the NWFSC (2010). The Clatskanie data was also used indirectly for the modeling analysis of the Scappoose population. Because there were no direct estimates of abundance for the Scappoose, the data from the Clatskanie was rescaled to account for difference is subbasin size and then used in the life-cycle analysis for the Scappoose. Results from the life-cycle analysis indicated that the two populations were supported largely by hatchery strays and that juvenile survival rates were inexplicably low relative to the generic survival rates used in the analysis. The general conclusion of the life-cycle analysis was that the populations were unproductive and not viable under current conditions even with little or no harvest. If there are substantive flaws in the escapement data, then results from the life-cycle analysis are also flawed. The general conclusion of the life-cycle analysis is still probably correct – the populations are not viable. But the recent data suggests that there are in fact few hatchery strays and little or no natural production in the Clatskanie or Scappoose, and that the populations may be extirpated or nearly so. Confirmation of these tentative conclusions will depend on continued monitoring over the next few years.

The Big Creek and Youngs Bay populations are both proximate to large net pen rearing and release programs designed to provide for a localized, terminal fishery in Youngs Bay. ODFW again estimates that 90 percent of the fish that spawn in these areas are hatchery strays. The number of fish released at the Big Creek hatchery has been reduced with additional changes in hatchery practices to help reduce straying into the Clatskanie and other neighboring systems. These programs are otherwise expected to continue to provide fish for ocean fisheries and localized terminal harvest opportunity. These are examples of actions the states have taken as part of a comprehensive program of hatchery reform to address the effects of hatcheries. The nature and scale of the reform actions were described in more detail in Anderson and Bowles (2008), in a letter from WDFW (Anderson 2010a), and the more recent Task E reports (Frazier 2011 and Stahl 2011).

Table 13. Annual escapement of selected Lower Columbia River tule Chinook salmon Coastal Strata populations (Beamesderfer et al. 2011).

	Clatskanie[a]		Grays		Elochoman		Ge/Ab/Mi	
Year	#	% wild	#	% wild	#	% wild	#	% wild
1974	155	10.0						
1975	408	10.0						
1976	355	10.0						
1977	355	10.0	1,009	46.0	568	42.0		
1978	355	10.0	1,806	46.0	1,846	42.0		
1979	330	10.0	344	46.0	1,478	42.0		
1980	525	10.0	125	46.0	64	42.0	516	49.0
1981	330	10.0	208	46.0	138	42.0	1,367	48.0
1982	1050	10.0	272	46.0	340	42.0	2,750	50.0
1983	330	10.0	825	46.0	1,016	42.0	3,725	51.0
1984	253	10.0	252	46.0	294	42.0	614	52.0
1985	175	10.0	532	46.0	464	42.0	1,815	53.0
1986	330	10.0	370	46.0	918	42.0	980	49.0
1987	777	10.0	555	46.0	2,458	42.0	6,168	59.0
1988	447	10.0	680	46.0	1,370	42.0	3,133	69.0
1989	641	10.0	516	46.0	122	42.0	2,792	69.0
1990	175	10.0	166	46.0	174	42.0	650	63.0
1991	287	10.0	127	47.0	196	9.0	2,017	85.0
1992	287	10.0	109	76.0	190	100.0	839	47.0
1993	287	10.0	27	52.0	288	78.0	885	71.0
1994	136	10.0	30	70.0	706	98.0	3,854	40.0
1995	194	10.0	9	39.0	156	50.0	1,395	51.0
1996	1069	10.0	280	17.0	533	66.0	593	54.0
1997	155	10.0	15	12.0	1,875	11.0	603	23.0
1998	214	10.0	96	24.0	228	25.0	368	60.0
1999	233	10.0	195	68.0	718	25.0	575	69.0
2000	607	10.0	169	70.0	196	62.0	416	58.0
2001	607	10.0	261	43.0	2,354	82.0	4,024	39.0
2002	894	10.0	107	47.0	7,581	0.0	3,343	5.0
2003	1,088	10.0	398	39.0	6,820	65.0	3,810	56.0
2004	252	10.0	766	25.0	4,796	1.0	6,804	2.0
2005	233	10.0	147	41.0	2,204	5.0	2,083	13.0
2006	97	10.0	302	100.0	317	100.0	636	62.0
2007	na	na	63	100.0	165	100.0	335	48.0
2008	na	na	40	68.0	841	10.0	750	49.0
2009	na	na	312	43.0	2,246	18.0	604	93.0
2010	na	na	19	100.0	913	16.0	3,030	57.0

[a] *The Clatskanie 2004 – 2006 escapement estimates are from Dygert 2011. See text for further discussion of these estimates.*

Overview of Fall Population Status

In the 2009 biological opinion regarding the effects of PFMC Fisheries on Lower Columbia River Chinook salmon, NMFS described methods and results from several analyses that have been used in the past to assess the status of the populations and the effects of harvest on Lower

Columbia River tule Chinook salmon populations. The assessments provided information regarding the effects of harvest on the ability of populations to meet viability targets. Results from those analyses still contribute to our understanding of population status, but for brevity are incorporated here by reference to that prior opinion (NMFS 2009c).

Two additional assessments used to support the 2010 opinion were conducted after completion of the 2009 opinion. The population risk assessment in the LCFRB Plan (2010) was updated (see Volume 3, Appendix E, Chapter 14). The NWFSC also conducted an expanded life-cycle modeling analysis that considered the effects of hatcheries, habitat conditions, and recovery actions on population risk at various harvest rates (NWFSC 2010). The results of all of these assessments were reviewed and summarized in a NMFS Memo (Walton 2010). The review considered similarities and differences related to the conclusions regarding population status, and possible reasons for the underlying differences. The various analyses used different approaches and sometimes used different data sets. Assumptions related to future condition, particularly with respect to the treatment of hatchery fish, differed between the analyses. These differences influenced the results and conclusions. The NMFS Memo provided several observations that are relevant to our consideration of the status of these populations, and concluded by dividing the populations into three status categories.

NMFS observed that there is considerable uncertainty about the status of many (perhaps all) Lower Columbia River tule Chinook salmon populations. The NWFSC 2010 analysis, for example, relied in part on estimates of natural origin abundance for each population. Some populations, such as the Clatskanie, have very low estimated natural origin abundance compared to their modeled capacity, a result that leads directly to low estimated productivity and ultimately to a pessimistic evaluation of recovery potential under the scenarios explored (NWFSC 2010). However, that initial estimate of low natural origin abundance was itself dependent upon highly uncertain estimates of hatchery-origin spawners in this population. As indicated above, through the completion of Task H described in the 2010 opinion, it is now apparent that there were substantive problems with the data used in the analysis. The status of the Clatskanie population is still uncertain, but surveys from the last several years suggest that there are very few fish spawning in the Clatskanie with indication that the Scappoose may be in a similar condition.

Also, assuming that the low estimated productivities of most Coastal stratum populations are correct, it is important to evaluate the factors that could be contributing to low productivity. Two factors appear to be the most likely cause of this very low productivity: poor habitat quality and impacts from hatchery/harvest management. With regard to habitat, the NWFSC 2010 analysis focused on recovery scenarios involving improvements only to tributary habitat, and modeled only a subset of the full range of tributary habitat actions in recovery plans. For the Coastal populations in particular, improvements to estuary habitat may be crucial. Results for the Task B analysis provide a more detailed assessment of the status of estuary habitat for each of the primary populations. If improvements in estuary habitat were included in the NWFSC 2010 model, the prospects for these populations would improve.

Finally, assumptions about the effect of hatchery fish on the spawning grounds are important (NMFS 2011d). For the Coastal and Cascade MPGs some populations are likely more affected by stray hatchery fish than others. Populations like the Coweeman and East Fork Lewis are apparently less affected, but populations in the coastal stratum have been subject to hatchery straying and past high harvest rates, and as a consequence are unlikely to retain the genetic diversity and adaption that was originally present in these populations. The probable lack of local adaptation in these populations may be a contributing factor to their apparent low productivity.

After reviewing the available information, the NMFS Memo (Walton 2010) concluded that it is useful to divide Lower Columbia River tule salmon populations into three Transitional Recovery Strategy Categories:

1. Populations with relatively low levels of past and current hatchery straying that appear to be self-sustaining and have a high persistence probability under current (~38 percent) harvest rates. Only the Coweeman and Lewis populations fall into this category. These populations are still below their target status but are relatively healthy compared to other Lower Columbia River tule salmon populations.

2. Populations that have relatively high current or past hatchery impacts, but that modeling suggests are able to be self-sustaining, either under current harvest rates or in some cases under rates less than the current rate. Based on the NWFSC 2010 and Ford et al. 2007 results, populations in this category include Washougal, Mill/Abernathy/Germany, and Hood. Grays/Chinook possibly would also fall into this category, but this population was not modeled in the 2010 effort. Although also not explicitly modeled, by analogy to similar populations, the Lower Cowlitz, Kalama, and probably the Toutle populations also fall into this category. These populations may be at less immediate risk, but still clearly will require recovery actions that address habitat, hatchery, and harvest factors.

3. Populations that have very high current or past hatchery impacts that modeling suggests are not self-sustaining under current habitat conditions even with no harvest. Populations in this category include the Elochman, Clatskanie, and Scappoose, and probably Big Creek. These populations clearly require recovery actions that address habitat, hatchery and harvest factors.

The placement of some of the population within these categories may change depending on the analysis and underlying assumptions. For example, the NWFCS 2010 report concluded that the Washougal population could be grouped with the Coweeman and Lewis populations. These categories provide an updated and more refined assessment of status relative to those reported in the recent five-year review (Ford 2011) that relied on earlier information.

The Tasks, listed in Section 1.2 above, largely clarified how actions and reforms were contributing towards recovery. Information resulting from the completion and reporting of the Tasks is used in this opinion to further update our understanding of the status of the fall Chinook salmon populations, but for brevity are incorporated here by reference (Hudson et al. 2011, Cooney and Holzer 2011, Dornbusch 2011, Stahl 2011, Frazier 2011, LaVoy 2011a, McIssac 2011b, Dygert 2011). These reports are posted on NMFS' website at: http://www.nwr.noaa.gov/Salmon-Recovery-Planning/Recovery-Domains/Willamette-Lower-Columbia/LC/BO-tasks.cfm.

2.2.1.4 Spatial Structure, Diversity and Overall VSP Risk Ratings

Spatial structure and diversity are VSP attributes that are evaluated for LCR Chinook using a mix of qualitative and quantitative metrics. Spatial structure has been substantially reduced in many populations within the ESU (NMFS 2012a).

The methods and results for categorizing spatial distribution from the LCFRB Plan (2010) for Washington tule populations are reported in Appendix B of the roll-up recovery plan and summarized here in Table 14. The LCFRB Plan did not provide similar information for the spring and bright populations in Washington. Population status is characterized relative to persistence (which combines the abundance and productivity criteria), spatial structure, and diversity, and also habitat characteristics. This overview for tule populations suggests that risk related to abundance and productivity are higher than those for spatial structure and diversity (Table 14). Lower scores indicate higher risk, as described in Table 14. 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. This general pattern of lower persistence scores and higher scores for spatial structure and diversity applied for other populations in the ESU as well.

The methods used to score the spatial structure and diversity attributes for populations in Oregon are reported in McElhany et al. (2007) with resulting scores, including some updates, reported in the roll-up recovery plan (NMFS 2012a, Apendix A). Results from those assessments are shown in Figure 6 below. The results are presented graphically to help characterize the uncertainty of the designations. These indicate low to moderate spatial structure risk for most populations, but high diversity risk for all but two populations. The assessments of spatial structure and diversity are combined with those of abundance and productivity to give an assessment of the overall status of Lower Columbia River Chinook salmon populations in Oregon. Risk is characterized as high or very high for all populations except the Sandy River late fall and spring populations.

In summary, the recent status review (Ford 2011) concluded that, based on recovery plan analyses, all of the tule populations are considered very high risk except one that is considered at high risk. The modeling conducted in association with tule harvest management suggests that three of the populations (Coweeman, Lewis, and Washougal) are at a somewhat lower risk. However, even these more optimistic evaluations suggest that the remaining 18 populations are at substantial risk because of very low natural-origin spawner abundance (<100/population), high hatchery fraction, habitat degradation, and harvest impacts. For spring Chinook salmon populations, most remain cut off from access to essential spawning habitat by hydroelectric dams. Projects to allow access have been initiated in the Cowlitz and Lewis systems but these are not close to producing self-sustaining populations. The Sandy spring-run Chinook salmon population, without a mainstem dam, is considered at moderate risk and is the only spring Chinook salmon population not considered extirpated or nearly so. Hood River currently contains an out-of-ESU hatchery stock. Overall, the status review concluded that Lower Columbia River Chinook salmon continue to have a threatened status.

Table 14. Summary of current status for Lower Columbia River tule Chinook salmon populations for VSP characteristics expressed as a categorical score (NMFS 2012a, Appendix B).

Strata	State	Population	Persistence	Spatial Structure	Diversity	Habitat
Coastal 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
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
Gorge Fall	WA	Lower Gorge	1.8	3	2.5	2.5
	WA	Upper Gorge	1.8	2	2.5	2
	WA	White Salmon	1.7	2	2.5	1.5

Notes: Summaries are taken directly from the Appendix B, NMFS 2012. All are on a 4 point scale, with 4 being lowest risk and 0 being highest risk.

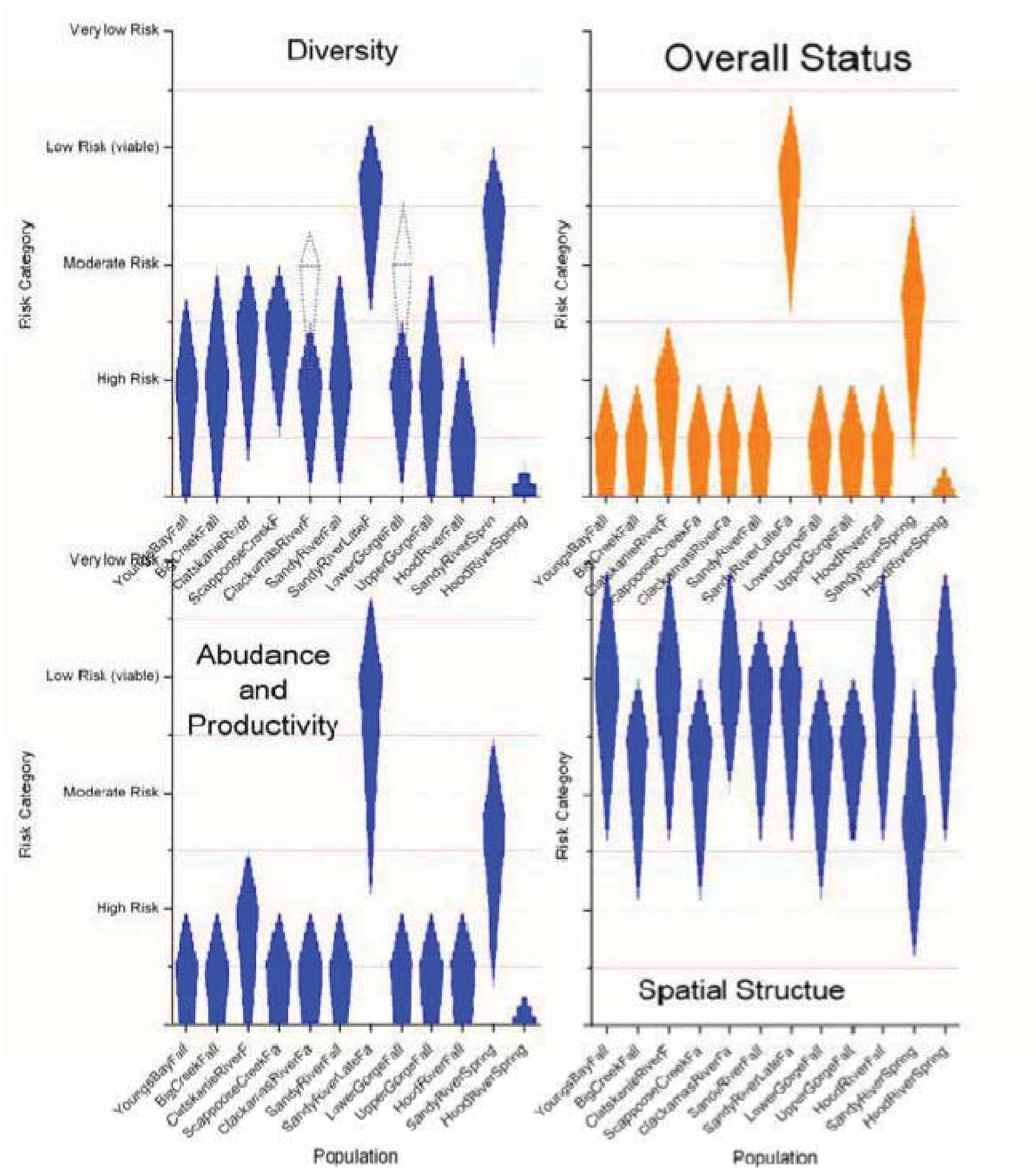
Persistence: 0 = extinct or very high risk of extinction (0-40% probability of persistence in 100 years); 1 = Relatively high risk of extinction (40-75% probability of persistence in 100 years); 2 = Moderate risk of extinction (75-95% probability of persistence in 100 years); 3 = Low (negligible) risk of extinction (95-99% probability of persistence in 100 years); 4 = Very low risk of extinction (>99% probability of persistence 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 historical range accessible but fish are not using it); 3 = Adequate to support a viable population but sub criteria for dynamics or catastrophic 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; significant degradation in habitat quality associated with reduced population productivity; 3 = Intact habitat. Some degradation but habitat is sufficient to produce significant numbers of fish; 4 = Favorable habitat. Quality is near or at optimums for salmon.

Figure 6. Extinction risk ratings for Lower Columbia River Chinook salmon populations in Oregon for the assessment attributes abundance/productivity, diversity, and spatial structure, as well as overall ratings for populations that combine the three attributes (From Ford 2011).[3]



[3] Where updated ratings differ from those presented in McElhany et al. (2007), the old rating is shown as an open diamond with a dashed outline.

2.2.1.5 Limiting Factors and Threats

Understanding the limiting factors and threats that affect the Lower Columbia River Chinook ESU provides important information and perspective regarding the status of a species. One of the necessary steps in recovery and consideration for delisting is to ensure that the underlying limiting factors and threats have been addressed. Lower Columbia River Chinook salmon populations began to decline by the early 1900s because of habitat alterations and harvest rates that were unsustainable given these changing habitat conditions. Human impacts and limiting factors come from multiple sources including hydropower development on the Columbia River and its tributaries, habitat degradation, hatchery effects, fishery management and harvest decisions, and ecological factors including predation and environmental variability. Limiting factors and threats for the Lower Columbia River Chinook ESU were discussed in prior biological opinions (e.g., NMFS 2008d, NMFS 2008e, NMFS 2008f, NMFS 2008g, NMFS 2010) and the management unit recovery plans. The ESU-level roll-up recovery plan consolidates the information available from various sources (NMFS 2012a).

The roll-up recovery plan provides a detailed discussion of limiting factors and threats and describes strategies for addressing each of them. Chapter 4 of the roll-up plan describes limiting factors on a regional scale and how they apply to the four listed species from the lower Columbia River considered in the plan. Chapter 7 of the roll-up recovery plan discusses the limiting factors that pertain to Lower Columbia River Chinook salmon in particular with details that apply to the spring, fall, and late fall populations and major population groups in which they reside. The discussion of limiting factors in Chapter 7 is organized to address:

- Tributary Habitat
- Estuary Habitat
- Hydropower
- Hatcheries
- Harvest
- Predation

Chapter 4 includes additional details on large scale issues including:

- Ecological Interactions
- Climate Change
- Human Population Growth

Rather than repeating this extensive discussion from the roll-up recovery plan, it is incorporated here by reference. However, since this opinion is evaluating a proposed harvest action, we do summarize the roll-up recovery plan's discussion of the harvest threat to LCR Chinook and then supplement that information with a more detailed history of the fishery and its contribution to the current status of Lower Columbia River Chinook salmon.

The roll-up recovery plan describes harvest as a primary limiting factor for all but one population of Lower Columbia River Chinook salmon. The Sandy spring Chinook salmon population is considered more resilient to the effects of harvest (ODFW 2010), so harvest is considered a secondary threat for this population. The harvest threat is described relative to a time period approximately corresponding to the time of listing, so subsequent harvest reductions have partially reduced the threat. The history of harvest activities throughout the species' range is described in the "Past Harvest" subsection below. The roll-up recovery plan's harvest strategy for reducing this threat is described in Section 2.3.2.

In general, for healthy salmonid populations, the 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 for harvest 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 variables such 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, reducing the capacity of the salmon stocks to produce numbers in excess of their spawning escapement requirements.

In recent years fishery catches have been scaled back coast wide and harvest impacts have been reduced from historic levels as a result (see for example the discussion Chapter 3 of the LCFRB 2010). Managers are relying increasingly on mark selective fisheries that are designed to provide harvest opportunity while keeping harvest impacts to natural-origin fish low. 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 that is directed at harvestable hatchery and natural-origin stocks. As a result, fishery catches and harvest impacts on nearly every stock have been reduced significantly.

As discussed under the Proposed Action, Lower Columbia River Chinook salmon are harvested throughout their migratory range from Alaska to Oregon and in fisheries in the lower Columbia River. Because of their broad distribution, Lower Columbia River Chinook salmon are subject to harvest in fisheries managed by several interrelated and overlapping jurisdictions. Management jurisdictions that have fisheries affecting Lower Columbia River Chinook salmon include those related to the PST, fisheries in the Strait of Juan de Fuca and Puget Sound, and the lower Columbia River, in addition to the Council area fisheries that are being considered in this opinion. To address this complexity and help summarize applicable harvest limits for the year, NMFS provides guidance each year through the Council process that sets a total exploitation rate limit and requires that all the jurisdictions manage their fisheries to stay within the overall limit. From a practical perspective this allows the management processes to make allocation decisions to achieve the specified conservation objective. The close relation between the various fishery jurisdictions is described above in more detail in the Proposed Action.

In the following review we describe the magnitude and trends of past and ongoing harvest for the spring, bright, and tule components of the Lower Columbia River Chinook ESU including how it has been distributed across the various fisheries. Harvest that occurs in the Action Area is part of the Environmental Baseline. However, ocean fisheries in Alaska, Canada and in the Columbia River occur outside the Action Area and therefore are not part of the baseline; instead they are reflected in annual escapements listed in Section 2.2.1.3. The following provides an overview of the magnitude, trends, and distribution of harvest in all areas. Additional discussion in the following section on the Environmental Baseline helps distinguish which part of the harvest is formally in the baseline.

Past Harvest

Tables 15, 16, 17 and 18 provide estimates of harvest impacts and their distribution across fisheries for spring, bright, and tule populations in the Lower Columbia River Chinook ESU.

Table 15 provides estimates of harvest impacts to Lower Columbia River spring Chinook salmon populations based on an analysis of Cowlitz River hatchery fish. Estimates from the Cowlitz hatchery are best used to represent the magnitude and distribution of spring Chinook salmon stocks from the Washington side of the ESU (Cowlitz, Lewis, and Kalama rivers). These estimates do not account for reductions in harvest to natural-origin spring Chinook salmon that have occurred in recent years as a result of implementation of mark selective fisheries in the Columbia River. These rates are based on a recent Pacific Salmon Commission (PSC) Chinook Technical Committee (CTC) Code Wire Tag (CWT) cohort reconstruction methodology, and differ from the rates reported in the 2010 opinion (LaVoy 2012a). Exploitation rates were generally higher prior to the mid 1990s averaging 66 percent through 1994. The overall abundance of spring Chinook salmon stocks in the Columbia River, including Upper Willamette River spring Chinook salmon, decreased significantly in the mid 1990s, which led to a significant reduction in harvest, with overall exploitation rates averaging 16 percent from 1995 through 1998 (Table 15). Stock abundance gradually increased, reaching another peak by the early part of the 2000 decade (Table 9). Fishery impacts increased in response to higher abundance. Both Upper Willamette River Chinook and Lower Columbia River Chinook ESUs had been listed by 1999 under the ESA. Reforms were implemented in response to these listings to further limit the effects of harvest. Fishery managers implemented mass-marking programs for hatchery origin fish and phased in mark-selective fisheries in the lower Columbia River.

LaVoy (2012a) considered how harvest impacts to unmarked spring Chinook salmon changed as a result of implementation of mark selective fisheries in lower Columbia River mainstem and tributary fisheries. Without adjustment for mark selective fisheries, exploitation rates for all inriver fisheries averaged 12 percent from 2001 to 2008. When these rates are adjusted to account for mark selective fisheries the overall exploitation rate in the river fisheries is less than 2 percent (LaVoy 2012a). Since 2001 total exploitation rates on marked and unmarked fish have averaged 42 and 32 percent, respectively (LaVoy 2012a). Exploitation rates have been lower in recent years. Since 2004 the total exploitation rates on marked and unmarked fish have averaged 31 and 21 percent, respectively. The rates in Table 15 are based on brood year CWT recoveries converted to a fishing year format. Brood year estimates are estimated by tracking the catch of fish from a given brood that occurs over several years. Fishing year estimates are derived by tracking the catch of several age classes from several broods that occur in one year. Both methods are commonly used with the choice depending on the application and need. For comparison the recent five-year average total exploitation rate from a brood year perspective across consecutive fishing years is 36 percent before a mark selective fishery adjustment, and 27 percent afterwards (LaVoy 2012a).

Table 15. Total adult equivalent exploitation rates for marked Cowlitz River spring Chinook salmon (LaVoy 2012a)[a].

Year	Total Exploitation Rate	Ocean					Columbia River Exp Rate
			Canada		Southern US		
		Southeast Alaska	WCVI	Other Canada	PFMC	PgtSd	
1984	79%	3%	23%	8%	9%	3%	33%
1985	67%	8%	17%	4%	18%	2%	18%
1986	70%	2%	15%	8%	15%	8%	22%
1987	58%	3%	15%	3%	20%	1%	18%
1988	72%	2%	20%	5%	23%	1%	20%
1989	67%	3%	13%	3%	27%	3%	19%
1990	70%	2%	15%	3%	22%	2%	27%
1991	57%	2%	5%	1%	8%	0%	41%
1992	64%	1%	9%	6%	30%	6%	12%
1993	64%	1%	21%	5%	14%	1%	22%
1994	57%	3%	7%	4%	2%	0%	41%
1995	16%	2%	2%	2%	2%	0%	7%
1996	15%	0%	0%	3%	4%	0%	7%
1997	14%	0%	0%	10%	3%	0%	0%
1998	18%	6%	3%	8%	0%	0%	2%
1999	56%	6%	3%	0%	23%	0%	24%
2000	43%	5%	10%	1%	23%	0%	4%
2001	42%	2%	7%	0%	26%	0%	6%
2002	86%	1%	7%	2%	50%	0%	26%
2003	50%	2%	10%	2%	28%	2%	5%
2004	51%	1%	15%	0%	21%	0%	12%
2005	36%	2%	11%	1%	9%	0%	13%
2006	30%	1%	8%	0%	3%	0%	17%
2007	28%	1%	7%	0%	6%	1%	13%
2008	12%	0%	6%	0%	3%	0%	2%

[a]These estimates do not account for reductions in harvest that occurred as a result of implementing mark selective fisheries beginning in 2001(see text).

Table 16 provides estimates of harvest to Lower Columbia River spring Chinook salmon from the Sandy River based on an analysis of Willamette River hatchery fish. The Sandy River spring Chinook salmon hatchery program has used locally adapted brood stock since 2000. Recent analysis indicates that the distribution of the Sandy River population is more like that of fish from the Upper Willamette River than the Cowlitz River (LaVoy 2012b). As a consequence, Willamette CWT groups are a better representative for Sandy River than Cowlitz River tag groups. Fishery and escapement rate estimates for Willamette spring Chinook salmon are derived by the PSC CTC during their annual exploitation rate analysis. Exploitation rates were generally higher prior to the mid 1990's averaging 57 percent through 1994. The overall abundance of spring Chinook salmon stocks in the Columbia River, including Upper Willamette River spring Chinook salmon, decreased significantly in the mid 1990's, which led to a significant reduction in harvest, with overall exploitation rates averaging 34 percent from 1995 through 1999 (Table 16). Stock abundance gradually increased, reaching another peak by the early part of the 2000 decade (Table 9). Fishery impacts increased in response to higher abundance. As mentioned above, reforms were implemented in response to ESA listings to further limit the effects of harvest, including implementation of mass-marking programs for hatchery origin fish to phase in mark-selective fisheries in the lower Columbia River.

LaVoy (2012b) considered how harvest impacts to unmarked spring Chinook salmon changed as a result of implementation of mark selective fisheries in lower Columbia River mainstem and tributary fisheries. Without adjustment for mark selective fisheries, exploitation rates for all inriver fisheries averaged 29 percent from 2001 to 2009 (Table 16). When these rates are adjusted to account for mark selective fisheries the overall exploitation rate in the river fisheries is less than 4 percent (LaVoy 2012b). For comparison the 2001 through 2009 year average total exploitation rate from a brood year perspective across consecutive fishing years is 39 percent before a mark selective fishery adjustment, and 14 percent afterwards (LaVoy 2012b). The rates in Table 16 are based on brood year coded-wire tagged recoveries converted to a fishing year format similar to those in Table 15.

Although there are no direct estimates of harvest impacts on the Hood River population, they are presumed to be similar to those reported for the Cowlitz and Sandy river populations and perhaps more like the Sandy given their relative proximity. The Master Plan (ODFW and CTWSR 2008) indicates that total harvest on the Hood River spring population was on the order of 25 percent.

Table 16. Total adult equivalent exploitation rates for marked Sandy River spring Chinook salmon (LaVoy 2012b)[a]

		Ocean					
			Canada		Southern US		
Year	Total Exploitation Rate	Southeast Alaska	WCVI	Other Canada	PFMC	PgtSd	Columbia River Exp Rate
1984	44%	5%	2%	3%	1%	0%	32%
1985	48%	8%	1%	1%	0%	0%	38%
1986	50%	6%	7%	11%	1%	0%	26%
1987	71%	19%	3%	18%	3%	1%	28%
1988	63%	11%	4%	9%	3%	0%	37%
1989	47%	6%	2%	3%	2%	0%	34%
1990	63%	11%	3%	3%	2%	0%	44%
1991	61%	7%	1%	3%	1%	0%	50%
1992	57%	13%	3%	2%	3%	1%	35%
1993	63%	13%	2%	2%	2%	0%	45%
1994	56%	8%	1%	1%	0%	0%	45%
1995	55%	6%	1%	2%	0%	0%	46%
1996	40%	2%	0%	0%	0%	0%	37%
1997	24%	4%	0%	1%	0%	0%	18%
1998	26%	6%	0%	0%	0%	0%	19%
1999	28%	11%	1%	0%	0%	0%	17%
2000	51%	15%	1%	1%	1%	0%	33%
2001	33%	2%	1%	0%	0%	0%	30%
2002	43%	2%	1%	1%	1%	0%	37%
2003	29%	6%	3%	1%	0%	0%	19%
2004	42%	4%	6%	1%	2%	0%	29%
2005	33%	3%	6%	1%	1%	0%	22%
2006	46%	4%	4%	1%	1%	0%	35%
2007	33%	6%	1%	0%	1%	0%	25%
2008	38%	3%	1%	1%	0%	0%	33%
2009	51%	9%	9%	4%	1%	2%	27%

[a]These estimates do not account for reductions in harvest that occurred as a result of implementing mark selective fisheries beginning in 2001(see text).

Table 17 provides estimates of harvest to the North Fork Lewis bright Chinook salmon population. Exploitation rates were generally high through 1990 (averaging 53 percent), declined during the decade of the 1990s (averaging 32 percent), and increased since 2000 (averaging 43 percent). Mark selective fisheries for Chinook salmon have not been implemented during fall season fisheries.

Table 17. Total adult equivalent exploitation rate for North Fork Lewis bright Chinook salmon population (PSC JCTC 2010).

Year	Total Exploitation rate	Ocean					Columbia River Exp Rate
		Southeast Alaska	Canada		Southern US		
			WCVI	Other Canada	PFMC	PgtSd	
1986	64%	6%	11%	5%	4%	0%	37%
1987	57%	6%	11%	7%	4%	0%	30%
1988	65%	5%	11%	4%	6%	1%	37%
1989	40%	3%	6%	7%	6%	0%	16%
1990	38%	8%	14%	4%	6%	1%	6%
1991	46%	7%	6%	6%	4%	0%	22%
1992	48%	2%	7%	7%	4%	1%	28%
1993	39%	6%	8%	7%	2%	0%	16%
1994	22%	9%	4%	6%	1%	0%	2%
1995	46%	10%	6%	4%	0%	0%	25%
1996	18%	9%	0%	0%	3%	0%	6%
1997	21%	14%	0%	3%	0%	0%	4%
1998	17%	8%	0%	5%	0%	0%	4%
1999	32%	19%	3%	8%	2%	0%	0%
2000	29%	8%	0%	0%	3%	0%	18%
2001	35%	8%	13%	0%	9%	0%	6%
2002	44%	16%	12%	0%	9%	0%	7%
2003	44%	11%	6%	3%	11%	0%	13%
2004	19%	7%	2%	4%	1%	0%	5%
2005	52%	4%	4%	20%	3%	0%	21%
2006	62%	15%	9%	10%	2%	0%	25%
2007	60%	39%	2%	6%	10%	0%	3%
2008	42%	8%	14%	3%	7%	4%	6%

The retrospective analysis done in conjunction with the biological opinion on the latest PST Agreement (PST 2009) indicted that the exploitation rate on Lower Columbia River bright Chinook salmon would be reduced in the future by two percentage points relative to what it would have been under the prior PST Agreement. Fisheries in Alaska, Canada, and in the Columbia River occur outside the action area, but account for more than 80 percent of the overall harvest. Since 1993 the exploitation rate in fisheries in Alaska, Canada, and the Columbia River averaged 32 percent; the average in Council fisheries is four percent (Table 17).

Table 18 provides estimates of harvest impacts for tule Chinook salmon populations based on an aggregate of CWT indicator stocks. Exploitation rates were generally higher through 1993 (averaging 69 percent), lower through 1999 (averaging 37 percent), then increasing since 2000 (averaging 42 percent). From 2002 to 2006 fisheries were managed subject to a 49 percent exploitation rate limit. This objective was met in four out of five years. Exploitation rate limits in 2007 and 2008 were 42 and 41 percent, respectively and then 38 percent in 2009 and 2010. The actual exploitation rate was higher than allowed in 2007, but was more than offset by lower rates in subsequent years. The exploitation rate limits was reduced to 37 percent in 2011.

Table 18. Total adult equivalent exploitation rates for Lower Columbia River natural-origin tule populations (Beamesderfer et al. 2011).

Year	Total Exploitation rate	Ocean					Columbia River Exp Rate
		Alaska	Canada	PFMC Exp. Rate Non-Indian	PFMC Exp. Rate Indian	Puget Sound	
1983	68%	4%	37%	16%	2%	2%	7%
1984	68%	4%	40%	4%	1%	3%	17%
1985	60%	4%	30%	11%	2%	3%	10%
1986	78%	3%	30%	11%	1%	4%	29%
1987	78%	4%	25%	12%	2%	3%	29%
1988	81%	2%	29%	14%	4%	3%	30%
1989	66%	3%	22%	17%	5%	3%	16%
1990	65%	3%	31%	18%	6%	3%	5%
1991	61%	3%	30%	9%	4%	3%	12%
1992	68%	3%	37%	15%	4%	3%	7%
1993	64%	3%	32%	12%	5%	3%	9%
1994	44%	4%	34%	0%	1%	1%	3%
1995	38%	4%	22%	3%	2%	1%	6%
1996	24%	4%	5%	3%	3%	1%	9%
1997	39%	5%	14%	5%	3%	2%	11%
1998	33%	4%	11%	4%	3%	0%	11%
1999	41%	4%	11%	6%	5%	0%	15%
2000	42%	5%	18%	7%	2%	0%	10%
2001	35%	3%	14%	7%	3%	0%	8%
2002	42%	4%	17%	12%	3%	0%	7%
2003	47%	3%	20%	16%	3%	0%	4%
2004	46%	4%	21%	10%	5%	0%	6%
2005	49%	4%	17%	9%	6%	0%	12%
2006	53%	4%	17%	9%	6%	0%	16%
2007	48%	5%	19%	9%	6%	0%	9%
2008	33%	3%	14%	5%	3%	0%	7%
2009	37%	3%	15%	5%	2%	1%	11%
2010	35%	3%	11%	11%	3%	0%	6%

2.2.1.6 Large Scale Environmental Variation

Salmonid population abundance is affected substantially by inter-annual changes in the freshwater and marine environments, particularly by conditions early in their life histories. Generally, the inland environment (including rivers, tributaries, and the associated uplands) is most favorable to salmon when there is a cold, wet winter, leading to substantial snowpack. This normally results in higher levels of runoff during spring and early summer, when many of the juvenile salmon are migrating to the ocean. The higher levels of runoff are associated with lower water temperatures, greater turbidity, and higher velocity in the river, all of which are beneficial to juvenile salmon. However, severe flooding may constrain populations.

Within the ocean environment, near-shore upwelling is a key determinant of ocean productivity as it affects the availability of food for juvenile salmon at the critical point when they first enter the ocean. The upwelling results from ocean currents that appear to be driven by spring and early summer winds which, in turn, result from oscillations in the jet stream that follow certain cycles. Within a year, there are cycles of 20-40 days that affect upwelling, and among years there are longer-lasting conditions, such as El Niño/La Niña cycles of 2-3 years and the Pacific Decadal Oscillation (PDO) which may have cycles of 30-40 years or more that influence upwelling.

Scheuerell and Williams (2005) showed that the coastal upwelling index is a strong determinant of year-class strength and subsequent smolt-to-adult return ratios. The Northwest Fisheries Science Center currently monitors a number of ocean conditions and provides a forecast on their website for salmon returns to the Columbia River based on these and other observations. The forecast and related background information can be found at: http://www.nwfsc.noaa.gov/research/divisions/fed/oeip/a-ecinhome.cfm.

While strong salmon runs are a product of both good in-river conditions and good ocean conditions, favorable ocean conditions appear to be especially important. This section briefly discusses inter-annual climatic variations (e.g. El Niño and La Niña), longer term cycles in ocean conditions pertinent to salmon survival (e.g. Pacific Decadal Oscillation), and ongoing global climate change and its implications for both oceanic and inland habitats and fish survivals. Because these phenomena have the potential to affect salmonids survival over their entire range and multiple life stages, they are an area of substantial scientific investigation.

The Southern Oscillation Index

In an effort to predict the likely strength of the annual monsoons over India in the 1920s, which greatly affected human life through floods and famines, Sir Gilbert Walker conducted extensive statistical analyses of long-term weather observations for many locations around the globe. Among his many findings was that deviations from long-term average seasonal differences in atmospheric pressure between the western Pacific and the eastern Pacific (typically Darwin, Australia to Tahiti), correlated strongly with subsequent climatic conditions in other parts of the globe. Walker termed these deviations, the “Southern Oscillation Index” (SOI). In general, substantial negative SOIs tend to correlate well with above average tropical sea-surface temperatures, termed El Niños, and positive SOIs tend to correlate with below average sea-surface temperatures, termed La Niñas. Both have been found to have “teleconnections” to climatic and oceanic conditions in regions far distant from the south Pacific, including the Pacific Northwest. Although in modern usage a broader array of oceanic and atmospheric characteristics have been found to provide greater predictive power, these teleconnections between conditions in the south Pacific and subsequent climatic conditions elsewhere have come into routine use, including pre-season predictions of runoff in some portions of the Columbia basin.

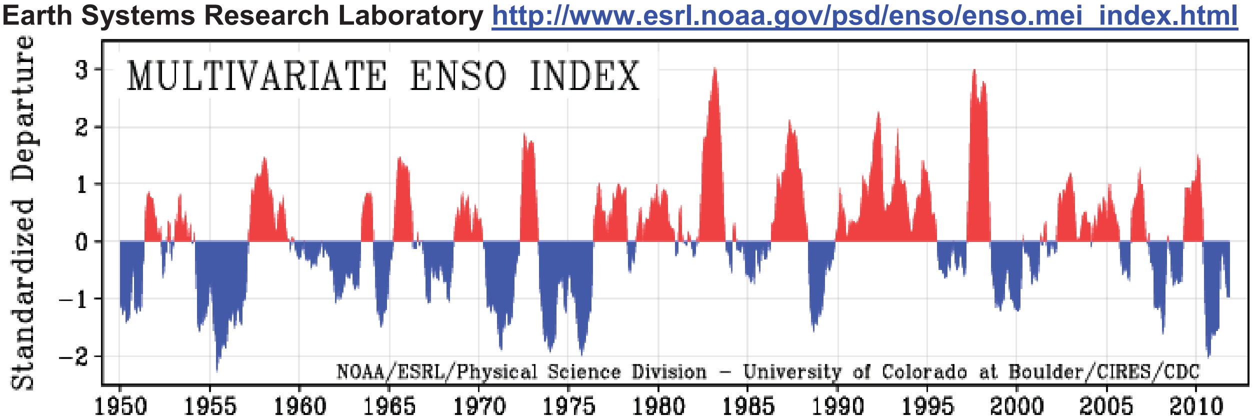
During an El Niño, the forces that create upwelling off the U.S. coast are reduced, as are nutrient inputs to the euphotic zone (well lit, near surface zone), reducing near-shore ocean productivity. This reduction in ocean productivity has been shown to reduce juvenile salmon growth and survival (Scheurell and Williams 2005). Warmer surface waters can also change the spatial distribution of marine fishes with potential predator-prey effects on salmon.

The warmer, drier weather in the Pacific Northwest often associated with El Niño can also cause or increase the severity of regional droughts. Droughts reduce streamflows through the Columbia and Snake River migratory corridor, increase water temperatures, and reduce the extent of suitable habitat in some drainages. Each of these physical effects has been shown to reduce salmon survival. Thus, El Niño events are associated with poor returns of salmon and steelhead.

La Niñas tend to be associated with cooler north Pacific surface water temperatures, and cooler, wetter fall and winter conditions inland. Conditions associated with La Niña tend to increase snowpack and runoff in the Columbia basin, improving outmigration conditions, and ocean conditions tend to be more conducive for coastal upwelling early in the spring, providing better feeding conditions for young salmon.

Currently, NOAA Physical Sciences Division calculates a "Multivariate El Niño Southern Oscillation Index" or MEI, which effectively inverts the SOI relationships: a positive MEI indicates El Niño conditions and a negative MEI a La Niña. Once established, El Niño and La Niña conditions tend to persist for a few months to two years although prevalent El Niño conditions have dominated the Pacific since 1977 and persisted from 1990 through 1995 and 2002 through 2005 (Figure 7 below). It is likely that the dominance of El Niño conditions since the late 1970s has contributed to the depressed status of many stocks of anadromous fish in the Pacific Northwest.

Figure 7. Time-series of MEI conditions from 1950 through December 2011. Source: NOAA Earth Systems Research Laboratory http://www.esrl.noaa.gov/psd/enso/enso.mei_index.html



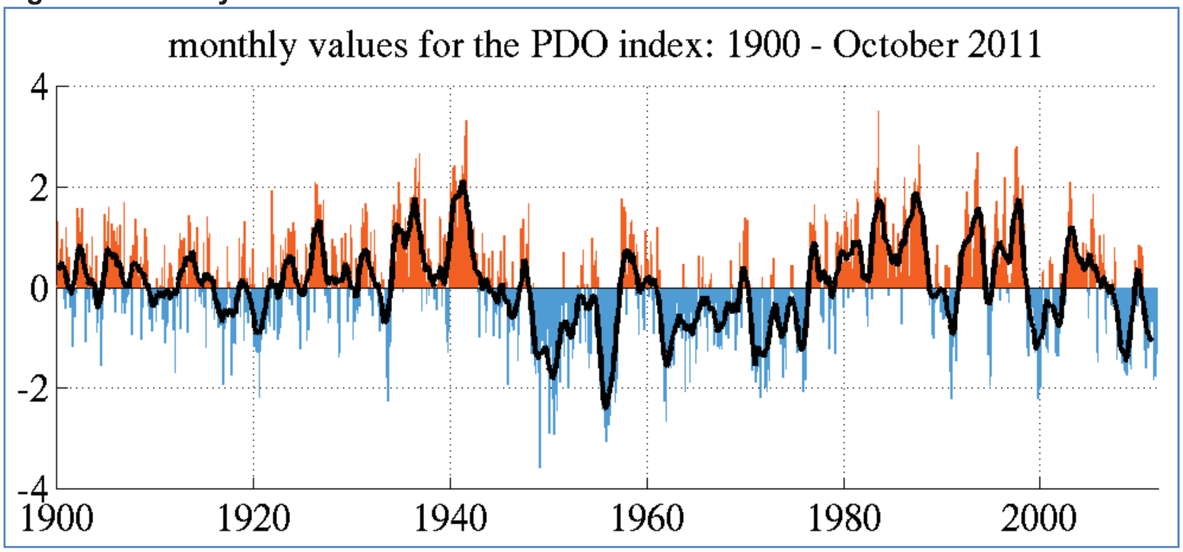
Pacific Decadal Oscillation

First defined by Steven Hare in 1996, the Pacific Decadal Oscillation (PDO) index is the leading principal component (a statistical term) of North Pacific sea surface temperature variability (poleward of 20° N to the 1900-1993 period (Mantua et al. 1997).

Two main characteristics distinguish the PDO from El Niño: first, 20th century PDO "events" persisted for 20-to-30 years, while typical El Niño events persisted for 6 to 18 months; second, the climatic fingerprints of the PDO are most visible in the North Pacific/North American sector, while secondary signatures exist in the tropics – the opposite is true for El Niño. Several independent studies find evidence for just two full PDO cycles in the past century: "cool" PDO regimes prevailed from 1890-1924 and again from 1947-1976, while "warm" PDO regimes dominated from 1925-1946 and from 1977 through (at least) the mid-1990s (Figure 8).

Major changes in northeast Pacific marine ecosystems have been correlated with phase changes in the PDO; warm eras have seen enhanced coastal ocean biological productivity in Alaska and inhibited productivity off the west coast of the contiguous United States, while cool PDO eras have seen the opposite north-south pattern of marine ecosystem productivity (e.g., Hare et al. 1999). Thus, smolt-to-adult return ratios for Columbia basin salmon tend to be high when the PDO is in a cool phase and low when the PDO is in a warm phase.

Figure 8. Monthly Values for the PDO Index: 1900-October 2011.



Evidence suggests that marine survival of salmonids fluctuates in response to the PDO's 20 to 30 year cycles of climatic conditions and ocean productivity (Cramer et al. 1999). Ocean conditions that affect the productivity of Northwest salmonid populations appear to have been in a low phase of the cycle for some time and to have been an important contributor to the decline of many stocks. The survival and recovery of these species will depend on their ability to persist through periods of unfavorable hydrologic and oceanographic conditions.

Global Climate Change

Descriptions of expected changes in Pacific Northwest climate relevant to listed salmon include the U.S. Global Change Research Program's national climate change impacts assessment (Karl et al. 2009), the Washington Climate Change Impacts Assessment (Climate Impacts Group 2009), and the Oregon Climate Change Assessment Report (Oregon Climate Change Research Institute 2010). Regional climate assessments include projections from the Intergovernmental Panel on Climate Change's (IPCC) global climate models (Intergovernmental Panel on Climate Change 2007), which were downscaled to reflect regional terrestrial and aquatic conditions (e.g., Salathe 2005) and ocean conditions (e.g., Stock et al. 2011). Trends and projections of ocean acidification are reviewed in chapters of the Oregon and Washington climate assessments or subsequent publications of those chapters (Mote et al. 2010, Ruggiero et al. 2010, Huppert et al. 2009). Mote et al. (2008) and Ruggiero et al. (2010) described observed sea level height changes along the Pacific coast and reviewed literature projecting sea level changes in the Pacific Northwest.

Recent reviews of the effects of climate change on the biology of salmon and steelhead in the Columbia Basin include ISAB (2007), NMFS (2010a), Ford (2011), and Crozier (2011). Crozier (2011, Section 9.3) includes a review of what is currently known regarding effects of ocean acidification on salmon. The roll-up recovery plan includes a more extensive overview of the climate change issue which is incorporated here by reference.

Ongoing global climate change has implications for the current and likely future status of anadromous fish in the Pacific Northwest. Climate records show that the Pacific Northwest has warmed about 1.0 °C since 1900, or about 50 percent more than the global average warming over the same period. Although total precipitation changes are predicted to be minor (+ 1 to 2 percent), increasing air temperature will alter snowpack (as a result of warmer temperatures more precipitation will fall as rain rather than snow), stream flow timing and volume, and water temperature in the Columbia Basin. Climate experts predict the following physical changes to rivers and streams in the basin will cause a trend toward loss of snowmelt-dominant and transient subbasins.

The changes in air temperatures, river temperatures, and river flows in the Pacific Northwest are expected to cause changes in salmon and steelhead distribution, behavior, growth, and survival. A variety of associated effects on listed salmon and steelhead in freshwater, estuarine, and marine environments are likely, and are listed in Chapter 4 of the roll-up recovery plan. NMFS (2012) points out that we need to consider the cumulative impacts of climate change across the salmon life cycle and across multiple generations. Because these climate effects are multiplicative across the life cycle and across generations, small effects at individual life stages can result in large changes in the overall dynamics of populations. This means that the mostly negative effects predicted for individual life history stages will most likely result in a substantially negative overall effect of climate change on Pacific Northwest salmonids over the next few decades.

The IPCC defines climate change adaptation as adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Adaptation strategies that contain measures to reduce impacts of climate change on Pacific Northwest salmon and steelhead include the Northwest Power and Conservation Council's ISAB (2007) review, the interim Washington Climate Change Response Strategy (Washington Department of Ecology 2011), the Oregon Climate Change Adaptation Framework (Oregon Department of Land Conservation and Development 2010), and the draft National Fish, Wildlife, and Plants Climate Adaptation Strategy (U.S. Fish and Wildlife Service et al. 2012). NMFS incorporates recommended actions for reducing climate change impacts on Columbia Basin salmon and steelhead in the roll-up recovery plan.

The effect of a sustained and broad scale down turn in the productivity and abundance of Chinook salmon that could occur as a consequence of long term cycles in ocean conditions or global climate change are considered based on the sources above. Global climate change in the Pacific Northwest may be similar to periods experienced during past strong El Niños and warm phases of the PDO. No single factor, threat, or threat category accounts for the declines in Lower Columbia River Chinook salmon; instead, their status is the result of the cumulative impact of multiple limiting factors and threats. Although the direction and nature of climate change effects are generally understood, the timing and magnitude of those effects, particularly at the local level, are hard to predict. Close monitoring and adaptive management that responds to changing circumstances are therefore necessary features of a recovery plan.

2.2.2 Rangewide Status of Critical Habitat

Critical habitat for Lower Columbia River Chinook salmon was designated on September 2, 2005 (70 FR 52630). Designated critical habitat for Lower Columbia River 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 2005a). Critical habitat for Lower Columbia River Chinook salmon 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 salmon and will not be considered in this opinion.

The status of critical habitat is discussed in more detail in the Supplemental Comprehensive Analysis (SCA) of the Federal Columbia River Power System (FCRPS) opinion (NMFS 2008f). Because the proposed actions occur outside the range of the designated critical habitat, we provide here only a brief summary of its status.

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). For more information, see Chapter 4 of the SCA. 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.

In the lower Columbia River and its tributaries, major factors affecting PCEs are altered channel morphology and stability; lost degraded floodplain connectivity; loss of habitat diversity; excessive sediment; degraded water quality; increased stream temperatures; reduced stream flow; and reduced access to spawning and rearing areas.

2.3 Environmental Baseline

The “environmental baseline” includes the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02). The environmental baseline for the species affected by the proposed action includes the effects of many activities that occur across the broad expanse of the action area considered in this opinion. The status of the species described in the previous section of the biological opinion is a consequence of those effects.

The action area in this case is limited to the offshore and near shore marine areas in the EEZ, and the coastal and inland marine waters of the states of Washington, Oregon and California which may be indirectly affected by the federal actions (Figure 1). Our discussion of activities that affect Lower Columbia River Chinook salmon within the environmental baseline focuses on groundfish and salmon fisheries. We are not aware of other activities in the action area that have a significant effect on the ESU in question.

The harvest impacts to Lower Columbia River Chinook salmon from salmon fisheries are described in some detail in the preceding section that considers harvest as a limiting factor (Section 2.2.1.5). Some of that harvest occurs in the action area and has been consulted on previously and is therefore formally part of the environmental baseline. Harvest in ocean fisheries in Alaska, Canada and in the Columbia River occurs outside the action area and therefore is not part of the environmental baseline; instead they are reflected in annual escapements listed in Section 2.2.1.3. For greater clarity and to facilitate an overall summary of harvest impacts, we described the magnitude, trends, and distribution of harvest in the preceding section on limiting factors. In the following discussion of the environmental baseline, we refer back to that discussion and briefly distinguish what part of the overall harvest is considered part of the baseline.

2.3.1 Harvest Actions

2.3.1.1 Groundfish Fisheries

The PFMC also manages groundfish fisheries off the west coast under their Groundfish FMP. NMFS completed a supplemental biological opinion on that FMP in 2006 with particular attention to the whiting fishery and limited entry trawl fisheries (NMFS 2006b). The bycatch of salmon in these fisheries is limited primarily to Chinook salmon, with relatively few individuals from other species caught each year. The bycatch of all Chinook salmon in the whiting fishery averaged about 7,300 annually from 1991 to 2005. This compares to an incidental take limit of 11,000 Chinook salmon per year that is specified in the biological opinion. Since completing the consultation in 2006 the annual bycatch has declined averaging about 4,100 annually from 2006 to 2010.

The bycatch of Chinook salmon in the limited entry trawl fishery averaged 11,320 fish from 2002 to 2004. However, the bycatch of Chinook salmon has dropped steadily from a high of over 18,000 in 2002 to less than 2,000 in 2004. The bycatch of Chinook salmon has continued to drop in recent years with less than 800 and 100 taken in 2005 and 2006, respectively (Bellman and Hastie 2008). The estimated bycatch of Chinook salmon in the limited entry trawl fishery in 2007 was 234, in 2008 it was 389, and for 2009 it was 325 (Bellman, et al. 2011).

When the supplemental biological opinion on the groundfish fishery was completed in 2006, information related to the stock composition of the Chinook salmon caught in the groundfish fisheries was relatively limited. Of the ESA listed Chinook ESUs, NMFS concluded that four (Snake River fall Chinook salmon, Lower Columbia River Chinook salmon, Upper Willamette Chinook salmon, and Puget Sound Chinook salmon) 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 percent per year" to "less than 1 percent per year" depending on the ESU or populations being considered (NMFS 2006b). Since then information regarding the stock composition of the Chinook salmon bycatch has become available from samples taken in 2008 from the shoreside whiting fishery and at-sea fishery. The samples were analyzed using genetic stock identification (GSI) techniques. A total of 442 Chinook salmon were sampled in Newport, Oregon from the shoreside fishery. The majority of Chinook salmon were from the mid Oregon coast (40 percent), followed by Rogue, Klamath, California coastal, and Northern California/Southern Oregon stocks. ESA listed stocks from the Lower Columbia River including both spring and fall stocks, Snake River fall Chinook salmon, and Puget Sound Chinook salmon were present, but the proportion of the overall bycatch of each stock was generally low (< 5 percent for each stock). These low proportions are consistent with the previous qualitative characterizations of likely exploitation rates described above. Some of the California coastal stocks were also likely from ESA listed ESUs (Bellinger et al. 2009). A total of 271 samples from the at-sea whiting fishery were also taken and used for GSI analysis. The at-sea fishery is more mobile than the shoreside fishery. As a result, the bycatch was distributed more broadly along the coast. The samples were stratified among three catch areas from northern Washington to northern California (similar to the International North Pacific Fisheries Commission catch reporting areas - Vancouver, Columbia, and Eureka). The samples were also stratified by season with an early period between 18 May 2008 and 15 August 2008 and a late period between 10 October and 31 December. Not surprisingly, the stock composition of Chinook salmon caught in the at-sea fishery was more diverse, particularly when compared to the more localized shoreside fishery. Stocks from the mid Oregon coast, Rogue, Klamath, California coastal, and Northern California/Southern Oregon were still important contributors, but there were also more northern stocks from the Fraser/Thompson system in British Columbia. The bycatch included ESA listed stocks from the California coast, lower Columbia River, Snake River, and Puget Sound (Moran 2009). These studies provide more specific information regarding the stock composition of the Chinook salmon bycatch in the whiting fishery, but the results are consistent with the more qualitative expectations in the 2006 supplemental opinion; i.e., much less than one percent mortality per year for Lower Columbia River Chinook salmon (NMFS 2006b). ESA listed stocks are caught in the fishery, but best available information continues to indicate that the impact of the fishery is low.

2.3.1.2 PFMC Salmon Fisheries

PFMC Fisheries in 2012 and beyond are the subject of this biological opinion, so they are not included in the environmental baseline. However, historical PFMC Fisheries have contributed to the current status of the species in the action area and are therefore considered part of the environmental baseline. Tables 15 to 18 provide information on the harvest of Lower Columbia River Chinook salmon that has occurred in the action area in Council area fisheries. The exploitation rate on Lower Columbia River spring Chinook salmon populations based on an analysis of Cowlitz River hatchery fish in Council area fisheries averaged 18 percent from 2001 to 2008, but was much lower in recent years (Table 15). Council area fisheries account for 44 percent of the total exploitation rate of spring Chinook salmon populations represented by Cowlitz hatchery fish over this time period. For Sandy River spring Chinook salmon, represented by Willamette River hatchery fish, Council area fisheries averaged 1 percent from 2001 to 2008 (Table 16) and account for 2 percent of the total exploitation rate.

The exploitation rate on Lower Columbia River bright populations averaged 5 percent (Table 17) in Council area fisheries from 2001 through 2008 and accounted for 12 percent of the total exploitation rate of Lower Columbia River bright Chinook salmon. The exploitation rate on Lower Columbia River tule Chinook salmon in PFMC Fisheries averaged 13 percent from 2001 to 2010 (Table 17) accounting for 31 percent of the total exploitation that occurred in all fisheries over this time period.

2.3.1.4 Treaty Indian Fisheries

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

2.3.2 Recovery Planning

Recovery plans provide, among other things, an ESU level recovery scenario with population specific viability targets, and threats criteria for each listing factor that are designed to ensure that the underlying causes of decline have been addressed. The ESU level recovery scenario was discussed above in Section 2.2.1. What follows is a more detailed discussion of recommendations from the roll-up recovery plan regarding actions that need to be taken to address harvest as a limiting factor (NMFS 2012a). The roll-up recovery plan also describes the overall recovery strategy and actions that will be required to address other limiting factors and threats. Although the roll-up recovery plan addresses fisheries outside of the action area, the discussion of the recovery harvest strategy is included in this section because it directly affects the fishery in the action area that is the subject of this opinion.

The roll-up recovery plan is predicated on the restoration of healthy natural-origin populations distributed over their native range to provide social and cultural benefits of meaningful harvest opportunities that are sustainable over the long term (NMFS 2012a). The recovery goals are therefore defined with the presumption that the roll-up recovery plan will provide for sustainable harvest of naturally spawning populations. The plan describes near-term strategies for limiting harvest impacts, and long-term strategies for restoring naturally-spawning populations to harvestable levels. The 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 in the future. It therefore anticipates that "limited" harvest will occur during the recovery phase, and provides guidance regarding harvest levels that are consistent with recovery objectives and the intent to provide an "all-H" (habitat, hydro, hatcheries, and harvest) solution that shares the burden of conservation among all of the limiting factors. Where hatchery programs are currently preventing stocks' genetic lineage from disappearing, once natural production, abundance, and diversity of these populations begin to recover, rates of harvest will need to be reevaluated to avoid impacting these newly emerging weak stocks.

The task remains, however, to define the specific level of near term harvest that is consistent with future survival and recovery. That task is something that is properly considered through the consultation process based on NMFS' analysis of the proposed actions, recommendations from the roll-up recovery plan, and other information on status, baseline conditions, and cumulative effects.

Chapter 7 of the roll-up recovery plan describes strategies and measures designed to address threat effects on Lower Columbia River Chinook salmon by life history in context of the all-H strategy. The all-H strategy is important because it provides context for assessing the proposed action, and whether it conforms with the recovery strategy. It is clear from the preceding parts of this opinion that survival and recovery of the species depends on implementation of an effective all-H strategy. Harvest reductions are necessary, but even complete elimination of harvest is not sufficient to achieve recovery if other limiting factors are not addressed as the productivity of the poorly performing populations is so low that their extinction risk would remain high, regardless of harvest rates (NMFS 2012a).

2.3.2.1 Spring Chinook Salmon Populations

The recovery strategy for the spring life-history component of the Lower Columbia River Chinook ESU is an all-H approach aimed at restoring the Cascade spring stratum to a high probability of persistence and improving the persistence probability of the two Gorge spring Chinook salmon populations (Table 6).

The critical elements of the strategy are to (1) maintain and improve the Sandy spring Chinook salmon population, which currently is the only Lower Columbia River spring Chinook salmon population with appreciable natural production, (2) reestablish naturally spawning populations above dams on the Cowlitz and North Fork Lewis rivers, where populations historically were among the most productive but now are virtually extirpated, (3) protect favorable tributary habitat and restore degraded but potentially productive habitat, particularly in the upper subbasins where spring Chinook salmon hold and spawn, and (4) reestablish spring Chinook salmon in the White Salmon and Hood River subbasins.

The roll-up plan and associated management unit plans indicate that harvest impacts have already been reduced substantially as a result of past management actions. The Oregon management unit plan considers a baseline harvest rate averaging 25 percent to be consistent with recovery of natural-origin spring Chinook salmon in the Sandy River and does not call for additional reductions in harvest in its population threat reduction scenarios for spring Chinook salmon (ODFW 2010). The Washington management unit plan also estimated that fishery impacts averaging 25 percent are consistent with long-term objectives. For harvest in general, the Washington management unit plan recommends a phased harvest strategy involving lower near-term rates to reduce population risks until habitat has improved. Modeling in the plan shows a scenario in which spring Chinook salmon harvest rates would be managed for benchmarks of 15 to 25 percent for three consecutive 12-year evaluation periods (i.e., from 1999-2010, 2011-2022, and 2023-2034). The 15-25 percent benchmark reflects the possible need for (1) rates lower than 25 percent in some years to reduce the risk of critically low escapements in years of low ocean survival and (2) fishery restrictions within selected subbasins to protect local populations (LCFRB 2010).

The status of Lower Columbia River spring Chinook salmon populations require close alignment between the harvest and hatchery related recovery strategies. The hatchery strategy for the Cascade spring Chinook salmon stratum centers on using hatchery spring Chinook salmon to reestablish the Upper Cowlitz and Cispus populations in historically accessible habitats in the Cowlitz river basin and to reestablish the North Fork Lewis population in historically accessible habitats in the Lewis River basin. For the Kalama and Sandy populations, hatchery strategies will be targeted at reducing impacts on naturally spawning fish while continuing to produce spring Chinook salmon that provide fish for harvest.

In the Cowlitz and Lewis systems, outplanting of hatchery-origin juveniles and adults is considered the initial stage of reintroduction. In this stage, brood stock choices are limited to existing hatchery stocks. In the Cowlitz, the Cowlitz hatchery brood stock has had negligible out-of-basin influence and is considered consistent with the original Cowlitz naturally spawning stock (LCFRB 2010). Hatchery fish will be used to (1) reintroduce natural production in appropriate areas of the basin and adjacent tributary streams, (2) develop a local brood stock to reestablish historical diversity and life history characteristics, and (3) provide fishery mitigation in a manner that does not pose significant risks to natural populations as they rebuild (LCFRB 2010). The reintroduction program will include eventual development of a biologically appropriate relationship and management strategy for hatchery and wild brood stock over time (NMFS 2012a).

In the North Fork Lewis Basin, the Lewis River spring Chinook salmon program will be used to reintroduce spring Chinook salmon upstream of the hydrosystem. The Lewis hatchery spring Chinook salmon brood stock was developed from outside stocks, principally Cowlitz spring Chinook salmon, but currently is sustained without transfer from other hatcheries. As part of the reintroduction programs, facilities and operational strategies for these hatchery programs will address space, brood stock development, rearing methods, transfer of fish, marking strategies, and monitoring and evaluation (LCFRB 2010).

In the near term, managing fisheries to meet hatchery escapement goals in the Cowlitz and Lewis systems is critical, since recovery of spring Chinook salmon in those systems depends on the success of hatchery reintroduction programs, including the ability to collect enough fish at the hatcheries to meet the needs of the reintroduction program. Managing fisheries to meet hatchery escapement goals is therefore a key near-term strategy that integrates both harvest and hatchery objectives. As the reintroduction proceeds and natural production is established above the dams, the hatchery programs may shift to integrated supplementation to reduce risks to reestablished natural populations (as a first priority) and to improve the fitness of the hatchery stock (as a secondary priority). A matrix will be developed to manage naturally spawning fish in the brood stock, adult escapement to natural production areas and to the hatcheries, and hatchery fish on the spawning grounds (LCFRB 2010).

In the Kalama and Sandy basins, hatchery programs will continue to produce fish for harvest concurrent with efforts to reduce impacts of hatchery fish on the natural populations. The spring Chinook salmon hatchery program in the Kalama is operated for fishery enhancement but with a dual supplementation objective: natural-origin spring Chinook salmon, no longer used as broodstock, are released above lower Kalama Falls to spawn naturally. Here, hatchery strategies will focus on (1) developing protocols regarding how many fish to pass upstream and (2) integrating hatchery and wild broodstock in the future after wild production is established. In the Sandy basin, ODFW will implement actions designed to meet the pHOS, the percentage of fish spawning in the wild that are hatchery origin, target of 10 percent or less established by ODFW for populations targeted for high persistence probability in Oregon.

The hatchery strategy for the Gorge spring Chinook salmon stratum involves the continuation of hatchery reintroduction efforts in the Hood River subbasin, and a potential hatchery reintroduction program in the White Salmon River basin once Condit Dam is removed. The historical spring Chinook salmon population in the Hood River Basin is considered extirpated, and Deschutes river stock (an out-of-ESU stock) is being used for a hatchery reintroduction program. Some natural production is occurring in the Hood River subbasin, but the origin of that natural production is unknown. The recovery strategy calls for the program to continue and eventually be developed into an integrated hatchery/natural program. Specific strategies include moving toward in-basin rearing of hatchery spring Chinook salmon for better local adaptation of the Deschutes stock, developing a sliding scale for take of wild spring Chinook salmon broodstock for the integrated hatchery program, and installing an adult fish ladder and fish trap at Moving Falls to remove stray hatchery spring Chinook salmon from natural spawning areas. The recovery strategy also includes reevaluation of the program at some point and exploration of alternatives (including alternative broodstock) if the current program is not successful.

The historical spring Chinook salmon population also is extirpated in the White Salmon subbasin because Condit Dam blocked access to virtually all historical spawning habitat. Condit Dam was removed in 2011. The immediate plan is to monitor natural escapement and production for the next 4- to 5-years, and then evaluate whether a hatchery supplementation program is needed. If hatchery supplementation is needed, the current recommendation is to use Klickitat hatchery spring Chinook salmon as the brood source for juvenile release into the White Salmon subbasin.

The roll-up recovery plan provides additional information on the recovery actions necessary to address each threat category (NMFS 2012a). It adopts conclusions from the LCFRB and ODFW management unit plans with respect to harvest, and concurs that actions taken to date are consistent with the all-H strategy and sufficient to address harvest as a limiting factor concerning the spring life-history component of the Lower Columbia River Chinook ESU, at least for the time being. As reintroduction and passage improvement efforts begin to yield more natural production, it will be necessary to reevaluate harvest impacts and determine an appropriate harvest strategy.

2.3.2.2 Tule Fall Chinook Salmon Populations

The recovery strategy for the tule fall component of the Lower Columbia River Chinook salmon ESU is designed to restore the Coastal and Cascade tule strata to a high probability of persistence and the Gorge stratum to a probability of persistence that, when combined with compensation in the other strata, is at an acceptable level of risk (Table 6).

In the Coastal tule stratum, the design and successful implementation of transition strategies to appropriately reduce pHOS and improve habitat productivity will be crucial for the Elochoman, Clatskanie, Scappoose, and Mill/Abernathy/Germany populations, all of which are targeted for high viability. The Grays population will be targeted for improvement to medium-plus viability, to be achieved through similar strategies. The Youngs Bay and Big Creek populations will be maintained at high risk to accommodate terminal fisheries targeting hatchery Chinook salmon while minimizing the effects of those hatchery fish on other populations.

In the Cascade stratum, the roll-up recovery plan maintains that the higher performing populations (Coweeman, Lewis) must be protected as described above and moved to high viability. The Toutle and Washougal are also targeted for high or high-plus viability. The Lower Cowlitz and Kalama rivers are targeted for medium and medium-plus viability, respectively (these targets reflect, in part, a decision to accommodate hatchery production in the Lower Cowlitz and the Kalama). The Clackamas and Sandy populations are also targeted for medium viability, with the Upper Cowlitz and Salmon Creek populations considered "stabilizing" and projected to be maintained at their current status (Table 6).

In the Gorge stratum, the Hood tule population is targeted for high viability and the Upper Gorge, Lower Gorge, and White Salmon populations for moderate viability (Table 6). As indicated in the de-listing criteria, this scenario does not meet the criteria for a high probability of persistence as defined by the WLC TRT, and meeting even this scenario is highly uncertain due to questions about the historical role of the Gorge populations and constrained opportunities for habitat restoration because of the Bonneville dam reservoir. To compensate for these limited recovery prospects, additional populations in the Coastal and Cascade strata are prioritized for higher levels of viability.

The recovery strategy involves transitioning from decades of management that allowed habitat degradation, emphasized hatchery production of fish for harvest, and resulted in diminished viability of all tule populations to management that supports a naturally self-sustaining ESU and preserves harvest opportunities in the long term. The strategy for tule fall Chinook salmon is a long-term, "all-H" approach that can only be accomplished by reducing impacts in all threat categories and sharing the burden of recovery across categories. Substantive actions are needed to improve tributary and estuarine habitat and reduce the effects of hatcheries, harvest, and hydropower; without significant improvements in all of these threat categories, the benefits of actions in any individual sector are unlikely to be fully realized and the expected threat reductions will not be achieved.

Critical elements of the recovery strategy include:

- Protecting and improving the Coweeman and Lewis populations, which are currently performing the best, by ensuring that habitat is protected and restored, that the proportion of hatchery-origin spawners is reduced, and that harvest rates allow for gains in productivity to translate into continued progress toward recovery.

- Filling information gaps regarding the extent of natural production and the extent of hatchery-origin spawners.

- Focusing recovery efforts on populations that have the greatest prospects for improvement and determining whether programs to reestablish populations are needed.
- Protecting existing high-functioning habitat for all populations.
- Implementing aggressive efforts to improve the quality and quantity of both tributary and estuarine habitat.
- Implementing aggressive efforts to reduce the influence of hatchery fish on natural-origin fish.
- Adjusting harvest as needed to ensure appropriate increases in natural-origin abundance.
- Assessing habitat quantity, quality, and distribution.

Transition strategies will be developed for each primary population that specify (1) timelines and strategies for reducing hatchery-origin spawners, (2) benchmarks for habitat improvement, (3) expected population response, and (4) harvest adjustments as needed to ensure appropriate increases in natural-origin abundance. These strategies will include adaptive management that provides a pathway for addressing critical uncertainties and that establishes benchmarks and adaptive actions if benchmarks are not met.

The recovery strategy for harvest focuses on refining harvest management to further reduce impacts to naturally produced fall Chinook salmon while maintaining harvest opportunities that target hatchery-produced fall Chinook salmon. Harvest on Lower Columbia River tule Chinook salmon has been reduced from historical highs of 80 percent through successive ESA consultations to 65 percent immediately following the listing to 49 percent in 2002. The exploitation rate limit was further reduced in successive steps to 42 percent, 41 percent, 38 percent and, most recently, 37 percent in 2011. These changes have contributed to the harvest reductions called for in the Oregon and Washington management unit plans, both of which envision reductions through a strategy of implementing mark-selective fisheries when feasible as a tool to sustain important fisheries, implementing abundance based management when feasible, and applying weak-stock management principles.

In terms of needed additional reductions, the Oregon management unit plan did not recommend specific exploitation rate limits; instead, in its analyses it used 35 percent as a modeled, long-term average exploitation rate and assumed that harvest actions such as abundance-based, weak-stock management and mark-selective commercial fisheries would be implemented. The Washington management unit plan recommends a phased harvest strategy involving lower near-term rates to reduce population risks until habitat improvements are achieved. Modeling in the Washington management unit plan shows a scenario in which harvest rates would be managed for benchmarks of 38 to 49 percent for the period between 1999 (the time of listing) and 2010, and rates of 33 to 38 percent from 2011 to 2022.

NMFS's recent modeling (NWFSC 2010), which addressed all primary tule populations except the Toutle, indicates that, in the Cascade stratum, the Lewis, Washougal, and Coweeman populations would benefit somewhat from additional harvest reductions but would be at low demographic risk at harvest rates of up to 38 percent. In the Coastal stratum, the analysis concluded that the Clatskanie, Scappoose, and Elochoman/Skamokawa populations appear to be sustained by hatchery straying under current conditions and are projected at high risk in the absence of hatchery augmentation, even at very low harvest rates. The Mill/Abernathy/Germany population would be at intermediate risk at intermediate harvest levels. The modeling analysis indicated that the Hood population appears to be self-sustaining at a harvest rate of around 20 percent, although the Oregon management unit plan was more pessimistic about the status of that population (ODFW 2010). The uncertainty in all of these predictions is substantial. The Oregon and Washington management unit plans both highlight the need for improved estimates of current spawning levels and habitat conditions for Lower Columbia fall Chinook salmon populations as important short-term objectives. Evaluating and potentially updating available data series for the Clatskanie, Scappoose, and Hood River fall Chinook salmon populations were identified as high priority short-term technical tasks in the Oregon management unit plan.

Recent analysis associated with Task H of the 2010 harvest opinion has helped refine our understanding of the status of the Clatskanie and Scappoose populations. As discussed in more detail in Section 2.2.1.3, recent information suggests that there are currently few if any Chinook salmon spawning in either the Clatskanie or Scappoose rivers.

The roll-up recovery plan called for near-term actions to evaluate and describe options for employing mark-selective fishing strategies in order to sustain fisheries while reducing fishery impacts on naturally produced Lower Columbia tule Chinook salmon populations. Task F from the 2010 harvest opinion called for an analysis of the feasibility and benefits of implementing mark selective fisheries. The Task F report (LaVoy 2011) responded to that assignment. In addition, Washington and Oregon are now in the third year of a large scale effort to evaluate the effectiveness of alternative live capture gear types that could be used to implement mark selective fisheries on a commercial scale.

The roll-up recovery plan, and the Washington and Oregon management unit recovery plans, also calls for consideration and development of an abundance based management framework for managing tule Chinook salmon. Over the last year the Council developed an abundance based plan and, in November 2011, recommended it to NMFS for our consideration and use in 2012 and beyond. Under the Council's recommended plan, the total exploitation rate would vary between 30 percent and 41 percent depending on projected abundance. The plan is the subject of this consultation and is described in more detail in Section 1.3 of this opinion.

The current harvest strategy is based on the assumption (supported by the results of the NWFSC 2010 modeling) that the productivity of the poorly performing populations in the Coastal stratum is so low that their extinction risk would remain high, regardless of harvest rates. The Hood tule population presents an additional challenge for several reasons. First, there is a relatively high degree of uncertainty associated with the specific assumptions regarding current tributary habitat conditions incorporated into NMFS' modeling for the Hood population. In addition, the population's baseline persistence probability in these model runs is very low, the population is targeted for high persistence probability, and—because of harvest impacts in Zone 6 fisheries above Bonneville Dam—the Hood population is subject to exploitation rates higher than those for the Coastal and Cascade strata (Walton 2010). In the future, as productivity begins to improve in populations that currently are performing poorly, NMFS, co-managers, and the management unit leads will evaluate whether harvest needs to be adjusted. Additional information will be needed to understand how harvest and other threats are affecting the ability of tule populations to achieve their recovery targets and appropriate strategies will need to be developed (NMFS 2012a).

2.3.2.3 Late Fall Chinook Salmon Populations

The overall roll-up recovery plan (NMFS 2012a) strategy for the late-fall component of the LCR Chinook ESU is an all-H approach designed to maintain the two healthy populations (North Fork Lewis and Sandy, Table 6).

Critical elements of the strategy include implementing the regional hatchery strategy to minimize the impact of hatchery releases and the regional tributary and estuary habitat strategies. Fisheries are currently managed to meet a spawning escapement goal for lower Columbia bright fall Chinook salmon that is based on the North Fork Lewis river population. In recent years, this escapement goal has been 5,700 natural adult late-fall Chinook salmon. Under the recovery strategy, ocean and freshwater fisheries would continue to employ escapement goal management for Lewis River late-fall Chinook salmon (NMFS 2012a). The escapement goal may be reassessed as new data are acquired. The roll-up recovery plan identifies an abundance target for delisting of 7,300 (Table 6). The target is estimated from population viability simulations and is assessed as a median abundance over any successive 12 year period. Median escapements over the last 12 years have been 9,462 (Table 11), thus exceeding the delisting abundance goal. The Oregon management unit plan targets a reduction in harvest impacts for the Sandy late-fall Chinook salmon population, but anticipates that this reduction will be achieved through implementation of the harvest strategies for tule fall Chinook salmon. Ocean and inriver fisheries are managed specifically to achieve the escapement goal for the Lewis River.

2.4 Effects of the Action on the Species and its Designated Critical Habitat

"Effects of the action" means the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur.

2.4.1 Direct and Indirect Effects

Fisheries may affect Lower Columbia River Chinook salmon in several ways which have bearing on the likelihood of continued survival and recovery of the species. Immediate mortality occurs from the capture, by hook or net, and subsequent retention of individual fish - those direct effects are considered explicitly in the following subsection of this opinion.

In addition, indirect effects occur when fish that are caught and released alive to comply with non-retention requirements that may be related to species or size limits are injured or die subsequently. Non-retention regulations are also sometimes used in mark-selective fisheries that target marked hatchery-origin fish for retention while requiring the release of unmarked fish. These indirect effects are accounted for 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 14.0 to 26.0 percent incidental mortality rate to Chinook salmon caught and released during recreational fishing and ocean troll activities in PFMC fisheries, depending on the area caught and the age of the fish.

The STT also applies an incidental mortality rate to Chinook salmon 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 (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.

As described in the section on the Action Area, indirect effects also occur in marine waters off the Washington, Oregon, and California coast that are inside the EEZ (zero to three miles offshore). The harvest that occurs in these state marine area fisheries are specifically included in the overall assessment of the impacts of PFMC fisheries that are reported as part of the overall impact in the Council's preseason and postseason reporting documents (e.g., PFMC 2012a and PFMC 2012 c-e) and relied on for assessing impacts in this consultation.

2.4.2 Effects of the Actions on Populations

2.4.2.1 Gorge Spring MPG and Cascade Spring MPG

PFMC Fisheries have not been subject to specific exploitation rate limits or management constraints for Lower Columbia River spring Chinook salmon populations in the past (Stelle and McInnis 2011). Instead, these populations have relied on hatchery programs for continued survival during reintroductions and passage and habitat improvements. No new constraints are proposed as part of this action.

Because the proposed action is to continue recent harvest levels, mortality resulting from the proposed action can be estimated from the historical record. The effect of the proposed action for the various populations in 2012 and beyond would presumably be within the range of values observed in recent years as PFMC Fisheries have become increasingly restrictive since listing in 1999. Some additional harvest occurs in marine and inriver fisheries that are outside the action area. Fisheries directed at spring Chinook salmon in the lower Columbia River are, with few exceptions, mark selective.

The exploitation rates in PFMC Fisheries on spring Chinook salmon populations from the Washington side of the ESU are estimated using the Cowlitz River as an indicator stock. The exploitation rate in Council area fisheries has ranged from 3 to 28 percent over the last ten years except for one anomalous observation (Table 15) and this represents the expected mortality from the proposed action. The total exploitation rate, including that of other fisheries that have already undergone ESA section 7 consultation, has ranged from 12-56 percent in all years except one (Table 15). The total exploitation rate estimates do not account for reductions that have occurred as a result of implementing mark selective fisheries in the lower Columbia River fisheries. The total exploitation rate on unmarked, natural origin fish has on average been about ten percentage points lower than those on marked hatchery origin fish since implementation of mark selective fisheries over the last ten years or so (LaVoy 2012a).

There would be no effect to the White Salmon population since there are currently no fish returning to that system.

Upper Willamette River spring Chinook salmon are used as an indicator stock for the Sandy River population on the Oregon side (LaVoy 2012b). The exploitation rate on Sandy River spring Chinook salmon in Council area fisheries has ranged from 0 to 2 percent over the last ten years and this represents the expected mortality from the proposed action (Table 16). The total exploitation rate, including that of other fisheries that have already undergone ESA section 7 consultation, has ranged from 29-51 percent. The total exploitation rate on unmarked, natural origin fish has on average been about 25 percentage points lower than those on marked hatchery origin fish since implementation of mark selective fisheries over the last ten years or so (LaVoy 2012b). The exploitation rate reduction from implementing mark selective fisheries is greater for Sandy River Chinook compared to populations on the Washington side because of presumed differences in ocean distribution and the relatively low impacts that occur to Sandy River fish in ocean fisheries.

The effect of the proposed action on fish returning to the Hood River is unknown since there is no harvest indicator for that introduced stock. We assume that it may be similar to the range of exploitation rates on the Cowlitz and Sandy River populations, which range from 12 to 56 percent.

We evaluate the impact of the expected mortality rates described above on populations and MPGs by comparing with expectations of recovery harvest strategies, which are informed by the full range of limiting factors and recovery management actions and, in some cases, quantitative analyses of the likelihood of achieving recovery goals.

As described in Section 2.3.2.1, the near-term recovery strategy for Cowlitz and Lewis spring Chinook salmon populations is to meet hatchery escapement goals because most of the historical spawning habitat has been inaccessible due to hydro development and reintroduction programs are reliant on surplus hatchery fish. Harvest rates in recent years at the same or higher levels as those in the proposed action have resulted in meeting hatchery escapement goals (Table 10), so the proposed action is also likely to meet these goals.

As described in Section 2.3.2.1, most of the other Washington side spring Chinook populations are also constrained by poor habitat or lack of access to productive habitat and some are also the subject of reintroduction efforts. As described at the beginning of this section, these populations continue to rely on hatchery programs as habitat improvements and reintroduction programs come online. NMFS expects that hatchery escapement goals will continue to be met in 2012 and for the foreseeable future.

As described in Section 2.3.2.1, the recovery goal for the Sandy River population is an overall exploitation rate of 15-25 percent, depending upon factors such as ocean conditions. This goal is derived from modeling showing that long-term recovery objectives can be met with this harvest rate and other recovery actions. The implemented total exploitation rate is expected to be approximately 14 percent, based on past observations under the same harvest action, coupled with a reduction in freshwater fisheries resulting from initiation of mark-selective fisheries (LaVoy 2012b). Previous implementation of the proposed action has resulted in meeting recovery natural-origin abundance goals in recent years (Table 6 and Table 9).

As described in Section 2.3.2.1, a reintroduction program is currently underway in the Hood River. Although we have no direct estimates of harvest impacts on this population, they are presumed to be similar to those reported for the Cowlitz and Sandy river populations, perhaps more like the Sandy given their relative proximity.

The effect of the proposed action will reduce the number of Gorge Spring MPG and the Cascade Spring MPG adults returning to hatcheries and spawning areas, compared to the number that would return if the proposed action is not implemented. However, the proposed action is consistent with the hatchery escapement objectives for Washington populations and the overall exploitation rate limit that is consistent with recovery goals for the Sandy River population. The collective conservation restrictions for several other Chinook salmon populations allowed hatchery escapement goals for Lower Columbia River spring Chinook salmon populations to be met and exceeded, with few exceptions, in recent years (Table 10). The proposed harvest strategies may not be consistent with achieving recovery goals once populations are reintroduced, habitat improvements are made, and the populations are no longer reliant on hatcheries for their continued survival. The five year check in provides an opportunity to regularly assess how well the recovery strategy is being implemented, and how effective it is in improving the status of the populations and their prospects for survival and recovery.

2.4.2.2 Cascade Late Fall MPG

PFMC Fisheries have not been subject to specific exploitation rate limits or management constraints for Lower Columbia River bright Chinook salmon populations in the past (Stelle and McInnis 2011).). Instead, these populations are managed for an escapement goal of 5,700, based on estimates of escapement needed to achieve MSY. No new constraints are proposed as part of this action.

Because the proposed action is to continue recent harvest levels, mortality resulting from the proposed action can be estimated from the historical record. The effect of the proposed action in 2012 and beyond would presumably be an exploitation rate within the range of values observed over the last ten years.

Two natural-origin bright fall 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 inriver fisheries. The exploitation rate on North Fork Lewis River bright Chinook salmon in Council area fisheries has ranged from 1 to 11 percent over the last ten years (Table 17) and this represents the expected mortality from the proposed action. The total exploitation rate, including that of other fisheries that have already undergone ESA section 7 consultation, has ranged from 19 - 62 percent (Table 15). The Sandy River population is presumably subject to the same PFMC and overall exploitation rates.

We evaluate the impact of the expected mortality rates described above on the two populations in the Cascade MPG by comparing with expectations of recovery harvest strategies, which are informed by the full range of limiting factors and recovery management actions.

As described in Section 2.3.2.3, the late fall Chinook salmon harvest strategy is currently to manage for escapement of 5,700 natural-origin spawners to the North Fork Lewis River. Escapement under the harvest rates described above has exceeded this goal, averaging 9,500 spawners over the past 10 years (Table 11). This average is also higher than the roll-up recovery plan's recovery scenario abundance target of 7,300 spawners (Table 6). The plan's harvest strategy does not set a separate escapement goal for the Sandy population, but the Oregon management unit plan expects a reduction in harvest rate for this population that would be achieved through the same measures identified for tule fall Chinook salmon.

The proposed action would reduce the number of Cascade bright fall MPG adults returning to spawn, compared to the number that would return if the proposed action is not implemented. However, the proposed action is consistent with the harvest-related management objectives outlined in the roll-up recovery plan.

2.4.2.3 Gorge Fall MPG, Cascade Fall MPG, and Coastal Fall MPG

Under the proposed action, Council area fisheries would be subject to an overall exploitation rate that would vary from 30 - 41 percent depending on year-specific abundance forecasts (Table 3). As described in the Proposed Action Section 1.3, Beamesderfer et al. (2011) estimated that the sliding scale harvest is equivalent to a constant harvest rate of 36 percent. This provides a point of reference for comparing the proposed abundance based framework to fixed exploitation rates that were anticipated in the management unit recovery plans, and those used in recent years. The forecast in 2012 is high and would allow for an overall exploitation rate of 41 percent in 2012.

Exploitation rates in Council area fisheries have ranged between 7 and 19 percent over the last ten years (Table 18). The effect of the proposed action in 2012 and beyond would presumably be an exploitation rate within this range, but would be at the lower end of the range during years of low abundance.

We evaluate the impact of the expected mortality rates described above on populations and MPGs by comparing with expectations of recovery harvest strategies, which are informed by the full range of limiting factors and recovery management actions, as well as quantitative risk analyses.

- The Oregon management unit plan did not recommend specific harvest rates, but modeled a 35 percent long-term total exploitation rate that it assumed would be implemented.
- The Washington management unit plan recommends a phased harvest strategy in which the benchmark total exploitation rate would range between 33 - 38 percent between 2011 and 2022.
- NMFS modeling in 2010 indicated that three Cascade Fall MPG populations would be at low demographic risk at a 38 percent total exploitation rate; three Coastal Fall MPG populations appeared to be sustained by hatchery straying and harvest rates had little impact on their probability of persistence, while one population had intermediate risk at

intermediate harvest rates; and the Gorge Fall MPG Hood population would be self-sustaining at a 20 percent total exploitation rate.

- PFMC modeling of the proposed action (Beamesderfer et al. 2011) included a risk assessment for groups of populations. The relative effect of the proposed action is to reduce the current quasi-extinction risk by approximately four percent. The 100-year quasi-extinction risk was estimated to be <1 percent for large productive populations like the Coweeman and Washougal, approximately 17 percent for intermediate populations like East Fork Lewis and Elochoman/Skamokawa, and >90 percent for small populations with poor productivity like the Clatskanie and Scappoose.

The roll-up recovery plan considered all of these factors and developed an MPG harvest strategy that implements the Oregon and Washington management unit recommendations. Risks to poorly-performing populations in the Coastal Fall MPG are expected to remain high regardless of harvest rates, so the plan does not include special recommendations for these populations until other factors that would improve productivity are addressed. The plan identified the Hood population as problematic, but primarily called for additional research and monitoring before changing harvest rates based on the needs of this population. The plan acknowledges the uncertainties related to populations in the Gorge MPG and, as discussed in section 2.2.1.1, sought to address those uncertainties by putting greater emphasis on recovery of additional populations in the Cascade MPG. The plan indicates that, in the future, as productivity begins to improve in populations that are performing poorly, harvest rates may need to be adjusted.

The effect of the proposed action would be to reduce the number of tule fall adults returning to hatcheries and spawning areas, compared to the number that would return if the proposed action is not implemented. Populations, particularly in the Cascade Fall MPG, can be expected to persist and meet recovery goals under these harvest rates. Information for the Hood population in the Gorge Fall MPG indicates that these harvest rates may be too high to reach viability, but the analysis is highly uncertain and other goals are set to offset these uncertainties. Populations in the Coastal Fall MPG are dependent upon hatchery straying and these harvest rates currently have little or no impact on their probability of persistence. The proposed action is generally consistent with the harvest-related management objectives outlined in the roll-up recovery plan. The proposed harvest rates may not be consistent with achieving recovery goals once habitat improvements are made and productivity increases, especially for populations in the Coastal Fall MPG. The five year check in provides an opportunity to regularly assess how well the recovery strategy is being implemented, and how effective it is in improving the status of the populations and their prospects for survival and recovery.

2.4.3 Effects of the Actions on Critical Habitat

The designated critical habitat for the Lower Columbia River Chinook ESU does not include offshore marine areas of the Pacific Ocean and therefore does not overlap with the action area. 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.

2.5 Cumulative Effects

"Cumulative effects" are those effects of future tribal, state, local or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the

Federal action subject to consultation (50 CFR 402.02). 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 for PFMC Fisheries is the U.S. west coast EEZ (which is directly affected by the proposed federal action) and the marine waters, other than internal, of the states of Washington, Oregon, and California (which may be indirectly affected by the federal action).

Future tribal, state and local government actions will likely be in the form of legislation, administrative rules, or policy initiatives and fishing permits. Activities in the action area are primarily those conducted under state, tribal or federal government management. These actions may include changes in ocean policy and increases and decreases in the types of activities currently seen in the action area, including changes in the types of fishing activities, resource extraction, 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.

2.6 Integration & Synthesis

The Integration and Synthesis section is the final step of NMFS' assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action (Section 1.3) to the environmental baseline (Section 2.3) and the cumulative effects (Section 2.5) to formulate the agency's biological opinion as to whether the proposed action is likely to: 1) result in appreciable reductions in the likelihood of both survival and recovery of the species in the wild by reducing its numbers, reproduction, or distribution; and 2) reduce the value of designated or proposed critical habitat for the conservation of the species. These assessments are made in full consideration of the status of the species and critical habitat (Section 2.2).

As discussed in Section 2.4.3, the proposed actions will have no effect on designated critical habitat for Lower Columbia River Chinook salmon, so the goal of this section is to summarize the information relevant to NMFS' jeopardy determination. This ESU has a complex structure with populations organized within six MPGs consisting of three life history types (Table 4), distributed across three ecological regions (Table 5). Therefore, in reaching a decision at the ESU level, NMFS must first review the direct and indirect effects of the action, when added to the environmental baseline and cumulative effects, on the six MPGs and their component populations and then aggregate that information to support a conclusion for the entire ESU. The effect of the proposed actions on listed hatchery fish and their effect on various populations is also an important consideration for various components of the ESU. Consideration of the effects of the proposed actions as an addition to the environmental baseline 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, the jeopardy determination is made in the context of a comprehensive recovery strategy that has been articulated through recovery planning that is described in NMFS' roll-up recovery plan (NMFS 2012a), and the continuing evolution of information over the last several years.

For all populations and MPGs, indirect effects are included in the estimates of proposed harvest effects as described in Section 2.4.1. As described in Section 2.5, cumulative effects are uncertain and most significant impacts in the action area are likely to require future consultations with Federal agencies. Therefore, in the sections that follow, the effects of the action (which include indirect effects) primarily are added to the environmental baseline and considered in the context of the rangewide status as described above.

2.6.1 Spring Chinook Salmon Populations

Spring Chinook salmon populations occur in both the Gorge and Cascade MPGs.

2.6.1.1 Gorge Spring MPG

The persistence probabilities for the White Salmon and Hood River spring Chinook salmon populations are currently listed as very low (Table 6). In fact, both are considered extirpated or nearly so. The White Salmon and Hood River populations are targeted for low and very high persistence probabilities, respectively as part of the overall recovery scenario.

The White Salmon population was extirpated when Condit Dam blocked all access to upstream spawning and rearing areas. Condit Dam was breached in 2011 providing access to essential habitat in the upper drainage. The roll-up recovery plan calls for monitoring escapement into the basin for four to five years to see if natural recolonization occurs and that process has now started. At the end of that period, a decision will be made about whether to proceed with a reintroduction program for spring Chinook salmon. Since there are currently no spring Chinook salmon in the White Salmon River, none will be caught as a consequence of the proposed action. If spring Chinook successfully recolonize the White Salmon and begin to produce natural origin fish, some take may occur.

Most of the habitat that was historically available to spring Chinook salmon in the Hood River is still accessible, but the basin was likely not highly productive for spring Chinook salmon due to the character of the basin. Because the Hood River population was considered extirpated or nearly so, recovery now relies on the success of a reintroduction program. The reintroduction program for Hood River spring Chinook salmon is using spring Chinook salmon from the Deschutes River which is the nearest source for brood stock, but is from the Middle Columbia River ESU. Details related to the reintroduction program are described in the Revised Hood River Master Plan (ODFW and CTWSR 2008) which is incorporated into NMFS's roll-up recovery plan (NMFS 2012a). The reintroduction program is now the subject of an interim study to provide the information necessary for co-managers to identify a long-term, biologically sound and cost effective spring Chinook salmon production strategy for the Hood River Basin that can lead to recovery.

Proposed harvest rates on the Hood River population are expected to be unchanged from recent historical levels. Both the roll up recovery plan (NMFS 2012a) and Master Plan (ODFW and CTWSR 2008) indicate that total harvest on the Hood River spring population was on the order of 25 percent, but no direct estimates are currently available. The Master Plan indicated that harvest did not appear to be a significant factor limiting the success of the reintroduction program. The roll-up recovery plan, assuming a 25 percent total exploitation rate limit, also indicates that current harvest levels were not an impediment to recovery of Hood River spring Chinook salmon. Although we have no direct estimates of harvest impacts on this population, they are presumed to be similar to those reported for the Cowlitz and Sandy river populations described in the effects section in 2.4.2.1 and perhaps more like the Sandy given their relative proximity (i.e., approximately one percent from PFMC Fisheries (Table 16)). The proposed harvest rates may not be consistent with achieving recovery goals once populations are reintroduced, habitat improvements are made, and the populations are no longer reliant on hatcheries for their continued survival. Review of these reintroduction efforts and their relation to the roll-up recovery plan's harvest strategy for these populations will be a subject for the five year check in.

Given the current reliance on the hatchery supplementation program for Hood River spring Chinook salmon and the lack of harvest on the currently-extirpated White Salmon population, NMFS concludes that the proposed fisheries are not likely to reduce the likelihood of survival and recovery for the Gorge Spring MPG populations.

2.6.1.2 Cascade Spring MPG

There are seven spring Chinook salmon populations in the Cascade Spring MPG. The Upper Cowlitz and Sandy populations are considered genetic legacy populations (Table 5), meaning that they have had minimal influence from nonendemic fish due to artificial propagation activities or that they exhibit important life history characteristics that are no longer found throughout the ESU. These populations provide the primary genetic reserves affecting diversity of this MPG and the ESU as a whole. The current persistence probability status of all of the Cascade spring Chinook salmon populations except the Sandy is listed as very low. The current status of the Sandy population is listed as medium (Table 6). The Upper Cowlitz, Cispus, Sandy, and Lewis populations are all targeted for high or very high persistence probability as part of the overall recovery scenario. The Toutle and Kalama populations are targeted for medium and low persistence probability, respectively (Table 6). The Tilton population is targeted for very low persistence.

The roll-up recovery plan recovery strategy for Lower Columbia River spring Chinook salmon in the Cascade MPG is described in Section 2.3.2.1. As discussed above, spring Chinook salmon populations in the Gorge MPG are at greater risk and recovery for those populations is less certain. As a consequence, more than the minimum number of populations in the Cascade MPG are targeted for high viability, in part, to mitigate the risks and uncertainty for recovery of the Gorge spring populations. NMFS concurred with this overall recovery strategy (NMFS 2012a).

There are many limiting factors for populations in the Cascade Spring MPG that are summarized in the roll-up recovery plan (NMFS 2012a). These are referenced above in Section 2.2.1.5, but include effects related to hydro, habitat, hatchery, and harvest activities. For the three Cowlitz populations (Upper Cowlitz, Cispus, and Tilton) and the North Fork Lewis population, the paramount limiting factor is the dams that block access to their historic spawning and rearing habitat.

The Upper Cowlitz, Cispus, and Tilton are populations in the Cowlitz River and are all located above Mayfield Dam. These populations have been homogenized and, as described below, except for the Tilton, are the subjects of an ongoing reintroduction program. References to individual populations within this group apply to the expectation that population-specific distinctions will re-emerge following successful reintroduction. The Tilton is targeted for very low persistence probability because of the habitat is relatively poor and the prospects for successful reintroduction are low.

A key part of the recovery strategy is to reestablish naturally spawning populations above blocking dams on the Cowlitz and Lewis rivers. The reintroduction program on the Cowlitz has already started. As mentioned in Section 2.2.1 a supplementation program on the Lewis River is expected to begin in 2012. The success of both of these programs depends on providing adequate juvenile and adult passage over the dams, and improving habitat conditions (NMFS 2012a). In the short-term, extinction risk is reduced for the three Cowlitz populations and for the North Fork Lewis population by hatchery programs that are producing large numbers of listed hatchery fish that preserve genetic legacy, reduce the risk of immediate extinction, and provide a source for the reintroduction program. Given these circumstance, harvest is managed to achieve the hatchery escapement goals that support the reintroduction programs. The escapement goals have been met by a wide margin with few exceptions since 1996 (Table 10).

The persistence probability for the Sandy population is currently medium. It is targeted to improve to a very high persistence probability. The return of natural origin fish to Marmot Dam prior to its removal averaged approximately 1,700 (Table 9), although this did not account for the additional spawning of natural-origin fish below the dam. The abundance component of the delisting goal for Sandy River spring Chinook salmon is 1,230 (Table 6). The return of natural-origin fish has therefore met the tentative delisting goal in recent years. The total return of spring Chinook salmon to the Sandy including listed hatchery fish has averaged more than 5,800 since 2000 (Table 9). The Sandy River also has a harvest augmentation hatchery program that was developed using local natural origin fish for brood stock. The hatchery program therefore provides a genetic legacy reserve that further mitigates the short term risk of extinction for the population. Although the abundance criterion for delisting has been met in recent years, other aspects of the VSP criteria would have to improve for the population to achieve the higher persistence probability level that is targeted.

The persistence probability of the Toutle population is listed as very low. It is targeted to improve to a medium persistence probability (Table 6). There is relatively little known about current spring Chinook salmon production in this basin. Legacy effects of the 1980 Mount St. Helen's eruption are still a fundamental limiting factor for Toutle River spring Chinook salmon (NMFS 2012a). The North Fork Toutle was dramatically affected by sedimentation from the eruption. Because of the eruption, a sediment retention structure (SRS) was constructed to manage the ongoing input of fine sediments into the lower river. Nonetheless, the SRS is a continuing source of fine sediments and blocks passage to the upper river. A trap and haul system was implemented and operates annually from September to May to transport adult fish above the SRS. The transport program provides access to 50 miles of anadromous fish habitat located above the structure (NMFS 2012a). Recovery of this population will depend on developing better information about its status and how to overcome the habitat-related limitations resulting for the Mount St. Helens eruption.

The historical significance of the Kalama population was likely limited because habitat there was probably not as productive for spring Chinook salmon (NMFS 2012a). In the recovery scenario the Kalama spring Chinook salmon population is designated as a contributing population targeted for low persistence probability (Table 6). There is currently a harvest augmentation hatchery program operating in the basin that integrated local returning wild spring Chinook salmon into the program from 2005 through 2009. The management strategy has changed recently. Brood stock for the hatchery program is separated from the natural-origin fish. The natural-origin fish are passed above the falls to utilize inaccessible, but otherwise suitable habitat in the upper basin.

The recovery strategy for Lower Columbia River spring Chinook salmon includes substantially reducing hatchery impacts on natural-origin spring Chinook salmon. Hatchery-related actions will include excluding hatchery fish from portions of the Sandy through the use of weirs, traps, and other measures to reduce the effects of the hatchery program in the Sandy River watershed. For the Sandy, lessening the effects of hatchery-origin fish on naturally produced fish is expected to provide greater benefit than any other general category of action (ODFW 2010). In Washington, actions include integrating natural-origin broodstock into some hatchery programs to improve fitness and support the reintroduction programs, and eliminating or adjusting some releases. On the Kalama the strategy, as described above, is to segregate the hatchery and natural-origin fish.

While the roll-up recovery plan discusses harvest as a limiting factor for Lower Columbia River spring Chinook salmon, harvest objectives specified in the roll-up plan have largely been met or exceeded. The Oregon management unit plan considers a baseline harvest rate of 25 percent to be consistent with recovery of natural-origin spring Chinook salmon and does not call for additional reductions in harvest in its population threat reduction scenarios for Sandy River spring Chinook salmon (ODFW 2010). The Washington management unit plan also estimated that fishery impacts of 25 percent were consistent with long-term objectives. The transition to reliance on mark-selective fisheries in the lower Columbia River for spring Chinook salmon was completed approximately ten years ago and resulted in significant reductions in overall harvest.

As discussed in above in Section 2.2.1.5, the recent five-year average exploitation rate total on Cowlitz River spring Chinook salmon from a brood year perspective across consecutive fishing years is 36 percent before a mark selective fishery adjustment, and 27 percent afterwards (LaVoy 2012a). For the Sandy, recent year exploitation rates averaged 39 percent before a mark selective fishery adjustment, and 14 percent afterwards (LaVoy 2012b). Although harvest impacts on the Washington populations have been just above levels targeted in the roll-up recovery plan, the more immediate goal for these populations is to meet the hatchery escapement objectives that support the reintroduction programs on the Cowlitz and Lewis rivers.

The exploitation rates in Council area fisheries for Washington populations has ranged from 3 percent to 28 percent over the last ten years except for one anomalous observation, but have been lower in recent years as a result of increasingly restrictive ocean fisheries (Table 15). The exploitation rate on Sandy River spring Chinook salmon in Council area fisheries has ranged from 0 to 2 percent over the last ten years (Table 16).

The roll-up recovery plan indicated that near-term harvest impact reduction benchmarks have been met, but may require further consideration once significant natural populations are re-established in Washington sub-basins as a result of the supplementation programs.

In summary, the proposed action will result in direct and indirect mortality of fish of all populations in the Cascade Spring MPG. Estimates for the expected harvest impacts are expected to be similar to recent years. The exploitation rate that would occur in Council area fisheries that are considered under the proposed action mean that fewer adults will return to natal areas than if the proposed action does not occur. However, the proposed action is not likely to appreciably reduce the likelihood of survival and recovery of the Cascade Spring MPG because it is likely:

- The reduction in returning adults that will occur as a result of the proposed action, compared to the number that would return if the action does not occur, will have little effect on the survival or potential for recovery of the three Cowlitz River populations or the North Fork Lewis population. As described in the Status and Environmental Baseline sections above, dams block passage to spawning habitat and survival and recovery are dependent upon a hatchery program and fledgling reintroduction programs. The only fish that will be able to reach the blocked habitat in 2012 and beyond will be those collected for the reintroduction program and hauled above the dams. In recent years, when harvest rates have been equal to or greater than those included in the proposed action, there have been more than enough returning adults to supply the reintroduction program and the brood stock needs for the ongoing hatchery program (Table 10). It is likely that there will continue to be sufficient returns under the proposed harvest rates.
- The Sandy River population has met recovery-related abundance objectives and is expected to continue to do so under the proposed action.
- The genetic legacies of the Upper Cowlitz, Tilton, and Lewis populations in the Cascade Spring MPG are still housed in hatchery programs. Their recovery therefore depends on first resolving dam passage problems for successful reintroduction. In the meantime, the hatchery programs serve as a reserve thus reducing the short term risk to all three. The proposed harvest rates will result in adequate hatchery production to support reintroduction and maintain the genetic legacy.
- The Kalama population is designated as a contributing population and targeted for low persistence probability under the recovery scenario. The hatchery program is managed to augment harvest in the lower river, but natural-origin fish are being passed above the falls to utilize inaccessible, but otherwise suitable habitat in the upper basin. This is expected to improve the status of the population to meet the level targeted for the population.
- Less is known about the Toutle population. The proposed action may reduce the prospects for survival and recovery of the Toutle population, but the impact is likely to be low, at least in part, because empirically measurable reductions in harvest have occurred throughout the Cascade Spring MPG. Although the Toutle population is designated as a contributing population that will require an improvement in status over the long term, it is one of six populations that have been designated for improved status in an MPG that has only seven populations. Therefore, the potential effect of the proposed action on the Toutle population does not change NMFS overall conclusion that the proposed action is not likely to appreciably reduce the likelihood of survival and recovery of the Cascade Spring MPG.
- The proposed harvest rates may not be consistent with achieving recovery goals once populations are reintroduced, habitat improvements are made, and the populations are no

longer reliant on hatcheries for their continued survival. Review of these reintroduction efforts and their relation to the roll-up recovery plan's harvest strategy for these populations will be a subject for the five year check in.

2.6.2 Late Fall Chinook Salmon Populations

Bright Chinook salmon populations occur in the Cascade MPG.

2.6.2.1 Cascade Late Fall MPG

The North Fork Lewis and Sandy River populations are the only bright populations in the ESU. The current persistence probability status for the North Fork Lewis population is listed as very high. The population is targeted for very high persistence probability at delisting (Table 6). The North Fork Lewis population is the principal indicator stock for management for this component of the ESU. It is a natural-origin population with little or no hatchery influence. The escapement goal for management purposes is 5,700 and is based on estimates of the escapement needed to achieve maximum sustained yield (MSY). NMFS (2012a) also identifies an abundance target for delisting of 7,300 (Table 6). The target is estimated from population viability simulations and is assessed as a median abundance over any successive 12 year period. Escapements from seven out of the last ten years have been above the MSY goal, with a median escapement over the last 12 years of 9,462 (Table 11), thus exceeding both the MSY escapement goal and the delisting abundance goal. Ocean and inriver fisheries are managed specifically to achieve the MSY escapement goal for the Lewis River. Under the proposed action, it is reasonable to expect that escapement would continue to be above goals consistent with observations in recent years and the overall management objective.

NMFS classified the current persistence probability status of the Sandy bright population has high, and set the delisting persistence probability objective as very high (Table 6). The abundance target for delisting is 3,747 (Table 6). Escapements have averaged about 3,000 since 1995 (Table 11).

Key limiting factors described in the roll-up recovery plan for these bright populations include habitat quality in the estuary, and reduced habitat quality and access in the tributaries among others. There are no in-basin hatchery production programs for these populations, so they are likely not greatly affected by hatchery strays. Competition in the estuary with hatchery fish from other species or populations is noted as a secondary limiting factor for the Sandy River population (NMFS 2012a, Table 7-9).

Harvest was considered a primary limiting factor for both populations. Harvest in both ocean and in-river fisheries has declined over the years. The roll-up recovery plan recommends that harvest for these populations continue to be managed, as it has even before listing, subject to the escapement goal for North Fork Lewis River fish of 5,700.

The total exploitation rate in all fisheries has been reduced from an average of 51 percent prior to 1993 to 36 percent since (Table 17). The combined effect of recent changes in harvest management has therefore been to help alleviate the effect of harvest as a limiting factor. The latest PST Agreement (PST 2009) in further reductions in exploitation rate in northern fisheries. The retrospective analysis done in conjunction with the biological opinion on the PST Agreement indicted that the exploitation rate on Lower Columbia River bright Chinook salmon would be reduced in the future by two percentage points relative to what it would have been under the prior PST Agreement. Fisheries in Alaska, Canada, and in the Columbia River occur outside the action area, but account for more than 80 percent of the overall harvest. Since 1993 the exploitation rate in fisheries in Alaska, Canada, and the Columbia River averaged 32 percent; the average in Council fisheries is four percent (Table 17).

The proposed action will result in direct and indirect mortality of fish of both populations in the Cascade Late Fall MPG. The exploitation rate on North Fork Lewis River bright Chinook salmon in Council area fisheries has ranged from 1 to 11 percent over the last ten years (Table 17). The Sandy River population is presumably subject to the same exploitation rate. The effect of the proposed action in 2012 and beyond would presumably be an exploitation rate within the range of values observed over the last ten years.

The proposed action will reduce the number of Cascade bright fall MPG adults returning to spawn, compared to the number that would return if the proposed action is not implemented. A reduction in returning adults that will occur as a result of the proposed actions, compared to the number that would return if the action does not occur, will have little effect on the survival or potential for recovery of the populations in the Cascade Late Fall MPG. Therefore NMFS concludes the proposed action is not likely to appreciably reduce the likelihood of survival and recovery of the Cascade Late Fall MPG because it is likely:

- Returns will continue to be in the thousands for both populations, indicating a low risk of extinction in the short-term. The North Fork Lewis population has varied in recent years, but on average has exceeded both the escapement goal of 5,700 and the recovery target abundance level of 7,300 (Table 11).
- Available analysis indicates that the proposed action will have limited effect on the return of the North Fork Lewis population, and the returns will continue to meet the overall abundance objectives. The abundance of the Sandy population has averaged 3,000 compared to a delisting abundance objective of 3,747.
- The Oregon recovery plan included an analysis that indicated that the Sandy population is viable under current harvest patterns (ODFW 2010).
- The five year check in will provide an opportunity to assess regularly how well the recovery strategy is being implemented, and how effective it is in improving the status of the populations and their prospects for survival and recovery.

2.6.3 Tule Chinook Salmon Populations

There are twenty one populations of tule fall Chinook salmon with some located in each of the three MPGs (Table 5). There are four populations in the Gorge MPG, ten in the Cascade MPG, and seven in the Coastal MPG.

Before discussing the details of populations within each MPG, it is useful to consider several points that are relevant to our consideration of all of the Lower Columbia River tule fall populations. The theme of past harvest consultations for this ESU has been one of developing necessary information and an expectation that key issues would be resolved in the near future (NMFS 2009c, 2010) thereby providing the basis for a longer term biological opinion that fits within the broader context of a recovery plan.

The roll-up recovery plan is now complete. Recovery plans are an important source of information that describe, among other things, the status of the species and its component populations, limiting factors, recovery goals and actions that are recommended to address limiting factors. Recovery plans are not regulatory documents, but, as discussed in Section 2.3.2, they do provide an all-H perspective that is important when assessing the effects of an action. NMFS initial review (Walton 2010) and subsequent adoption of the management unit recovery plans (NMFS 2012a) provide an endorsement of the essential elements of the overall recovery strategy that has been under development for the last several years.

One of the key results of recovery planning is an ESU level recovery scenario that identifies population specific viability targets for Lower Columbia River Chinook salmon (Table 6). The recovery scenario generally conforms with the recommendations of the TRT, except for details related to the Gorge stratum. As discussed at length above in Section 2.2, NMFS proposes that three of the four Gorge populations be managed to achieve medium persistence probability, and the fourth for high persistence probability.

NMFS acknowledged the difficulties related to the Gorge populations and concurred that recovery opportunities in the Gorge were limited. NMFS also recognized the uncertainty regarding the TRT's MPG delineations between the Gorge and Cascade MPG populations, and that several Chinook salmon populations downstream from Bonneville Dam may be quite similar to those upstream of Bonneville Dam. The proposal to include more than the minimum number of populations required in the Cascade and Coastal MPGs was considered more precautionary than merely assuming that efforts related to the Gorge MPG would be successful (Table 6). The roll-up recovery plan concludes that these factors describe a clear rationale for this divergence from the TRT's recommendations for delisting and a clear argument that the ESU scenario proposed could result in a delisting of the ESU if the biological criteria described in the plan are achieved, and the associated threats to the ESU were adequately addressed.

We have discussed in this opinion at some length the relative abundance of hatchery and natural-origin fish and how it affects our understanding and assessment of the status of tule populations in particular (Section 2.2.1.2). The Lower Columbia River tule Chinook salmon populations have been subject to high harvest rates, degraded habitat conditions, and extensive hatchery influence for decades. It is clear from the record that the hatchery fish have strayed into natural spawning areas and, in most cases, dominated the natural spawning that has occurred in these systems. It is therefore pertinent, when considering whether an action is likely to appreciably reduce the survival and recovery of a population, or jeopardize the ESU as a whole, to consider the extent of local adaptation to natural conditions in these populations and whether it has been compromised by past practice to the point where it is no longer distinct. Past circumstances are such that it is very unlikely that the tule Chinook salmon currently spawning in the coastal stratum rivers in particular represent the genetic diversity and adaptation that was originally present in these populations. The probable lack of locally adapted populations is likely a contributing factor to the apparent low productivity of these populations (Walton 2010). Other populations in the ESU may be less affected by these circumstances. Two tule populations in the Cascade stratum, the Coweeman and Lewis, have not had direct releases of hatchery fish and have relatively lower fractions of hatchery origin spawners than the other tule populations. These populations are more likely to have retained appreciable local adaptation to natural conditions. All other Cascade and Gorge stratum tule populations have likely been composed of at least 50 percent hatchery origin spawners for decades, and we expect that this has also influenced the fitness of these populations as well (Walton 2010).

The pervasive influence of hatchery fish also affects the required approach to recovery. Populations are defined by their relative isolation from each other which presumably allows for their adaptation to unique conditions that exist in specific habitats. If there are populations that still retain their historic genetic legacy, such as the Coweeman and Lewis, then the appropriate course to insure their survival and recovery is to preserve that genetic legacy and rebuild those populations. However, if the genetic characteristics of the populations are significantly diminished and we are left with individuals that can no longer be associated with a distinct population, then the appropriate course to recover the population, consistent with the requirements of the ESA, is to use individuals that best approximate the genetic legacy of each population, reduce the effects of the factors that have limited their production, and provide the opportunity for them to readapt to the existing conditions. The transition will most often involve reducing the effect of limiting factors, and allowing time for habitat improvements to take effect and for the population to readapt to existing circumstances (NMFS 2012a). Given the nature of these processes, it is reasonable to expect that rebuilding and recovery will take years and perhaps decades of consistent and steady progress.

NMFS' understanding of the status of Lower Columbia River tule populations has evolved over time as a result of an ongoing sequence of assessments and studies. NMFS summarized the results from earlier studies in the 2009 PFMC opinion (NMFS 2009c). Two additional assessments, used to support the 2010 opinion, were conducted after completion of the 2009 opinion. The population risk assessment in the LCFRB Plan (2010) was updated (see Volume 3, Appendix E, Chapter 14). The NWFSC also conducted an expanded life-cycle modeling analysis that considered the effects of hatcheries, habitat conditions, and recovery actions on population risk at various harvest rates (NWFSC 2010). The results of all of these assessments were reviewed and summarized in a NMFS memo (Walton 2010), providing the support for the conclusions of the 2010 opinion (NMFS 2010) that applied to the 2010 and 2011 seasons.

The 2010 opinion listed a series of tasks (described in this opinion in Section 1.2) that were used to inform the decision for setting the exploitation rate for tule Chinook salmon in 2011 and provide additional information for the next opinion (this opinion) due in 2012. The purpose of these tasks was to reduce the uncertainty related to the recovery strategy. From recovery planning and other assessments, NMFS had a good understanding of the sorts of survival improvements that must occur to achieve recovery. The tasks were designed to accelerate the recovery process by identifying and promoting actions that benefited the tule populations. Four of the tasks addressed habitat activities. The other tasks focused on hatchery and harvest reforms and methods for improving our understanding of the escapement of primary populations. The tasks were also designed to bring greater certainty that actions would occur as quickly as possible.

The overall recovery strategy for the tule component of the Lower Columbia River Chinook ESU is an all-H approach designed to restore the Coastal and Cascade tule strata to a high probability of persistence, and the Gorge stratum to a probability of persistence that, when combined with compensation in the other strata, is at an acceptable risk level (Table 6). The strategy involves transitioning from decades of management that allowed habitat degradation, emphasized hatchery production of fish for harvest, and resulted in diminished viability of all tule populations, to management that supports a naturally self-sustaining ESU and preserves harvest opportunities in the long term. This transition will be accomplished by reducing impacts in all threat categories and sharing the burden of recovery across categories (NMFS 2012a).

Among the most immediate and high-priority needs for recovery are aggressive efforts to (1) improve the quality and quantity of both tributary and estuary habitat, and (2) reduce the influence of hatchery fish on natural-origin fish. Necessary elements of the transitional strategy are well described in roll-up recovery plan (NMFS 2012a).

The all-H recovery strategy presumes that the adverse effects of each of the limiting factors can be addressed and that the actions necessary to address those effects are reasonably certain to occur. If so, then we can assess harvest, or any other action, by considering whether it is meeting expectations specified in the plan for that H sector. The nature of the recovery process and complexities of the limiting factors that must be addressed are such that certainty is likely unachievable. The relative lack of certainty will need to be mitigated by continued assessment and monitoring. This will include continued monitoring of the status of each population. Washington and Oregon have both improved their status monitoring programs with particular emphasis on both abundance and the proportion of hatchery origin fish. Uncertainty can also be mitigated by establishing expectations for actions designed to address the limiting factors, and routinely assessing whether those actions are occurring and having the intended effect. The five year check in will provide an opportunity to assess regularly how well the recovery strategy is being implemented, and how effective it is in improving the status of the populations and their prospects for survival and recovery.

2.6.3.1 Gorge Fall MPG

There are four tule Chinook salmon populations in the Gorge Fall MPG including the Lower Gorge, Upper Gorge, White Salmon, and Hood. The baseline persistence probability status for all of these populations is listed as very low. Under the recovery scenario, three populations are targeted for medium persistence probability. The Hood population is targeted for high persistence probability, although Oregon has indicated that it is unlikely that that objective can be met (Table 6). All of the populations are targeted for improved status, but the roll-up recovery plan acknowledges uncertainty about the designations for these populations, and the constraints to recovery imposed by existing conditions. Additional populations in adjacent MPGs are targeted for high persistence probability to mitigate the greater risk to the ESU.

The total exploitation rates expected as a result of the proposed Council fisheries and other fisheries that have already undergone consultation are shown in Table 3. Under the proposed action, Council area fisheries coupled with other fisheries would vary from 30 percent to 41 percent depending on year-specific abundance forecasts. The forecast in 2012 is high and would allow for an overall exploitation rate of 41 percent in 2012. Exploitation rates in Council area fisheries have ranged between 7 percent and 19 percent over the last ten years (Table 18). But the overall exploitation rate limit has been 41 percent or less only since 2008. Since 2008 the exploitation rate in Council area fisheries has ranged from 7 percent to 14 percent. As described in Section 2.4.2.3, the proposed action in 2012 and beyond would result in exploitation rates within the range of values observed in recent years. In years of low abundance, Council area fisheries would be reduced further with exploitation rates at or below the low end of the observed range.

Absent information to the contrary, we assume that all populations in the Gorge Fall MPG are subject to the same level of harvest in Council area fisheries. Because of the relative lack of information, the effect of the reduction in abundance on the likelihood of survival and recovery on the Gorge tule populations must be inferred qualitatively.

Likelihood of Survival The reduction in adult returns poses little near-term risk to the extinction of the White Salmon population because of the presence of large numbers of hatchery fish. Condit Dam on the White Salmon was removed in 2011 and that will result in uncertainty until the river clears itself of accumulated sediments and stabilizes. Prior to dam breaching the number of fall Chinook salmon spawners in the White Salmon had increased from low levels in the early 2000's to an average of 2,750 for the period from 1998 to 2007 (Roler 2009), but that spawning is dominated by tule Chinook salmon strays from the neighboring Spring Creek Hatchery and upriver brights from the production program in the adjoining Little White Salmon River (these fish are not part of the Lower Columbia River Chinook ESU). The Spring Creek Hatchery, which is located immediately downstream from the river mouth, is the largest tule Chinook salmon production program in the basin, releasing 10 million smolts annually. The White Salmon River was the original source for the hatchery brood stock so whatever remains of the genetic heritage of the population is contained in the mix of hatchery and natural spawners. There are currently no proposals to make substantive changes to these production programs. There is little near-term risk to this populations' survival, at least to the extent that it is represented by the Spring Creek Hatchery stock. Next steps for the White Salmon include completing dam deconstruction, and allowing time for sediment that has accumulated over the years to clear and for the basin to stabilize. The plan allows time to evaluate whether the population can reestablish through for natural recruitment, and continued monitoring to evaluate that process before considering other forms of intervention to promote recovery. Review of reestablishment for the White Salmon population will be a subject for the five year check in.

ODFW reports that hatchery strays contribute about 90 percent of the escapement to the Lower Gorge, Upper Gorge, and Hood River populations on the Oregon side of the river (ODFW 2009). These populations are heavily influenced by hatchery strays from the Bonneville Hatchery located immediately below Bonneville Dam, and the Spring Creek and Little White Salmon Hatcheries located just above Bonneville Dam. It is reasonable to infer that tributaries in the Gorge on the Washington side of the river are similarly affected. Hatchery goals have been met or exceeded in recent years for all of these hatcheries when harvest rates were as high or higher than those proposed as part of this action. Review of information related to hatchery contributions to each population and progress related to hatchery reform will be a subject for the five year check in.

Likelihood of Recovery The roll-up recovery plan calls for a reduction in harvest rates to achieve recovery goals. As described previously, the plan envisions that further reductions will be achieved through a strategy of implementing abundance-based management when feasible, implementing mark-selective fisheries when feasible as a tool to reduce impacts to natural-origin fish and sustain important fisheries, and applying weak-stock management principles.

- Lower Columbia River Chinook salmon harvest rates have been cut by more than half in recent years, which is consistent with the recovery strategy.

- The proposed action would implement an abundance based management framework which is consistent with recovery plan expectations. The abundance base framework implements weak-stock management principles to the degree possible at this time by reducing the allowable exploitation rate when abundance is low.

- As described in the Task E and Task F reports (Frazier 2011, LaVoy 2011), there is currently an aggressive program in place to assess the feasibility of implementing mark-selective fisheries for fall Chinook salmon.

- The roll-up recovery plan lists several specific recovery actions related to harvest and, as described in Section 2.3.2, all of these actions have been implemented in whole or in part.

Additional harvest does occur on three of the four populations that are located above Bonneville Dam in what are primarily tribal fisheries that target returning upriver bright Chinook salmon and fish returning to the Spring Creek Hatchery in particular. There are no proposals to reduce these tribal fisheries.

Because of the long history of input of stray fish from several hatcheries, the Gorge populations are no longer the relatively isolated, uniquely adapted entities that we normally think of as populations (NMFS 2012a). They are instead amalgams resulting from the hatchery strays and whatever natural production may result from their spawning (NMFS 2012a). Actions are being taken that will improve the status of these populations (e.g., removal of Condit and Powerdale dams), but they do not include addressing limitations that occur as a result of Bonneville Dam, current hatchery production programs, or the associated fisheries above Bonneville Dam. The proposed harvest rates may not be consistent with achieving recovery goals once populations are reintroduced (White River), habitat improvements are made, and the populations are no longer reliant on hatcheries for their continued survival. NMFS expects that the status of these populations will improve over the long term, but is likely to continue to be limited by the prevailing baseline conditions.

NMFS acknowledged the unique difficulties associated with improving the status of the Gorge tule populations in their roll-up recovery plan (NMFS 2012a), but concluded that delisting could nonetheless occur despite these shortcomings if other biological criteria described in the plan were achieved, and the associated threats to the ESU were otherwise adequately addressed. The five year check in provides an opportunity to assess the progress of the overall recovery strategy and reconsider whether additional actions are required.

Summary Based on the above described considerations, NMFS concludes that the proposed action is not likely to appreciably reduce the likelihood of survival and recovery of the Gorge Fall MPG.

2.6.3.2 Cascade Fall MPG

There are ten populations in the Cascade Fall MPG. The persistence probability status of all of these populations is listed as very low, based on baseline conditions at the time of listing. The recovery scenario for the Cascade Fall stratum targets four populations for high plus persistence probability (Coweeman, Lewis, Washougal, and Toutle), and four more for medium or medium plus persistence probability (Lower Cowlitz, Kalama, Clackamas, and Sandy). The remaining two populations (Upper Cowlitz and Salmon) are designated as stabilizing and would continue to have very low persistence probability (Table 6).

The status of most of these populations has been reviewed through several recent analyses. The results of those reviews are summarized in the NMFS memo (Walton 2010). The Coweeman and Lewis populations have relatively low levels of past and current hatchery straying, and appear to be self-sustaining and have a high persistence probability under current (~38 percent) harvest rates. The Lower Cowlitz, Kalama, and Toutle populations have relatively high current hatchery contributions, insuring the likelihood of survival of these populations with harvest rates that are either at or below current levels. The Washougal has been placed in either the first or second category depending on the analysis (NWFSC 2010, Walton 2010). There is a third category of populations that are considered at high risk even with little or no harvest, but these are primarily in the Coastal MPG and are discussed further below.

Total escapements to the Coweeman and East Fork Lewis have averaged 754 and 937 (Table 12), respectively over the last ten years compared to recovery abundance targets of 900 and 1,500 (Table 6). Hatchery stray rates have averaged about 20 percent. Total returns to the Washougal, Kalama, and Lower Cowlitz populations have generally been in the thousands per year (Table 12). These populations are all associated with significant in basin hatchery programs and are thus subject to large numbers of hatchery strays. There is less information available on the Toutle population on the Washington side, and the Clackamas and Sandy populations in Oregon. ODFW indicated for both that 90 percent of the spawners in the Clackamas and Sandy are likely hatchery-origin fish from as many as three adjacent hatchery programs (ODFW 2010). Review of information related to hatchery contributions to each population will be a subject for the five year check in.

As discussed in the roll-up recovery plan and Section 2.2.1.5, Lower Columbia River tule populations are subject to the full range of limiting factors that are part of the baseline including tributary and estuary habitat, hydropower, hatcheries, harvest, and predation, and larger scale factors related to ecological interactions, climate change, and human population growth.

Harvest is considered a primary limiting factor for Lower Columbia River tule populations (NMFS 2012a). As explained in the preceding overview section on tule Chinook salmon populations, harvest has been reduced from rates that were once as high as 80 percent to the recent limit of 37 percent with further refinements in harvest proposed through use of an abundance based management approach. These changes are consistent with the large scale harvest reductions called for in the management unit recovery plans. The combined effect of recent changes in harvest management has therefore helped alleviate the effect of harvest as a limiting factor.

Hatchery straying is a limiting factor for many of the populations in the Cascade Fall MPG. The Coweeman and Lewis populations do not have in-basin hatchery programs and are generally subject to less straying. The recent increased straying being observed in the Coweeman is a relative new phenomenon (Table 12). Significant hatchery reforms have been implemented to reduce the effects of straying. On-station release levels on the Washougal, Toutle and Lower Cowlitz have been reduced. As discussed in Section 2.3.2.2, brood stock management practices for all hatcheries are being revised to conform to HSRG recommendations. Weirs are being operated on the Kalama to assist with brood stock management, and on the Coweeman and Washougal to further assess and control hatchery straying on that system. These are examples of actions the states have taken as part of a comprehensive program of hatchery reform to address the effects of hatcheries as a limiting factor. The nature and scale of reform actions were described in Anderson and Bowles (2008), a letter from WDFW (Anderson 2010), and the more recent Task E reports (Frazier 2011 and Stahl 2011). It is clear from these reports that significant progress continues to be made in addressing hatcheries as a limiting factor. Review of progress related to hatchery reform will be a subject for the five year check in.

It is more difficult to document the scale and efficacy of projects designed to address habitat conditions that are limiting. There is clearly more that needs to be done here, but it is also clear that actions have been and are being taken to help address habitat concerns. For example, the LCFRB through the Pacific Coast Salmon Recovery Funds has funded 142 projects valued at $41.8 million for lower Columbia River tributary and mainstem habitat restoration (Anderson 2010a,b). The Task A report provides details on the many sources of funding for habitat related projects (Hudson, et. al 2011). The Task B report provided new information emphasizing the relative importance of intertidal habitat for juvenile rearing (Cooney and Holzer 2011). The Task D report describes the Salmonid Recovery Action Tracking system (Dornbusch 2011) which is under development. The tracking system is designed to aid overall prioritization and performance evaluation of habitat restoration projects.

The total exploitation rates expected as a result of the proposed Council fisheries and other fisheries that have already undergone consultation are shown in Table 3. Under the proposed action, Council area fisheries coupled with other fisheries would vary from 30 percent to 41 percent depending on year-specific abundance forecasts. The forecast in 2012 is high and would allow for an overall exploitation rate of 41 percent in 2012. Exploitation rates in Council area fisheries have ranged between 7 percent and 19 percent over the last ten years (Table 18). But the overall exploitation rate limit has been 41 percent or less only since 2008. Since 2008 the exploitation rate in Council area fisheries has ranged from 7 percent to 14 percent. As described in Section 2.4.2.3, the proposed action in 2012 and beyond would result in exploitation rates within the range of values observed in recent years. In years of low abundance, Council area fisheries would be reduced further with exploitation rates at or below the low end of the observed range.

The Coweeman and East Fork Lewis populations are particularly important to the overall recovery strategy because they are the only tule populations that are presumed to retain their unique genetic characteristics. Preserving these stocks is therefore a high priority and a central part of the overall recovery strategy. NWFSC (2010) recent modeling suggests the Coweeman, East Fork Lewis, and Washougal populations are self-sustaining under current (~38 percent) harvest rates. The results of these analyses suggest that harvest levels associated with the proposed action, which are lower than those assumed in the NWFSC analysis, are consistent with expectations for the survival and recovery of these populations even if continued into the future. Beamesderfer et al.'s (2011) risk analysis compared various abundance based management alternatives to the risk that would occur under a fixed exploitation rate strategy. Abundance based alternatives that had risk levels that were less than or equal to a fixed exploitation rate of 36 percent were considered viable. This provides a point of reference for comparing the proposed abundance based framework to fixed exploitation rates that were anticipated in the management unit recovery plans, and those used in recent years. The risk metrics for the proposed abundance based framework are equivalent to those of a fixed exploitation rate of 36 percent. As discussed in Section 2.4.2.3, the relative effect of the proposed action is to reduce the current quasi-extinction risk by approximately four percent. The 100-year quasi-extinction risk was estimated to be <1 percent for large productive populations like the Coweeman and Washougal, approximately 17 percent for intermediate populations like East Fork Lewis and Elochoman/Skamokawa, and >90 percent for small populations with poor productivity like the Clatskanie and Scappoose.

Three other populations subject to relatively high current or past hatchery contributions are apparently self-sustaining with harvest rates that are either at or below current levels (Walton 2010). The Lower Cowlitz and Kalama populations, and probably the Toutle fall into this category. The abundance of total spawners for populations like the Lower Cowlitz and Kalama (and likely the Toutle although similar annual spawner estimates are not available) generally number in the thousands of fish per year due, at least in part, to the contribution of hatchery-origin fish from in basin hatchery programs (see Table 12). The proposed action would generally reduce the return to these populations. High abundance mitigates the near term risk to survival for these populations. Despite an exploitation rate associated with the proposed action, these populations will continue to be populated by large numbers of spawning fish as they have in the past under harvest levels that were much higher than those proposed in Table 3. Recovery for these populations will depend more on successful implementation of the overall recovery strategy.

We have less specific information about the Clackamas and Sandy populations. Their abundance is presumably lower and comprised primarily (on the order of 90 percent) of hatchery origin fish (ODFW 2010). The exploitation rate associated with the proposed action would vary depending on overall abundance. A continuing reduction in the number of returning adults associated with the proposed action would indicate a reduced likelihood that populations would achieve the contributing status objectives currently suggested for these populations if continued for a number of years unless they are coupled with survival improvements from actions in other sectors. Review of the status of these populations will be a subject for the five year check in.

Likelihood of Survival For the proposed action, the ongoing contribution of listed hatchery fish to the spawning areas, and past reductions in harvest that have helped alleviate the effects harvest as a limiting factor largely mitigate the immediate risk of extinction for these populations. For the time being, the proposed action does little to reduce the prospects for the survival of the Coweeman or Lewis populations or other populations in the MPG that are dominated by hatchery strays as the hatcheries will continue to maintain natural spawning levels that have been observed in recent years, at least for as long as they continue to produce fish.

Likelihood of Recovery By the same token, the proposed action will do little to reduce the prospects for recovery so long as the option for implementing an effective and comprehensive recovery program remains. However, the status quo is not a viable long term strategy. Comprehensive reform designed to address the limiting factors is essential to achieve the recovery objectives of the ESA (NMFS 2012a). The proposed abundance based management framework that ties lower exploitation rates with lower abundance reduces, compared to the current fixed 37 percent harvest rate, the extinction risk to all populations in the Cascade Fall MPG (by approximately 4 percent (Beamesderfer et al. 2011)), including those dominated by hatchery strays, by reducing harvest when populations are relatively depressed. The effects of the proposed PFMC Fisheries on the likelihood of recovery are best evaluated within the context of a comprehensive transitional strategy that is designed to achieve recovery. Necessary elements of the overall recovery strategy are described in the roll-up recovery plan (NMFS 2012a). A premise of this opinion is that we can use the recovery strategy as a benchmark that contributes to our ability to assess the proposed action. The five year check in will provide an opportunity to assess regularly how well the the recovery strategy is being implemented, and how effective it is in improving the status of the populations and their prospects for survival and recovery.

The roll-up recovery plan calls for a reduction in harvest rates to achieve recovery goals. As described previously, the plan envisions that further reductions will be achieved through a strategy of implementing abundance-based management when feasible, implementing mark-selective fisheries when feasible as a tool to reduce impacts to natural-origin fish and sustain important fisheries, and applying weak-stock management principles.

- Lower Columbia River Chinook salmon harvest rates have been cut by more than half in recent years, which is consistent with the recovery strategy.

- The proposed action would implement an abundance based management framework which is consistent with recovery plan expectations. The abundance base framework implements weak-stock management principles to the degree possible at this time by reducing the allowable exploitation rate to as low as 30 percent when abundance is low.

- As described in the Task E and Task F reports (Frazier 2011, LaVoy 2011), there is currently an aggressive program in place to assess the feasibility of implementing mark-selective fisheries for fall Chinook salmon.

- The roll-up recovery plan lists several specific recovery actions related to harvest and, as described in Section 2.3.2, all of these actions have been implemented in whole or in part.

Based on these considerations and others, NMFS has determined that the proposed action limits harvest to exploitation rate limits consistent with the overall recovery strategy (NMFS 2012a). That strategy adopted the Oregon and Washington management unit plan goals of 33-38 percent harvest rates under current conditions. The proposed harvest rates may not be consistent with achieving recovery goals once habitat improvements are made and the populations are no longer reliant on hatcheries for their continued survival.

The nature of the recovery process and complexities of the limiting factors that must be addressed are such that certainty is likely unachievable. However, the relative lack of certainty can be mitigated by continued assessment and monitoring. This will include continued monitoring of the status of each population. The lack of certainty can also be mitigated by establishing expectations for actions designed to address the limiting factors, and routinely assessing whether those actions are occurring and having the intended effect. Continued assessment and monitoring is therefore a key feature of the overall recovery strategy (NMFS 2012a). The five year check in provides an opportunity to assess the progress of the overall recovery strategy and reconsider whether additional actions are required.

Summary Based on the above described considerations, NMFS concludes that the proposed actions are not likely to appreciably reduce the likelihood of survival and recovery of the Cascade Fall MPG.

2.6.3.3 Coastal Fall MPG

There are seven populations in the Coastal Fall MPG. The persistence probability status of all of these populations, based on baseline conditions at the time of listing, is listed as low or very low. The recovery scenario for the coastal fall stratum targets the Elochoman, Mill/Abernathy/Germany, Clatskanie, and Scappoose populations for high persistence probability. The Grays population is targeted for medium plus persistence probability. The Youngs Bay and Big Creek populations are associated with large scale net pen or hatchery production programs and are expected to stay in the low persistence probability category (Table 6).

Total returns to the Elochoman and Germany/Abernathy/Mill populations have numbered in the hundreds or even low thousands in most recent years (Table 13). Total returns to the Grays have been variable, but have averaged a few hundred fish in recent years with estimates of natural-origin fish verified through weir operation. There is less certainty about the number of fish returning to coastal populations on the Oregon side. Estimates of escapement for the Clatskanie are reported in Table 13. However, the Task H report, discussed in more detail in the Status Section, highlights problems associated with these prior estimates (Dygert 2011). Results from spawner surveys conducted over the last four years report returns in survey areas that range from 0 to four fish. Absent better information, returns to the Clatskanie were previously presumed to represent the circumstances in the Scappoose as well (NWFSC 2010). Escapement surveys in the Scappoose were initiated in 2008. Two fish were observed in the survey area in 2008 and none in 2009, 2010, or the first half of 2011. Oregon highlighted the uncertain status of these populations in their management unit recovery plan. Because of these uncertainties, Oregon indicted their intent to continue with these surveys for the next few years before reassessing the status of the Clatskanie and Scappoose populations. Review of the status of these populations will be a subject for the five year check in.

As discussed in the roll-up recovery plan and Section 2.2.1.5, Lower Columbia River tule populations are subject to the full range of limiting factors that are part of the baseline including tributary and estuary habitat, hydropower, hatcheries, harvest, and predation, and larger scale factors related to ecological interactions, climate change, and human population growth.

Tributary habitat has been degraded by extensive development and other types of land use. Fall Chinook salmon spawning and rearing habitat in main channels of tributaries has been adversely affected by sedimentation, increased temperatures, and reduced habitat diversity.

The roll-up recovery plan concludes that harvest is a primary limiting factor for Lower Columbia River tule populations. As explained in the preceding overview section on tule Chinook salmon, harvest has been reduced from rates that were once as high as 80 percent to the recent limit of 37 percent. These changes are consistent with the large scale harvest reductions called for in the management unit and roll-up recovery plans. The combined effect of recent changes in harvest management has therefore helped reduce the effect of harvest as a limiting factor.

Hatchery straying is a significant problem for all of the populations in the Coastal Fall MPG, but a number of actions have been taken in recent years to reduce straying and the related effects. The WDFW describes the steps they have taken in recent years to reduce the adverse effects of hatchery straying in their Task E report (Frazier 2011). Actions include closing some hatcheries and reducing the number of fish released in others, changes in broodstock management, and installation of weirs. There was a Chinook salmon hatchery on the Grays River, but that program was closed in 1997. The Elochoman had an in-basin fall Chinook salmon hatchery production program with annual releases of 2,000,000 fingerlings. That program was closed with the last release of fish in 2008 as part of the overall hatchery reform program. The hatchery closure should greatly reduce the problem of hatchery straying in that system. The Mill/Abernathy/Germany population does not have an in basin hatchery program, but still has several hundred to several thousand spawners each year that are primarily hatchery origin (Table 13). Closure of the Elochoman program should also help reduce straying on the Mill population complex and other neighboring systems. WDFW also recently installed weirs on the Grays and Elochoman rivers to improve monitoring escapement and management of adult hatchery returns.

ODFW reported that hatchery strays contributed approximately 90 percent of the fall Chinook salmon spawners in both the Clatskanie and Scappoose over the last 30 years (ODFW 2010). However, as discussed above, it is now apparent that there are few fish spawning in the Scappoose or mainstem Clatskanie. There are large numbers of hatchery fish in Plympton Creek which is a tributary at the western boundary of the Clatskanie population area. Plympton Creek is adjacent to the Big Creek hatchery and typically gets several hundred or a few thousand returns per year to 1.7 miles of accessible habitat. The Big Creek and Youngs Bay populations are both proximate to large net pen rearing and release programs designed to provide for a localized, terminal fishery in Youngs Bay. ODFW again estimates that 90 percent of the fish that spawn in these areas are hatchery strays. The number of fish released at the Big Creek hatchery has been reduced with additional changes in hatchery practices to help reduce straying into the Clatskanie and other neighboring systems. These programs are otherwise expected to continue to provide fish for ocean fisheries and localized terminal harvest opportunity. These are examples of actions the states have taken as part of a comprehensive program of hatchery reform to address the effects of hatcheries as a limiting factor. The nature and scale of the reform actions were described in more detail in Anderson and Bowles (2008), in a letter from WDFW (Anderson 2010a), and the more recent Task E reports (Frazier 2011 and Stahl 2011). It is clear from these reports that significant progress continues to be made in addressing hatcheries as a limiting factor. Review of progress related to hatchery reform will be a subject for the five year check in.

As previously mentioned it is more difficult to document the scale and efficacy of projects designed to address habitat conditions that are limiting. It is clear that actions have been and are being taken to help address habitat concerns. For example, the LCFRB through the Pacific Coast Salmon Recovery Funds has funded 142 projects valued at $41.8 million for lower Columbia River tributary and mainstem habitat restoration (Anderson 2010a,b). The Task A report provides details on the many sources of funding for habitat related projects (Hudson, et. al 2011). The Task B report provided new information emphasizing the relative importance of intertidal habitat for juvenile rearing (Cooney and Holzer 2011). The Task D report describes the Salmonid Recovery Action Tracking system (Dornbusch 2011) which is under development. The tracking system is designed to aid overall prioritization and performance evaluation of habitat restoration projects.

The total exploitation rates expected as a result of the proposed Council fisheries and other fisheries that have already undergone consultation are shown in Table 3. Under the proposed action, Council area fisheries coupled with other fisheries would vary from 30 percent to 41 percent depending on year-specific abundance forecasts. The forecast in 2012 is high and would allow for an overall exploitation rate of 41 percent in 2012. Exploitation rates in Council area fisheries have ranged between 7 percent and 19 percent over the last ten years (Table 18). But the overall exploitation rate limit has been 41 percent or less only since 2008. Since 2008 the exploitation rate in Council area fisheries has ranged from 7 percent to 14 percent. As described in Section 2.4.2.3, the proposed action in 2012 and beyond would result in exploitation rates within the range of values observed in recent years. In years of low abundance, Council area fisheries would be reduced further with exploitation rates at or below the low end of the observed range.

The combined hatchery and wild abundance of spawners for the Elochoman and Mill/Abernathy/Germany populations are generally in the hundreds or thousands of fish per year because of the contribution of hatchery-origin fish from in basin or adjacent hatchery programs (see Table 12). High abundance reduces the near term risk of extinction for these populations. These populations will likely continue to be populated by large numbers of spawning fish as they have in the past under harvest levels that are much higher than those being proposed under the abundance based management framework. Operation of the weir on the Elochoman will allow better enumeration and control of fish returning to that system. The effects of hatchery program reductions and closures should become increasingly apparent in subsequent years. Review of information related to hatchery contributions to each population will be a subject for the five year check in.

The abundance of combined hatchery and wild spawners on the Grays has generally been lower, averaging on the order of a few hundred fish per year. Returns to the Grays have been variable, but the population has persisted for the last 30 plus years despite harvest impacts that were substantially higher than those considered under the proposed action indicating that the population is unlikely to go extinct under the proposed harvest plan as long as hatchery production supplements natural production. Continued operation of the weir on the Grays will also allow better enumeration and control of fish returning to that system. Actions taken to improve the overall productivity of the population are key to the population’s survival and recovery. Review of the status of the Grays population and progress related to the interim recovery strategy will be a subject for the five year check in.

There is less specific information about the four other populations on the Oregon side of the Coastal Fall MPG. The Youngs Bay and Big Creek populations are not proposed for status improvements in proposed delisting scenarios and are expected to continue to be dominated by the hatchery fish released from the in basin net pen programs. The Clatskanie and Scappoose are proposed for high persistence probability (Table 6), but recent information highlights the uncertainty of the status of these populations. The most recent and best available information suggests that there are very few fish returning to these rivers. The recovery plan calls for continued monitoring for the next few years followed by a reassessment of the recovery strategy for these populations. If we ultimately conclude that the populations are extirpated or nearly so, a reintroduction program may be required.

Likelihood of Survival Most populations in the Coastal Fall MPG that are prioritized for improved status are heavily influenced by hatchery-origin spawners, particularly the Elochoman, Mill/Abernathy/Germany, and Grays populations. The proposed action would generally reduce the return to these populations, but as the risk of extinction would remain low because the hatcheries will continue to maintain natural spawning levels that have been observed in recent years, at least for as long as they continue to produce fish.

Likelihood of Recovery By the same token, the proposed action will do little to reduce the prospects for recovery so long as the option for implementing an effective and comprehensive recovery program remains. However, the status quo is not a viable long term strategy. Comprehensive reform designed to address the limiting factors is essential to achieve the recovery objectives of the ESA (NMFS 2012a). The proposed abundance based management framework that ties lower exploitation rates with lower abundance reduces, compared to the current fixed 37 percent harvest rate, the extinction risk to all populations in the Cascade Fall MPG (by approximately 4 percent (Beamesderfer et al. 2011)), including those dominated by hatchery strays, by reducing harvest when populations are relatively depressed. The effects of the proposed PFMC Fisheries on the likelihood of recovery are best evaluated within the context of a comprehensive transitional strategy that is designed to achieve recovery. Necessary elements of the overall recovery strategy are described in the roll-up recovery plan (NMFS 2012a). A premise of this opinion is that we can use the recovery strategy as a benchmark that contributes to our ability to assess the proposed action. The five year check in will provide an opportunity to assess regularly how well the recovery strategy is being implemented, and how effective it is in improving the status of the populations and their prospects for survival and recovery.

The roll-up recovery plan calls for a reduction in harvest rates to achieve recovery goals. As described previously, the plan envisions that further reductions will be achieved through a strategy of implementing abundance-based management when feasible, implementing mark-selective fisheries when feasible as a tool to reduce impacts to natural-origin fish and sustain important fisheries, and applying weak-stock management principles.

- Lower Columbia River Chinook salmon harvest rates have been cut by more than half in recent years, which is consistent with the recovery strategy.

- The proposed action would implement an abundance based management framework which is consistent with recovery plan expectations. The abundance base framework implements weak-stock management principles to the degree possible at this time by reducing the allowable exploitation rate to as low as 30 percent when abundance is low.

- As described in the Task E and Task F reports (Frazier 2011, LaVoy 2011), there is currently an aggressive program in place to assess the feasibility of implementing mark-selective fisheries for fall Chinook salmon.

- The roll-up recovery plan lists several specific recovery actions related to harvest and, as described in Section 2.3.2, all of these actions have been implemented in whole or in part.

Based on these considerations and others, NMFS has determined that the proposed action limits harvest to exploitation rate limits consistent with the overall recovery strategy (NMFS 2012a). That strategy adopted the Oregon and Washington management unit plan goals of 33-38 percent harvest rates under current conditions. The proposed harvest rates may not be consistent with achieving recovery goals once habitat improvements are made and the populations are no longer reliant on hatcheries for their continued survival.

The nature of the recovery process and complexities of the limiting factors that must be addressed are such that certainty is likely unachievable. However, the relative lack of certainty can be mitigated by continued assessment and monitoring. This will include continued monitoring of the status of each population. The lack of certainty can also be mitigated by establishing expectations for actions designed to address the limiting factors, and routinely assessing whether those actions are occurring and having the intended effect. Continued assessment and monitoring is therefore a key feature of the overall recovery strategy (NMFS 2012a). The five year check in provides an opportunity to assess the progress of the overall recovery strategy and reconsider whether additional actions are required.

Summary Based on the above described considerations, NMFS concludes that the proposed actions are not likely to appreciably reduce the likelihood of survival and recovery of the Coastal Fall MPG.

2.7 Conclusion

After reviewing the current status of the listed species, the environmental baseline within the action area, the effects of the proposed action, any effects of interrelated and interdependent actions, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of Lower Columbia River Chinook salmon or to destroy or adversely modify its designated critical habitat.

2.8 Incidental Take Statement

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by regulation to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. For purposes of this consultation, we interpret "harass" to mean an intentional or negligent action that has the potential to injure an animal or disrupt its normal behaviors to a point where such behaviors are abandoned or significantly altered.[4] Section

[4] NMFS has not adopted a regulatory definition of harassment under the ESA. The World English Dictionary defines harass as "to trouble, torment, or confuse by continual persistent attacks, questions, etc." The U.S. Fish and Wildlife Service defines "harass" in its regulations as

7(b)(4) and Section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA, if that action is performed in compliance with the terms and conditions of this incidental take statement.

2.8.1 Amount or Extent of Take

NMFS anticipates that Lower Columbia River Chinook salmon will be taken annually as a result of proposed PFMC Fisheries beginning May 1, 2012. 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 landed catch and other sources of non-retention mortality.

The expected take of the spring, bright, and tule components of the ESU is described here in terms of anticipated exploitation rates that will occur as a result of the proposed action. Some spring Chinook salmon populations and the Lewis River bright population are managed to meet specified escapement objectives. For the tule populations, we also provide estimates of total exploitation rates that are expected to occur as a result of all fisheries combined since the take that may occur in the PFMC Fisheries is limited by the applicable total exploitation rate limit associated with annual estimates as described in Table 3. For example, the total exploitation rate of 30 percent applies to tule Chinook salmon when an annual forecasted abundance of hatchery fish is less than 30,000 and constrains the take that may occur in PFMC Fisheries. The amount of take, indicated by the exploitation rate that occurs in Council area fisheries will vary from year-to-year depending on the allowable exploitation rate in that year and the distribution of harvest between fisheries that are inside and outside the action area.

As discussed in Section 1.3, annual estimates of exploitation rates are based on model analysis of fisheries that are described in detail in Preseason Report III that is produced by the Council in late April each year at the end of the preseason planning process. Exploitation rates cannot be monitored directly inseason, but the fisheries are monitored under the proposed action to insure that they proceed consistent with those planned preseason. The preseason fishery plan includes details related to seasons, quotas, gear types, and other management measures.

The principle management objective for spring Chinook populations on the Washington side of the ESU is to meet hatchery escapement goals for Cowlitz and Lewis river spring Chinook salmon. Those objectives have been met in most recent years (Table 10). The exploitation rate on these populations in Council area fisheries has ranged from three percent to 28 percent over the last ten years with one anomalous exception (Table 15), and is expected to remain within that range under the proposed action. The exploitation rate in Council area fisheries on the Sandy River spring Chinook salmon population has ranged from zero to two percent over the last ten years (Table 16), and is also expected to remain within that range under the proposed action. No take is expected for the White Salmon populations since no fish are currently returning to that

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> an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering (50 CFR 17.3).

The interpretation we adopt in this consultation is consistent with our understanding of the dictionary definition of harass and is consistent with the U.S. Fish and Wildlife interpretation of the term.

system. If spring Chinook successfully recolonize the White Salmon and begin to produce natural origin fish, some take may occur. It is difficult to estimate the amount of take, but it will presumably be similar to that of other spring populations in the ESU. The expected take of Hood River spring Chinook is unknown, but is also limited by the expectations for the other populations described above.

The North Fork Lewis and Sandy river bright populations are managed to meet the escapement goal of 5,700 fish to the Lewis River. That objective has been met in most recent years (Table 11). The exploitation rate in Council area fisheries on the Lewis and Sandy river bright populations has ranged from one to 11 percent over the last ten years (Table 17), and is expected to remain within that range under the proposed action.

Under the proposed action, Lower Columbia River tule Chinook salmon (Gorge Fall MPG, Cascade Fall MPG, and Coastal Fall MPG) will be managed subject to an abundance based framework that allows for the total exploitation rate to vary from year-to-year between 30 and 41 percent. The year specific rate depends on the preseason forecast of Lower River Hatchery Chinook salmon (Table 3) and applies to all ocean fisheries and inriver fisheries below Bonneville Dam. The exploitation rate in Council area fisheries on the tule Chinook salmon has ranged from seven to 19 percent over the last ten years (Table 18), and is expected to remain within that range under the proposed action. However, the harvest impacts are distributed between fisheries to the north, and Council and inriver fisheries. The distribution of impacts between the fisheries may vary from year-to-year and may change inseason so long as the total exploitation rate for all fisheries does not exceed the total exploitation rate limit expected from the tier established by the forecast for that year. The expected level of take in Council fishing areas will not be known precisely until the preseason planning process is complete in April of each year. However, take resulting from the proposed action will be subject to the total exploitation rate limit, after accounting for anticipated impacts in northern fisheries and freshwater fisheries that are outside the action area.

2.8.2 Effect of the Take

In Section 2.7, NMFS determined that the level of anticipated take, coupled with other effects of the proposed action, is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

2.8.3 Reasonable and Prudent Measures

"Reasonable and prudent measures" are nondiscretionary measures to minimize the amount or extent of incidental take (50 CFR 402.02).

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

1. Inseason management actions taken during the course of the fisheries shall be consistent with the exploitation rate limits defined in Section 2.8.1 of the Incidental Take Statement. NMFS shall consult with the PFMC, states and tribes to account for the catch of Chinook salmon 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 Chinook salmon 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 annually.

2.8.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and the NMFS must ensure that the PFMC, states, and tribes comply with them in order to implement the reasonable and prudent measures (50 CFR 402.14). The NMFS, in cooperation with the PFMC, states, and tribes, has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this incidental take statement (50 CFR 402.14). If the following terms and conditions are not complied with, the protective coverage of section 7(o)(2) will likely lapse.

1a. NMFS shall confer with the affected states and tribes, and the PFMC chair, as appropriate, to ensure that inseason management actions taken during the course of the fisheries are consistent with the exploitation rate limits specified in Section 2.8.1 of the Incidental Take Statement above.

1b. NMFS shall confer with the affected states and tribes, and the PFMC chair to account for the catch of the PFMC Fisheries throughout the season. If it becomes apparent inseason that the fisheries have changed in any way such that estimates of exploitation rates may exceed those specified in the Incidental Take Statement, 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 the Incidental Take Statement.

2a. NMFS shall ensure that monitoring of catch in the PFMC commercial and recreational fisheries by the PFMC, states, and tribes is sufficient to provide catch estimates necessary for inseason management and post season assessment. 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. The monitoring is necessary to ensure that the fisheries that are the subject of this opinion are sampled for contribution of hatchery and natural-origin fish and the collection of biological information (age, sex, and size) to allow for a thorough analysis of fishery impacts on listed species.

2b. NMFS, in cooperation with the affected states and tribes, and the PFMC chair shall monitor the catch and implementation of other management measures at levels that are comparable to those used in recent years. The purpose of 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, and the PFMC chair 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 representative and statistically valid annual post-season analysis of fishery impacts on the Lower Columbia River Chinook ESU for all three life histories found within the ESU (spring, tule and late fall bright Chinook salmon). A postseason summary of the previous year's PFMC Fisheries shall be provided annually by February 28.

2.9 Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, conservation recommendations are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.02). 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 abundance based management framework for consistency with expectations described in the Beamesderfer et. al. report (2011) every three years or as needed to consider new information. The review should include, but is not limited to, forecast methods, the relationship between Lower Columbia River hatchery and natural-origin fish, and population specific information used in the Beamesderfer et al. risk analysis.

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, and release methods.

3. NMFS, in collaboration with the PFMC, states, and tribes, should continue to evaluate the effects to listed species of mark/selective, non-retention commercial and recreational fishing methods. Additional information is needed on:

    a) Release mortality rates, particularly in inriver, fall season fisheries;
    b) The design of sampling programs that provide necessary estimates of encounter rates of unmarked fish that are released;
    c) Criteria that can be used to evaluate the scale of mark/selective fisheries with the goal of limiting potential adverse affects.

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.

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.

2.10 Reinitiation of Consultation

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 is exceeded, (2) new information reveals effects of the agency action on listed species or designated 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 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.

NMFS has also proposed as part of the Proposed Action to reevaluate the assumptions and conclusions of the opinion every five years at a minimum (referred to subsequently as the five year check in), and more frequently if new information becomes available that may affect NMFS' conclusion in this opinion. This opinion relies significantly on the assumption that harvest will be managed consistent with the interim strategies and provisions described in the roll-up recovery plan (NMFS 2012a) and that progress will be made over time addressing the full range of other limiting factors. Conclusions about harvest and related expectations about the species survival and recovery therefore depend on the success of the all-H strategy described in the recovery plan and in more detail below. The purpose of this review therefore is to reconsider the status of the species, the effect of the action, key assumptions in the all-H strategy, and other information that may lead to a reconsideration of NMFS' conclusion in this opinion.

3 ▪ MAGNUSON-STEVENS ACT ESSENTIAL FISH HABITAT CONSULTATION

The consultation requirement of section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. The MSA (Section 3) defines EFH as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.” Adverse effects include the direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside EFH, and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH.

This analysis is based on descriptions of EFH for Pacific coastal pelagic species (PFMC 1998), Pacific Coast groundfish (PFMC 2005), highly migratory species (PFMC 2007), and Pacific Coast salmon (PFMC 1999) contained in the fishery management plans developed by the PFMC and approved by the Secretary of Commerce.

3.1 Essential Fish Habitat Affected by the Project

For this EFH consultation, the proposed action and action area (Figure 1) are described in detail above in Section 1.3. Briefly, the proposed action is NMFS promulgation of ocean fishing regulations within the EEZ of the Pacific Ocean. The action area is the EEZ (Figure 1), which is directly affected by the federal action, and the coastal and inland marine waters of the states of Washington, Oregon and California. The estuarine and offshore marine waters are designated EFH for various life stages of Pacific Coast salmon, Pacific Coast groundfish, coastal pelagic species, and highly migratory species managed by the PFMC..

Pursuant to the MSA, the PFMC has designated EFH for five coastal pelagic species (PFMC 1998), over 80 species of groundfish (PFMC 2005), 13 highly migratory species (PFMC 2007), and three species of federally-managed Pacific salmon: Chinook salmon (O. tshawytscha);coho salmon (O. kisutch); and Puget Sound pink salmon (O. gorbuscha)(PFMC 1999). The PFMC does not manage the fisheries for chum salmon (O. keta) or steelhead (O. mikiss). Therefore, EFH has not been designated for these species.

EFH for coastal pelagic species includes all marine and estuarine waters from the shoreline along the coasts of California, Oregon, and Washington offshore to the limits of the EEZ and above the thermocline where sea surface temperatures range between 10 C to 26 C. A more detailed description and identification of EFH for coastal pelagic species is found in Amendment 8 to the Coastal Pelagic Species Fishery Management Plan (PFMC 1998).

EFH for groundfish includes all waters, substrates and associated biological communities from the mean higher high water line, or the upriver extent of saltwater intrusion in river mouths, seaward to the 3500 m depth contour plus specified areas of interest such as seamounts. A more detailed description and identification of EFH for groundfish is found in the Appendix B of Ammnedment 10 to the Pacific Coast Groundfish Management Plan (PFMC 2005).

EFH for highly migratory species range from vertical habitat within the upper ocean water column form the surface to depths generally not exceeding 200 m to vertical habitat within the mid-depth ocean water column, from depths between 200 and 1000 m. These range from coastal waters primarily over the continental shelf; generally over bottom depths equal to or less than 183 m to the open sea, beyond continental and insular shelves. A more detailed description and identification of EFH for highly migratory species in Appendix F of the Fishery Management Plan for U.S. West Coast Fisheries for Highly Migratory Species (PFMC 2007).

Marine EFH for Chinook, coho and Puget Sound pink salmon 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, and longstanding, naturally-impassable barriers (i.e., natural waterfalls in existence for several hundred years). A more detailed description and identification of EFH for salmon is found 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.

The harvest-related activity of the proposed action considered in this consultation involves boats using hook-and-line gear. The use of hook-and-line gear affects the water column rather than estuarine and near shore substrate or deeper water, offshore habitats.

3.2 Adverse Effects on Essential Fish Habitat

The PFMC assessed the effects of fishing on salmon EFH, mostly in freshwater, and provided recommended conservation measures in Appendix A to Amendment 14 of the Pacific Coast Salmon Plan (PFMC 1999). The PFMC identified five types of impact on EFH: 1) gear effects; 2) harvest of prey species by commercial fisheries; 3) removal of salmon carcasses; 4) redd or juvenile fish disturbance; and 5) fishing vessel operation on habitat.

Harvest related activities described in this opinion for intercepted salmon are accounted for explicitly in the ESA analyses regarding harvest related mortality. Changes to overall salmon fishing activities have decreased over the last decade, as described in this opinion in Sections 1.2 and 2.2.1.5. Therefore any gear related effects have also been reduced over this time frame. Derelict gear effects occur in fishing activities managed under all four Pacific Coast FMPs, as well as recreational and commercial fishing activities not managed by the Council. However, the action considered in this opinion does not include commercial trawl nets, gillnets, long lines, purse seines, crab and lobster pots or recreational pots. These types of gear losses are those most commonly associated as having an effect on EFH. Hook-and-line gear is not placed into this category, and so long as the action continues to authorize fisheries using hook-and-line regulations, gear effects will not be present on EFH.

Prey species can be considered a component of EFH (NMFS 2006c). However, the action considered in this opinion is promulgation of fisheries targeting adult salmon, which are not considered prey for any of the remaining species managed under the other three Pacific coast FMPs. Furthermore, the salmon fisheries considered in this opinion have not documented interception of prey species for the adult species managed under the other three FMPs either.

The Council addresses the third type of possible EFH impact, the removal of salmon carcasses, by continuing to manage for maximum sustainable spawner escapement and implementation of management measures to prevent overfishing. The use of proper spawner escapement levels ensures PFMC Fisheries are returning a consistent level of marine-derived nutrients back to freshwater areas.

Fishing vessel operation will occur in the EEZ as a result of the action. Vessels can adversely affect EFH by affecting physical or chemical mechanisms. Physical effects can include physical contact with spawning gravel and redds (freshwater streams) and propeller wash in eelgrass beds (estuaries). However, the bounds of the action area are outside the bounds of freshwater EFH. Derelict, sunk, or abandoned vessels can cause physical damage to essentially any bottom habitat the vessel comes into contact with (PFMC 2011a). Operation of vessels in the EEZ will result through implementation of any of the four FMPs, and also from non-fishing related activities, providing potential for physical damage to any bottom habitat.

As discussed above the use of hook-and-line gear in the fisheries promulgated through the action in Section 1.3 of this opinion does not contribute to a decline in the values of estuarine and near shore substrate or deeper water, offshore habitats through gear effects. As adult salmon are not known prey species to the other species in the remaining three FMPs, prey removal is also not considered to have a discernable impact on EFH. Additionally the bounds of the action area are outside the bounds of freshwater EFH, therefore redd or juvenile fish disturbance will not result from the action in this opinion. Fishing vessel operation as a result of the action may result in physical damage to marine EFH, but the number of operating vessels solely attributable with the action considered in this opinion is unknown. Consequently, 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.

It is NMFS opinion that current PFMC actions address EFH protection, and no discernible adverse effects on EFH for species managed under the Coastal Pelagic Species Fishery Management Plan (PFMC 2009), the Pacific Coast Groundfish Management Plan (PFMC 2011b), the Fishery Management Plan for U.S. West Coast Fisheries for Highly Migratory Species (PFMC 2011c), and the Pacific Coast Salmon Plan (PFMC 2012b) will result from the proposed action considered in this biological opinion.

3.3 Essential Fish Habitat Conservation Recommendations

Pursuant to Section 305(b)(4)(A) of the MSA, NMFS is required to provide EFH conservation recommendations to Federal agencies regarding actions which may adversely affect EFH. However, because NMFS concludes that sufficient measures addressing possible EFH impact, as described in Section 3.2 of this opinion, have been made and adopted for the PFMC Fisheries and the proposed fisheries will not adversely affect the EFH, no additional conservation recommendations beyond those identified and already adopted are needed.

3.4 Statutory Response Requirement

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

3.5 Supplemental Consultation

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

4 ▪ DATA QUALITY ACT DOCUMENTATION & PRE-DISSEMINATION REVIEW

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

4.1 Utility

Consultation by Federal agencies with NMFS is required under section 7 of the ESA whenever a Federal agency approves funds or carries out an action that might affect a listed species. This consultation was required under the ESA to determine whether the implementation of the PFMC Fisheries would appreciably reduce Lower Columbia River Chinook salmon population survival and recovery, jeopardizing the affected ESU. Supplying copies of the document to the management agencies provides them with the documentation that NMFS has determined that the proposed fisheries will not jeopardize the continued existence of the affected ESUs. Providing copies to the WDFW, ODFW, NWIFC and the CRITFC is consistent with their roles as fishery managers for the affected ESUs and with NMFS' obligations under Secretarial Order 3206 (Department of Interior Order 3206, American Indian Tribal Rights, Federal-Tribal Trust Responsibilities and the Endangered Species Act). This opinion will be posted on the NMFS Northwest Region web site (http://www.nwr.noaa.gov). The format and naming adheres to conventional standards for style.

4.2 Integrity

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

4.3 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.

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