Coastal Multi-Species Conservation and Management Plan

OREGON DEPARTMENT OF FISH AND WILDLIFE

Approved by the Oregon Fish and Wildlife Commission:
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ODFW Mission

To protect and enhance Oregon's fish and wildlife and their habitats for use and enjoyment by present and future generations

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ACRONYMS and ABBREVIATIONS
- ANWS – Assoc. of Northwest Steelheaders
- alt. – alternate
- Assoc. – Association
- Conf. – Confederated
- CCA – Coastal Conservation Assoc.
- CMP – *Coastal Multi-Species Conservation and Management Plan*
- GRWB – Gardiner, Reedsport, and Winchester Bay
- NFS – Native Fish Society
- NSIA – Northwest Sportfishing Industry Association
- ODFW – Oregon Department of Fish and Wildlife
- POORT – Port Orford Ocean Resources Team
- STEP – Salmon and Trout Enhancement Program
- STAC – Salmon and Trout Advisory Committee
- SWCD – Soil and Water Conservation District

Acronyms and Abbreviations

A&P .... Abundance and Productivity
AABM ...... Aggregate Abundance-Based Management
AAS .... Adult-to-Adult Survival
A-13 .... Amendment 13 to the PFMC Salmon Fishery Management Plan
AK .... Alaska
A&P .... Abundance and productivity
AIC .... Akaike Information Criterion
ANCOVA .. Analysis of Covariance
AOS .... Adult-to-Outmigrant Survival
AQI .... Aquatic Inventories Project
AUC .... Area Under the Curve
AvPP .... Avian Predation Project
BC .... British Columbia
CCRMP ..... Coastal Chinook Research and Monitoring Project
CCT .... Coastal Cutthroat Trout
CEF .... Cohort Expansion Factor
cfs .... Cubic feet per second
ChF .... Fall-run Chinook
ChS .... Spring Chinook
CLAMS ..... Coastal Landscape Analysis and Modeling Study
CMP .... Coastal Multi-Species Conservation and Management Plan
CO .... Coho
COC .... Cogan Owens Cogan, LLC
COHSHAK Cohort Analysis with Shakers
CWT .... Coded-wire tag
D .... Diversity
DCCO .... Double-crested Cormorant
DEM .... Digital Elevation Model
DEQ .... Oregon Department of Environmental Quality
DIC .... Deviance Information Criterion
DIDSON .... Dual-Frequency Identification Sonar
EIS .... Escapement Indicator Stock
EPA .... Environmental Protection Agency
ER .... Extinction risk
ERIS .... Exploitation Rate Indicator Stock
ESA .... Endangered Species Act
ESU .... Evolutionarily Significant Unit
FHMP .... Fish Hatchery Management Policy
GIS .... Geographic Information System
GLMM ...... Generalized Linear Mixed Effects Model
GRTS .... Generalized Randomized-Tessellation Stratified technique
HB .... House Bill (Oregon Legislature)
HSRG .... Hatchery Scientific Review Group
HU .... Hydrologic Unit
HUC .... Hydrologic Unit Coding
ICTRT .... Interior Columbia Technical Recovery Team
IMST .... Independent Multidisciplinary Science Team
IP .... Intrinsic Potential
LCM .... Life-Cycle Monitoring Project
LCMS .... Life-Cycle Monitoring Site
LIDAR .... Laser Imaging, Detection and Ranging
MAF .... Mean Annual Flow
McMC ...... Markov chain Monte Carlo method
MET .... Minimum equilibrium threshold
MMP .... Marine Mammal Program
MR .... Mark-Recapture
MRP .... Marine Resources Program
MSY .... Maximum Sustained Yield
N/A .... Not applicable
NADOT ..... Non-Assessed Direct Ocean Tributary
Neq .... Number of spawners at equilibrium; an estimate of carrying capacity
NFCP .... Native Fish Conservation Policy
NMFS .... National Marine Fisheries Service
NOAA .... National Oceanic and Atmospheric Administration-Fisheries Service
OAR .... Oregon Administrative Rule
OASIS .... Oregon Adult Salmonid Inventory and Sampling Project
OCCCP ...... Oregon Coast Coho Conservation Plan
ODFW ...... Oregon Department of Fish and Wildlife
OFWC .... Oregon Fish and Wildlife Commission
OHRC .... Oregon Hatchery Research Center
ONFSR ...... 2005 Oregon Native Fish Status Report
OSCRP ...... Ocean Salmon and Columbia River Program
OSMB .... Oregon State Marine Board
OSU .... Oregon State University
OWEB ...... Oregon Watershed Enhancement Board
OWRD ...... Oregon Water Resources Department
P .... Productivity
PCM .... Peak Count Model
PFMC .... Pacific Fishery Management Council
pHOS .... Percent of hatchery fish on spawning grounds
Prop .... Propagation Program
PSC .... Pacific Salmon Commission
PST .... Pacific Salmon Treaty
PVA .... Population Viability Analysis
QET .... Quasi-Extinction Threshold
RecFish .... Recreational Fisheries Program
RFT .... Reproductive Failure Threshold
RME .... Research, Monitoring, and Evaluation
SAH .... Salmonid Anchor Habitat
SAR .... Smolt-to-Adult Survival
Scales .... Fish Life History/Scale Analysis Project
SE .... Standard Error
SEV .... Salmonid Ecosystem Value
SLAM .... Species Life-cycle Analysis Modules
SMB .... Smallmouth bass
SMSY .... Spawner abundance at Maximum Sustainable Yield
SMU .... Species Management Unit
SS .... Spatial Structure
STEP .... Salmon and Trout Enhancement Program
StW .... Winter Steelhead
StS .... Summer Steelhead
SWCD .... Soil and Water Conservation District
TAM .... Total Accessible Miles
TBD .... to be determined
TMDL .... Total Maximum Daily Load
USFS .... U.S.D.A. Forest Service
USFWS ..... U.S. Fish and Wildlife Service
USGS .... United States Geological Service
VSP .... Viable salmonid population
WinBUGS . Bayesian statistical software
WLC-TRT .. Willamette/Lower Columbia Technical Recovery Team
WORP ...... Western Oregon Rearing Project
yr .... year
yrs .... years

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Oregon Department of Fish and Wildlife

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Website: http://www.dfw.state.or.us/fish/CRP/coastal_multispecies.asp

Introduction

The *Coastal Multi-Species Conservation and Management Plan* (CMP) is to be used by anglers, conservation groups, watershed councils, government agencies, landowners and the general public to understand how salmon, steelhead, and trout within the Coastal planning area are being managed, what the long-term goals are for them, and what actions need to be taken to achieve those goals. This plan focuses on the long-term conservation[1] of naturally-produced (i.e., wild) salmon, steelhead and trout, but also provides the framework for how hatchery salmon and steelhead and fisheries will be managed[2]. The purpose of this multi-species plan is to ensure the continued viability and conservation of the Chinook salmon, chum salmon, steelhead trout, and cutthroat trout Species Management Units (SMUs)[3] along the Oregon Coast from Elk River (Cape Blanco) to the Necanicum River (Seaside) and to achieve a desired status that provides substantial ecological and societal benefits. This plan, along with the already approved conservation plan for Oregon Coast coho salmon (http://www.dfw.state.or.us/fish/CRP/coastal_coho_conservation_plan.asp), provides management direction for, and guidance to enhance, all wild salmon, steelhead and trout along the Oregon Coast from Cape Blanco to the mouth of the Columbia River. The current status of these SMUs reflects current hatchery and harvest management, and extensive habitat restoration work initiated or maintained under the *Oregon Plan for Salmon and Watersheds* (Oregon Plan) and the *Oregon Conservation Strategy*. The CMP maintains and enhances support of the Oregon Plan (ORS 541.898) and meets the requirements of Oregon's Native Fish Conservation Policy (NFCP) (OAR 635-007-0502 to 0509).

The CMP is different than most of the conservation plans developed and implemented by Oregon Department of Fish and Wildlife (ODFW) over the last eight years. This plan provides conservation and management guidance for six SMUs – none of which are listed under the state or federal Endangered Species Act. In addition, this plan focuses not only on conserving wild salmon, steelhead and trout, but also on management to provide fishing opportunities throughout the coast – utilizing both hatchery and wild fish. It is intended that this plan be a dynamic document that will be modified over time in response to learning from monitoring data and implementation experience.

A key strategy to achieve the goals of this plan, in addition to the harvest and hatchery strategies and consistent with the Oregon Plan, is to support efforts to improve habitat for the species and other native fish[4] and wildlife species through on-the-ground, non-regulatory work by community-based entities and individuals. In addition, this plan provides strategies for future management of hatchery fish and fisheries to ensure sustainable wild populations and fisheries. The CMP maintains existing regulatory programs and enhances support for non-regulatory cooperative conservation; it does not include new land-use regulations. A key element of this plan is to provide fish-based habitat enhancement guidance for multiple species that can be used by local conservation groups and private landowners (e.g., Soil and Water Conservation Districts [SWCDs], watershed councils, industrial forestland owners, Salmon and Trout Enhancement Program [STEP] volunteers, and other individuals and groups). These community-based organizations have demonstrated an impressive record of planning, prioritizing, and implementing habitat improvement projects through their participation in the Oregon Plan, and the CMP is intended to help maximize the benefits of those projects in the future.

Included in the CMP are strategies related to predators on Coastal salmon and trout. These predators include seals and sea lions ("pinnipeds"), birds (referred to as "avian predators", primarily cormorants on the coast), and non-native fish (including smallmouth bass). The known impacts to fishing opportunity and investments in hatchery resources, as well as the potential impact to wild fish populations, are acknowledged.

<u>Plan Development Process</u>

This plan meets the requirements for conservation plans described in Oregon's NFCP. The NFCP was adopted by the Oregon Fish and Wildlife Commission (OFWC) in 2002 to support and increase the effectiveness of the 1997 Oregon Plan. The NFCP employs conservation plans to identify and implement appropriate strategies and actions necessary to restore and maintain native fish in Oregon to levels that provide benefits to the citizens of the state. This is achieved by completing the following items, which are described in detail in this plan:

[1] As defined in Oregon Administrative Rule (OAR), the term conservation means managing for sustainability of native fish so present and future generations may enjoy their ecological, economic, recreational and aesthetic benefits (OAR 635-007-0501-10).
[2] The CMP does not provide all details of hatchery and fishery management. Other documents, such as Hatchery Program Management Plans and the annual *Oregon Sport Fishing Regulations*, do or will provide more detail.
[3] Species Management Unit is defined as a collection of populations from a common geographic region that share similar genetic and ecological characteristics.
[4] Native fish are defined as indigenous to Oregon and include both naturally and hatchery produced fish (OAR 635-007-0501-36).

1. Define SMUs and constituent populations.
2. Determine current status.
3. Define a desired status.
4. Determine any gap between current and desired status and the factors causing the gap (limiting factors).
5. Identify and implement strategies and actions that address the limiting factors.
6. Monitor and evaluate the SMU status and actions implemented and use adaptive management to make adjustments necessary to achieve desired status.

The NFCP also requires ODFW to seek input and involvement from the public during the planning process. The following describes the planning process.

SMU and Population Boundaries

The SMU and population boundaries[5] identified in this plan are the same for all SMUs to avoid confusion and provide consistency in management and implementation across species. Populations are grouped into four geographic strata for fall-run Chinook, winter steelhead and cutthroat trout – North Coast stratum, Mid-Coast stratum, Umpqua stratum, and Mid-South Coast stratum. These strata are very similar to those identified in the Oregon Coast Coho Conservation Plan.

Status Assessment

The CMP relied on a weight-of-evidence approach for assessment of the current status utilizing all available data and the most appropriate scientific methods. The recent performance of the fish was measured by assessing abundance, productivity, spatial structure, and diversity. Field biologists also provided local knowledge for consideration where other data were lacking or inconclusive. ODFW considered all sources of information, and the status conclusions identified in the CMP reflect the preponderance of the information and confidence in analytical assessments.

Strategies and Actions

Strategies and actions are identified in the CMP within four Management Categories: hatchery fish, fishing/harvest, other species (primarily predators), and habitat. The strategies and actions are intended to address the identified limiting factors in these management categories that are likely to impede the ability of each SMU to achieve the desired status for species health and societal benefits. An adaptive management process, including research and monitoring, is outlined in this plan to ensure the strategies and actions will be effective.

Public Involvement

To develop a conservation plan that seeks to achieve society's desired status for coastal salmon, steelhead and trout, ODFW enlisted the help of four Stratum Stakeholder Teams – each comprised of interest group representatives who live, work or recreate within that stratum (North Coast, Mid-Coast, Umpqua, or Mid-South Coast). Interest groups represented on some or all of these teams included watershed councils, conservation groups, fishing guides, angler groups, commercial fishers, Salmon and Trout Enhancement Program (STEP) groups, resource producers, local governments, Native American tribes, and the public-at-large. Four rounds of meetings utilizing an independent facilitator provided a forum for the Stakeholders Teams to provide ODFW with input and support for development of strategies and actions to achieve a desired status. These meetings included orientation sessions, individual stratum-level workshops, draft plan review sessions, and a final consensus-seeking workshop to achieve agreement on management actions. A summary of the Stakeholder process is presented in **Appendix VII – Process Facilitation Report**.

ODFW also contracted with the Survey Research Center at Oregon State University to conduct a survey of the general public and licensed anglers. The survey sought to ascertain the general and angling publics' preferences for management strategies, as well as their aspirations for wild salmon, steelhead and trout populations along the Oregon Coast into the future. Results of the survey are presented in **Appendix VI – Opinion Survey**.

Additionally, ODFW formed a Habitat Technical Work Group to provide initial feedback on habitat components and strategies in the CMP. Members of this group included representatives of stakeholders, watershed councils and land managers. The Independent Multidisciplinary Science Team (IMST), a scientific review panel charged with advising the State of Oregon on

[5] SMU boundaries encompass all watersheds that flow into the ocean from the Necanicum River in the north, to the Elk or Sixes River to the south (the Elk is only included for Chinook). The population boundaries are mostly the drainage areas of the moderate- and larger-sized streams flowing directly into the ocean (see exceptions in the Umpqua stratum and Yachats aggregate population).

matters of science related to the *Oregon Plan for Salmon and Watersheds*, provided a comprehensive review of the CMP, with numerous suggestions but no formal recommendations.

Finally, ODFW sought broad public involvement and input on the CMP from other interested groups and the general public. This was accomplished with ongoing dissemination of information about plan development and opportunities for comment via a website (http://www.dfw.state.or.us/fish/CRP/coastal_multispecies.asp) and an e-mail distribution list, as well as meetings with interested groups and individuals, public open house meetings, a formal public comment period, and participation in the Oregon Fish and Wildlife Commission (OFWC) proceedings.

Plan Approval

Following Stakeholder Team review of the draft plan, ODFW made the public review draft available for comments for a specified period and hosted public meetings to provide information and solicit additional public input. The plan was then revised and presented to the OFWC for review and then approval. The OFWC review and approval process included additional opportunity for public comment. The OFWC approved the plan and adopted associated OARs on June 6, 2014.

<u>Conceptual Framework</u>

The CMP, as required by the NFCP, evaluates the current status of six salmonid SMUs, establishes a desired status for each, and presents a "portfolio" of management preferences and associated actions intended to address gaps between current and desired status and optimize fishing opportunity. The key assumptions used in developing CMP actions were:

- There is not currently a conservation or fishing crisis, although species are not as abundant as they were historically (i.e., prior to 1800)
- Watershed functions and habitat conditions supporting production of native salmon and trout are diminished from historical conditions
- Management actions contained in the CMP are intended to decrease conservation risk and improve fishing opportunity through a "*portfolio*" approach that assigns different hatchery and fishing risks to wild fish in different areas
- Hatcheries and harvest create conservation risk, but that risk can be managed effectively to maintain the importance for fishing
- Predation by marine mammals and birds represents a risk to conservation and fishing, although actual impacts are poorly understood
- New management and monitoring efforts will require new funding
- Conservation and fishery management are an imprecise and adaptive process subject to change based on cyclic variation in survival, shifts in intrinsic productivity and capacity, uncertainty in monitoring information and causal relationships, and policy direction

<u>Oregon's Portfolio Management Approach</u>

The CMP utilizes a "*portfolio*" approach that provides a balanced mix of conservation and utilization that is intended to provide consistent returns into the future. The approach assigns and allows different hatchery and fishing risks to wild fish in different areas. This approach also assigns and allows for different fishing opportunities in different areas. There are seven Oregon Coastal salmonid SMUs comprised of almost 100 wild populations. There are also numerous runs of hatchery salmon and trout produced by Oregon hatcheries. These populations and hatchery programs are dispersed across roughly 250 miles of coastline in 17 major river basins, which can be further sub-divided into different management areas. Cumulatively, this represents a very diverse set of species, sources of fish, and locations, providing opportunities for both wild fish conservation and fishing opportunity.

Sources of Conservation Risk

- Hatchery fish and fishing both represent potential conservation risk to wild populations, with higher risk associated with more intense levels of hatchery production and higher rates of harvest
- Change in freshwater, estuarine, and ocean habitat conditions, including future changes due to climate change or development, from those in which salmon and trout developed their current characteristics are a conservation risk to wild populations

- Other species, such as birds, mammals, and non-native fish species, also represent risks to wild stocks through such interactions as predation and competition

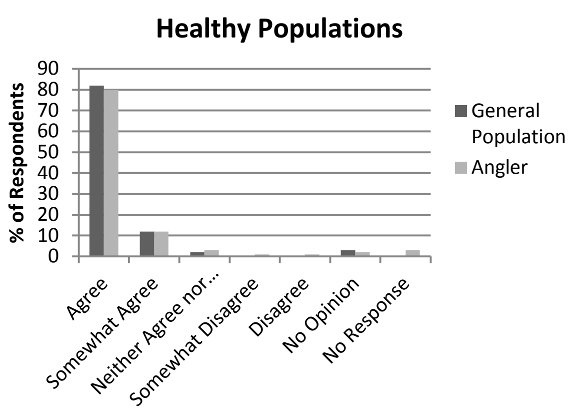
Although all of these risks are addressed in the CMP, ODFW has the most direct authority over hatchery and fishery management programs within freshwater, and the portfolio approach was applied within these responsibilities. ODFW plays a co-management or advisory role with respect to federally-protected species (e.g., those under the Endangered Species Act [ESA], Marine Mammal Protection Act, and the Migratory Bird Treaty Act), ocean fisheries, and habitat modification.

Portfolio Principles

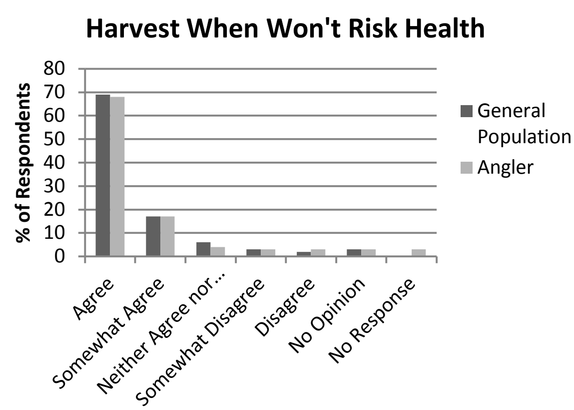
- Ensure long-term sustainability of wild salmon and trout at levels that will support robust fisheries and ecological, economic, and cultural benefits for present and future generations
- Maintain the current number of coastal fish hatcheries and roughly balance the expansion of some hatchery programs to increase fishing opportunity and the reduction of some programs or stocked locations to reduce risk to wild fish
- Maintain and expand fishing opportunity for wild fish based on retention and non-retention fishing, given species status and social preferences
- Balance hatchery programs and fishing opportunity with wild fish conservation by accepting higher risk to wild fish in some locations and lower risk in other locations based on wild fish range, diversity, and productivity

The *portfolio* approach accomplishes a balance of wild fish protection, wild fish harvest opportunity, and hatchery fish harvest opportunity within each stratum and across the entire Coastal area. Overall, the *portfolio* represents a pragmatic combination of the best available science, conservation needs for wild fish populations, fishing opportunity for anglers, management tradition, political and social desires, and limitations relative to new initiatives. To be inclusive of all salmon, steelhead, and trout management occurring within the planning area, hatchery and harvest actions related to Coastal coho are also included in the CMP even though a separate conservation plan exists for this SMU.

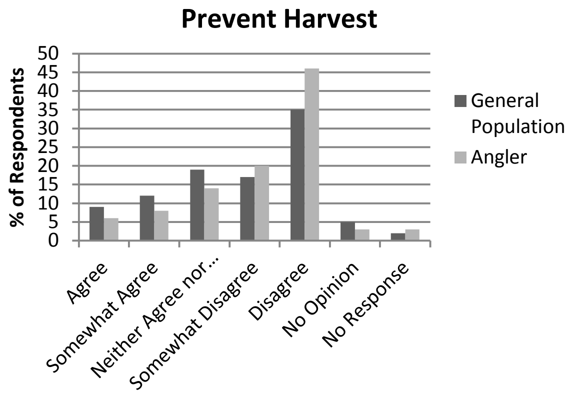
Anglers and non-anglers who responded to the opinion survey described earlier (also see **Appendix VI – Opinion Survey**) also indicated a desire to balance conservation and utilization in the management approach (Figure 1). They were asked several of the same questions. Both groups responded similarly to a question related to how ODFW should manage wild salmon, steelhead and trout. Almost all anglers and non-anglers agreed/somewhat agreed that the goal of wild salmon, steelhead and trout management should be to achieve healthy populations. A significant majority (anglers = 77%, non-anglers = 73%) agreed/somewhat agreed that management of these populations should be a high priority for Oregon. Large majorities also agreed/somewhat agreed (anglers = 85%, non-anglers = 86%) that management should seek to provide responsible harvest opportunities on wild populations.



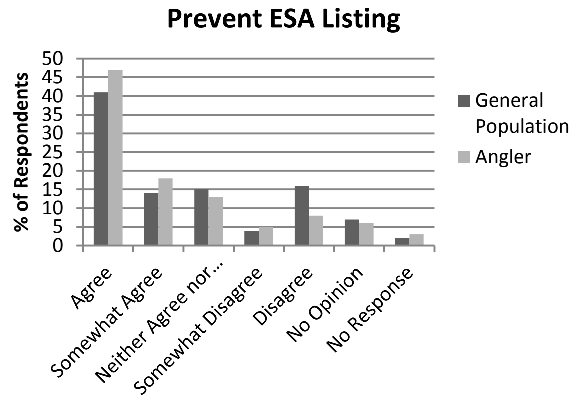
a)…aim for healthy populations



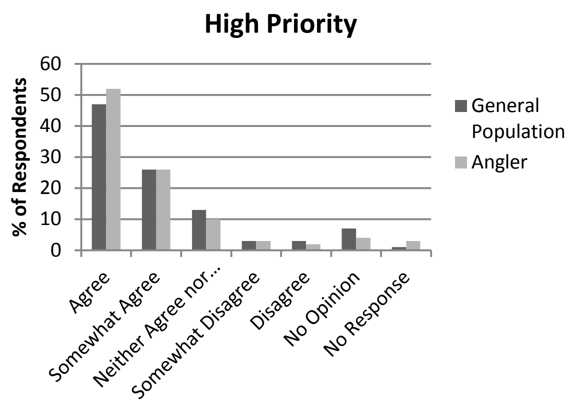
b)…provide opportunities to harvest fish when it won't risk population health



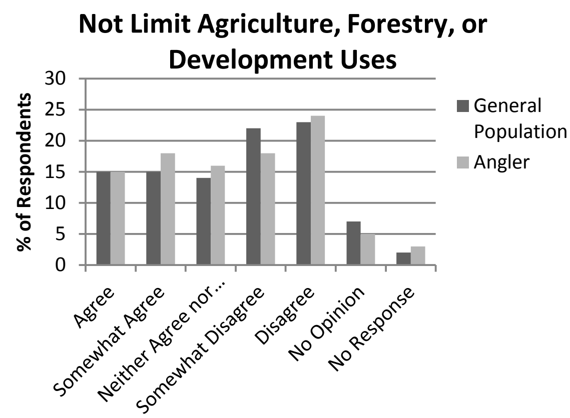
c)…prevent them from being harvested



d)…aim to prevent Endangered Species Act listings



e)…be a high priority for Oregon



f)…not limit agriculture, forestry, or development uses

Figure 1. Angler and non-angler (General Population) responses to the following question on management direction: ***ODFW must consider many issues when managing for wild salmon, steelhead, and cutthroat trout. Please indicate whether you generally agree or disagree with the following statements on what ODFW should consider for their wild fish management plan for these coastal basins. Management of coastal wild salmon, steelhead, and cutthroat trout should…***

Species

Each of the six SMUs covered in the CMP, plus the Oregon Coastal coho salmon SMU (for which a conservation plan already exists; ODFW 2007), consist of native fish that exhibit significant differences in their life history (summarized in Table 1). These species reside in freshwater, estuaries, and the ocean for different periods of time; migrate to vastly different ocean areas; and mature at different ages. These and other species traits affect the resilience and productivity of each, may explain differences between current and historical abundance, and guide effective management and restoration programs. This section provides background information about the species' characteristics managers recognize as critical to conserve for each SMU, as well as very broad information about historical trends in abundance, harvest, and hatchery programs.

<u>Chinook Salmon</u>
Chinook populations are defined in this plan based on the larger rivers that enter the Pacific Ocean. The very large Umpqua River Basin is an exception, with three populations defined for the Lower, Middle, and South Umpqua. These Chinook population delineations are very similar to those defined in the Oregon Native Fish Status Report (ONFSR; ODFW 2005). An exception is in the Umpqua, where the North Umpqua is not considered in this plan as an independent population, and the Upper Umpqua population is divided into two populations (Middle and South Umpqua). This plan also differs from the ONFSR by considering the late-run Chinook in the Nehalem to be part of a larger Chinook population, rather than an independent population. Recent genetic information on these fish is inconclusive on their independence.

Chinook populations in this SMU include early (returning in the spring or summer) and late (returning in the fall) adult components. In those Coastal basins that do not extend into the Cascades, early and late returning Chinook are considered in this plan to be one population, given that: a) there are fewer isolating mechanisms between the two life history components; b) these basins are not naturally conducive to independent spring or summer Chinook populations (as evidenced by both the lack of snow-fed summer water and the limited presence and scope of early Chinook runs); and c) existing data do not strongly support a bi-modal distribution in returns. This determination is subject to change with new genetic or spatial and temporal distribution information (e.g., the Nehalem summer run is potentially an independent and isolated population). Early component fish in several populations provide diversity and some fishing opportunities that are important to protect and enhance where possible. In order to distinguish different run timing in Chinook populations, early components are referred to as spring-run or summer-run Chinook (depending on the location). The more abundant late component is referred to as fall-run Chinook. Independent populations of spring returning Chinook are called spring Chinook (as opposed to spring-run Chinook).

Chinook salmon are mainstem and large tributary spawners, entering coastal rivers over a protracted period of time. This species has exhibited an increasing SMU escapement trend since the 1950s. Ocean fisheries for Chinook are managed by the Pacific Fishery Management Council, the US – Canadian Pacific Salmon Commission, and the Oregon Fish and Wildlife Commission (OFWC). Annual fishery adjustments are intended to provide fishing opportunity while meeting conservation goals, which include escapement goals and exploitation rate limitations. Variation in annual abundance, though significant, tends to be attenuated by the fact that Chinook mature from ages 2-6, rather than at a single age. All Chinook salmon die at the conclusion of their spawning migration.

<u>Spring Chinook</u>
Only two independent spring Chinook populations are identified in this plan – both in the upper Umpqua Basin. This differs from the ONFSR where spring-run Chinook in the rivers draining the Coast Range were considered independent populations (see discussion above on these spring-run Chinook). Spring Chinook are mainstem and large tributary spawners. Management of the spring Chinook SMU is complicated by the fact that the North Umpqua population consists of thousands of returning wild adults but the South Umpqua population consists of a few hundred. All spring Chinook die at the conclusion of their spawning migration.

<u>Chum Salmon</u>
Chum salmon have the widest natural geographic and spawning distribution of any Pacific salmonid, and on the west coast of the US they historically ranged south to Monterey Bay in California (Good et al. 2005). A status review of West Coast chum identified four

chum salmon ESU's (evolutionarily significant units) and determined that coastal Oregon chum were part of the Pacific Coast ESU that included all natural populations from the Pacific coasts of California, Oregon, and Washington (Johnson et al. 1997). NOAA proposed the Pacific Coast ESU was not warranted for listing under the Endangered Species Act (ESA) as threatened or endangered (NOAA 1998). Early commercial catch records for coastal Oregon indicate that chum were much more abundant from the 1930's through 1950's than they are today, and that northern coast basins consistently yielded larger catches than more southern basins (Cleaver 1951). Henry (1953) noted that over the period 1929-1950 the Tillamook Bay landings exceeded the landings of all other coastal Oregon rivers combined. Presently, major spawning populations are found only as far south as the Yaquina River on the mid Oregon coast, and current ODFW adult salmon monitoring indicates that chum salmon are present on a consistent basis in only a few coastal basins. Both the early records and current surveys indicate that chum occur in low numbers in many basins, but often only periodically. Given this limited information on historic population structure, ODFW could not confidently identify independent versus dependent populations. Therefore, this plan only identifies potential chum population areas. This approach differs from the ONFSR where all rivers where chum had been documented historically were identified as distinct populations, with many of those considered extinct or extirpated.

Chum salmon spawn in lower gradient reaches of mainstem rivers and small floodplain streams that are tributary to the mainstems. In some basins they are also known to spawn in upper intertidal reaches of rivers, streams and sloughs. In Oregon, chum fry rear in freshwater and estuary habitats between February and May before migrating to the ocean (Pearcy et al. 1989). In the ocean, juvenile Oregon coastal chum presumably follow a migratory path similar to other North American stocks, which have been reported to move northward along the coast of the Gulf of Alaska from February to May and spend most of their ocean life in the Gulf of Alaska (Neave et al. 1976). However, these stocks have also been found west of the Gulf of Alaska in sockeye fisheries near the Shumagin Islands in July, and in Bering Sea walleye pollack fisheries (Seeb et al. 004). Given the low abundance of Oregon Coast chum relative to the large populations in BC and Alaska, ODFW assumes that Oregon fish are unaffected by these ocean fisheries. In addition, since there are no chum fisheries along the Oregon Coast, harvest impact on returning adults is likely to be minimal. Chum reach maturity at ages from two to five (age 4 is dominant; age 6 is rare) and die after spawning. The age 2 maturation trait seems to occur only in Oregon populations.

<u>Winter Steelhead</u>

Winter steelhead are widely distributed along the coast. This wide distribution has likely led to considerable adaptation and differentiation within this SMU and limited genetic analysis has suggested this may be the case. For the CMP, winter steelhead populations are defined based on management consistency and mirror the population boundaries used in the Oregon Coast Coho Conservation Plan and as identified here for Chinook. These population delineations are different than those identified in the ONFSR, where more and smaller populations are defined.

Winter steelhead are upper mainstem and tributary spawners. Juvenile steelhead reside in freshwater for 2-3 years prior to smolting. Limited data suggest that winter steelhead are subject to negligible direct or by-catch mortality in ocean fisheries. In comparison to all other Oregon coast steelhead populations, winter steelhead in the North Umpqua population exhibit a unique life-history characterized by their migration distance, smolt age, and age at first maturity. Winter steelhead are capable of surviving spawning, returning to the ocean, and making multiple spawning runs.

<u>Summer Steelhead</u>

Consistent with the ONFSR, this plan identifies only two independent populations of summer steelhead in this SMU – in the Siletz and North Umpqua basins. Summer steelhead spawn in tributaries or upriver mainstem reaches of their basins. This form of steelhead is usually associated with a passage or distance barrier that favors a spring/summer returning run. The juvenile life history of summer steelhead is likely to be similar to winter steelhead.

<u>Coastal Cutthroat Trout</u>

Coastal cutthroat trout are the most widely distributed salmonid along the Oregon Coast. As with winter steelhead, it is likely that there are many independent and isolated populations. For management consistency, the population delineations for coastal cutthroat are the same as for winter steelhead. This differs from the populations defined in the ONFSR.

Coastal cutthroat tend to spawn in the smaller tributaries. Coastal cutthroat may express a variety of life histories characterized by: living entirely in tributaries; migrating into larger streams or lakes as adults; rearing in freshwater followed by short periods of ocean rearing; and variable periods of freshwater, ocean, estuary, and river/lake rearing. Coastal cutthroat may survive spawning.

Coho

Coho salmon along the Oregon Coast are managed consistent with the Oregon Coast Coho Conservation Plan adopted in 2007 by the OFWC (ODFW 2007). This plan includes some description of coho management to provide the complete context of salmon, steelhead and trout management in these SMUs. The population delineations for coho are very similar to those identified in this plan for steelhead.

Coho salmon are low gradient, small tributary spawners and are currently listed as threatened under the federal ESA. Coho typically mature after two summers of ocean rearing, although a small proportion of males mature after one ocean-rearing season. Most Oregon coastal juvenile coho smolt after one winter in freshwater. The species has expressed a wide range of survival, production, and escapement over recent decades. All coho die after spawning.

Table 1. Summary of life history characteristics for CMP species.

	Chinook[a]	Spring Chinook	Chum	Winter Steelhead	Summer Steelhead	Cutthroat	Coho
River Rearing	1-6 months	6 mo - 1 yr	Weeks	2 + full yrs	2 + full yrs	2 + full yrs	1 full yr
Estuary Rearing	3-6 months	Limited	Weeks	Very Limited	Very Limited	Limited-Extensive	Limited-Moderate
Smolt Season	Summer/ Autumn	Autumn & spring	Early spring	Late spring	Late spring	Spring	Late spring
Return Season	May - Dec	Feb - July	Oct - Dec	Nov - April	March - September	Jul - Oct	Aug - Feb
Spawning Season	Sep - Jan	Sep - Nov	Oct - Dec	Dec - May	Dec - Feb	Nov - Dec	Oct - Feb
Ocean Distribution	OR - AK	CA - WA	N. Pacific Gyre	N. Pacific Gyre	N. Pacific Gyre	Near-shore No. CA, OR	CA - WA
Typical Age at Maturity (yr)	2-6	3-6	3-5	4-5	4-5	2-3	2-3
Ocean Rearing (yrs)	1-5	2-5	3-5	1-3	1-3	1	1-2
Current vs. Historical Distribution	Presumed Very Similar	Presumed Very Similar	Presumed Diminished	Presumed Very Similar	Presumed Very Similar	Presumed Very Similar	Presumed Very Similar
Current vs. Historical Abundance	Presumed Reduced	Presumed Reduced	Presumed Severely Reduced	Presumed Reduced	Presumed Reduced	Presumed Reduced	Presumed Somewhat Reduced

[a] Includes spring-run, summer-run and fall-run life-histories.

Wild Fish Escapement Through Time

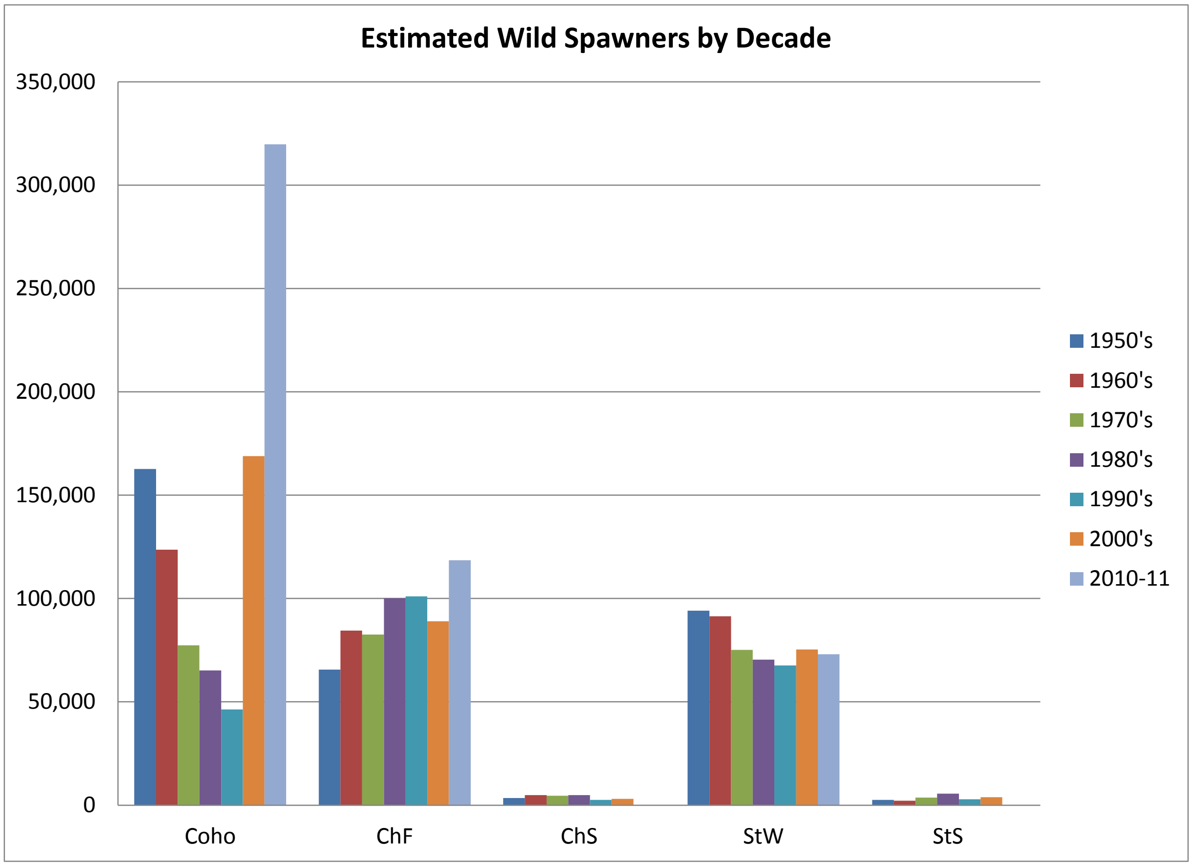


Figure 2. Estimated wild spawner abundance by decade. Spring Chinook and summer steelhead abundances are from Winchester Dam counts only. See *Appendix I – Additional Background Information* for a description of methods used to develop these numbers.

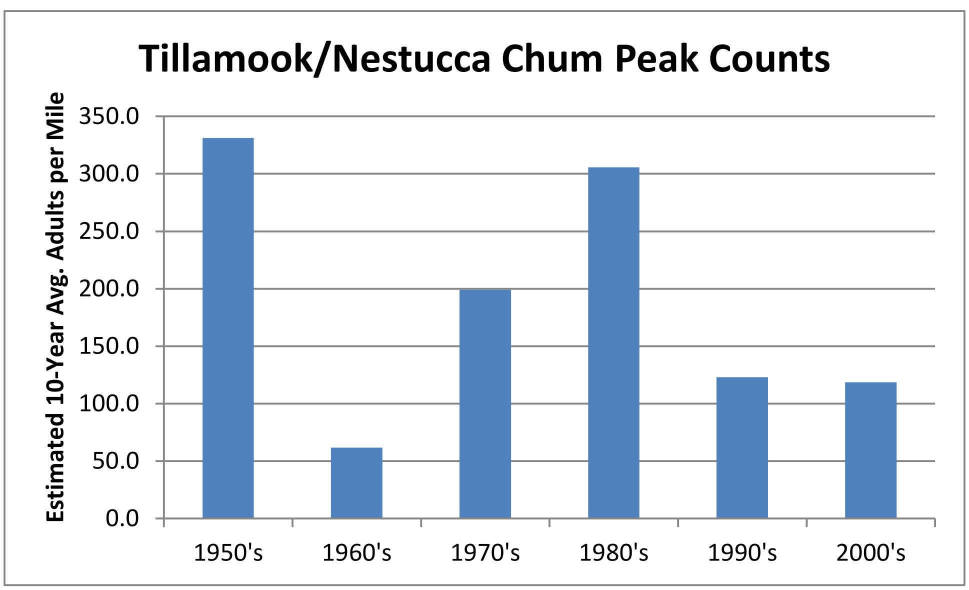


Figure 3. Average decadal peak counts for chum in the Tillamook and Nestucca. See *Appendix I – Additional Background Information* for a description of methods.

<u>Hatchery Releases and Locations</u>

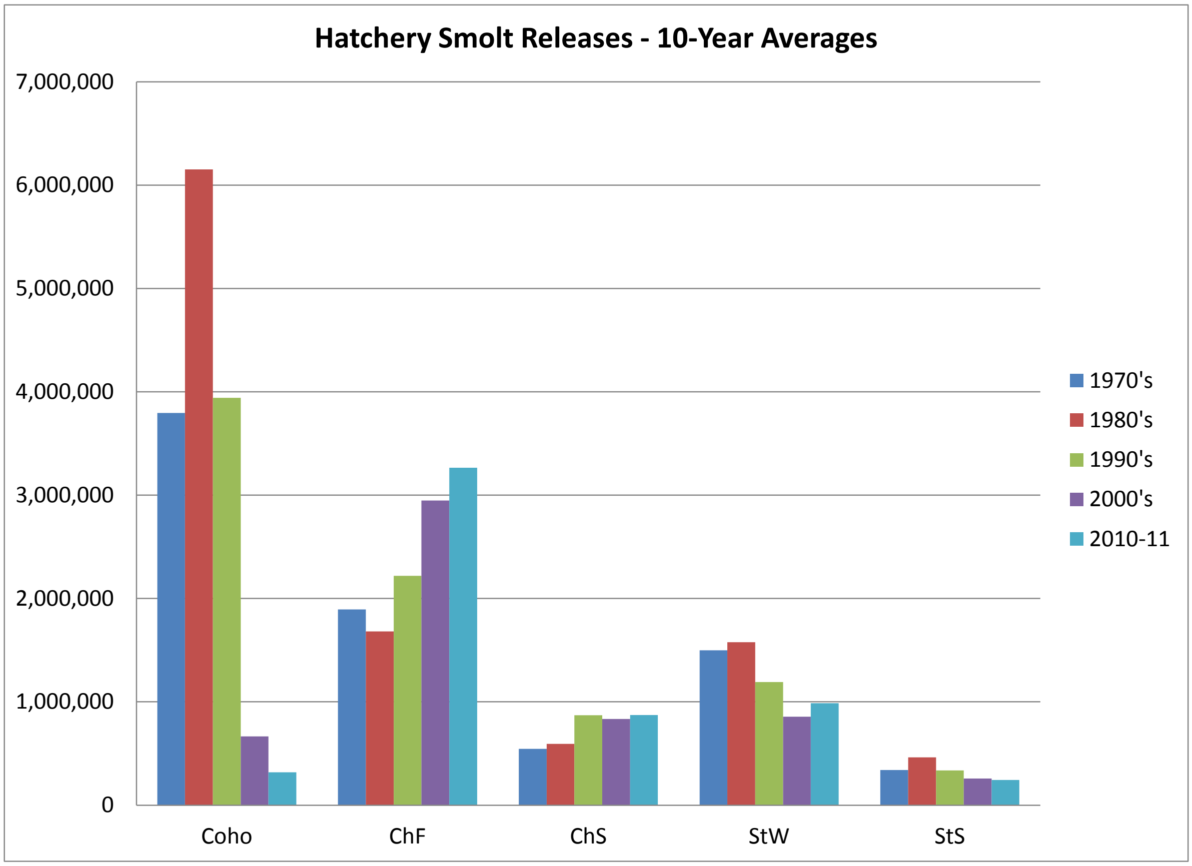


Figure 4. Smolt releases through time (ODFW only). See *Appendix I – Additional Background Information* for a description of methods.

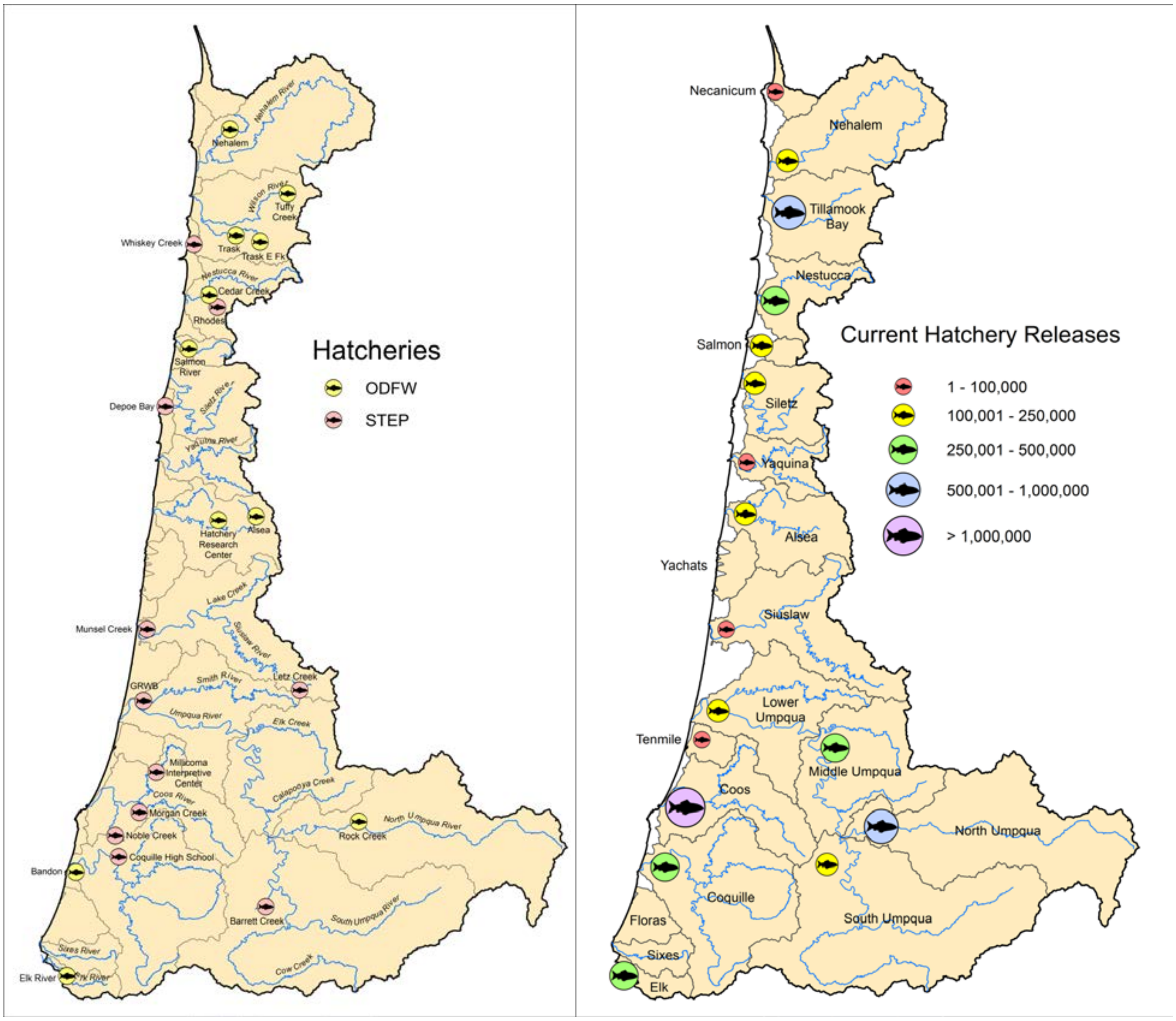


Figure 5. Location of hatcheries and releases within basins. "STEP" is ODFW's volunteer-based Salmon and Trout Enhancement Program, which, among other activities helping to enhance salmon and trout, operates hatcheries for ODFW to achieve the state's overall fish management objectives. OSU is a partner with ODFW in the Oregon Hatchery Research Center.

Relative Numbers of Wild and Hatchery Fish

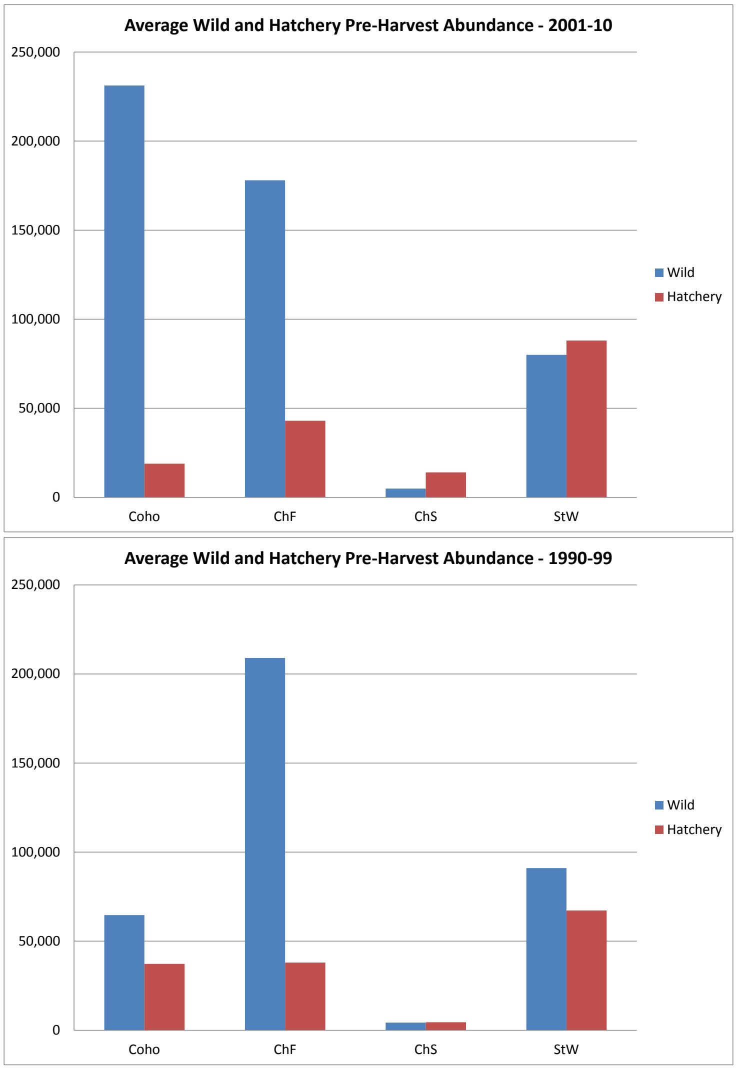


Figure 6. Pre-harvest abundance in the 1990s and 2000s for hatchery and wild fish. See *Appendix I – Additional Background Information* for a description of methods.

Where Fish End Up

Figure 7. Distribution of mortality in the 2000's for coho, fall-run Chinook, spring Chinook, and winter steelhead, and in the 1990's for coho. Only coho differed significantly in distribution between decades. See *Appendix I – Additional Background Information* for a description of methods.

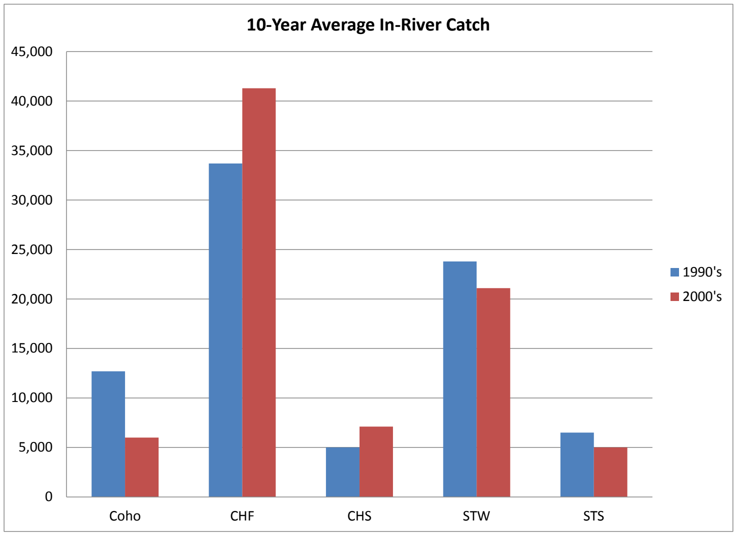


Figure 8. In-river catch in the 1990's and 2000's.

Populations and Basins

The Coastal planning area covered by the CMP includes much of the Oregon Coast – from Elk River (Cape Blanco) in the south to the Necanicum River (Seaside) in the north. There are a number of river basins and species populations within this area.

Populations

The NFCP establishes the "population" as the fundamental management scale for managing coastal anadromous salmonid species. In concept, each population represents a largely discrete reproductive unit. However, the population designations in the CMP represent a combination of scientific rationale, management pragmatism, and traditional thinking. Specifically, some currently defined population units possibly include several distinct reproductive units (e.g., winter steelhead and cutthroat) and some currently defined population units may actually be subsets of a single larger reproductive unit (e.g., Chinook populations in the Umpqua). Regardless, these population designations are used throughout this plan and its implementation period absent new information that warrants modification. Note that some of these population designations are updates of those identified in ODFW's ONFSR (ODFW 2005).

Table 2. Populations within SMUs which were assessed for viability. "yes" indicates a population. "---" indicates that a population is not present. "unknown" indicates that historical population status is not known. "out-of-SMU" indicates that a population is present but it is in a different SMU and is not addressed in the CMP. "*" indicates that a spring-run or summer-run life history variant is present. "TBD" means to be determined. Also note that Netarts is an additional potential historical chum population, and there are 21 coho populations in 5 strata.

Stratum	Basin/Population Area	Chinook	Spring Chinook	Chum	Winter Steelhead	Summer Steelhead	Cutthroat
North Coast	Necanicum	yes	---	*unknown*	yes	---	yes
	Nehalem	yes*	---	yes	yes	---	yes
	Tillamook	yes*	---	yes	yes	---	yes
	Nestucca	yes*	---	*unknown*	yes	---	yes
Mid Coast	Salmon	yes	---	*unknown*	yes	---	yes
	Siletz	yes*	---	*unknown*	yes	yes	yes
	Yaquina	yes	---	yes	yes	---	yes
	Alsea	yes*	---	*unknown*	yes	---	yes
	Yachats **Aggregate**	yes	---	---	yes	---	yes
	Siuslaw	yes	---	*unknown*	yes	---	yes
Umpqua	Lower Umpqua	yes	---	*unknown*	yes	---	yes
	Middle Umpqua	yes	---		yes	---	yes
	North Umpqua	---	yes	---	yes	yes	yes
	South Umpqua	yes	yes	---	yes	---	yes
Mid-South Coast	Tenmile	---	---	---	yes	---	yes
	Coos	yes	---	*unknown*	yes	---	yes
	Coquille	yes*	---	*unknown*	yes	---	yes
	Floras	yes	---	---	yes	---	yes
	Sixes	yes	---	---	yes	---	yes
	Elk	yes	---	---	*out-of-SMU*	---	*out-of-SMU*
Number of Populations		18	2	TBD (≥3)	19	2	19
Number of Strata		4	1	1	4	2	4

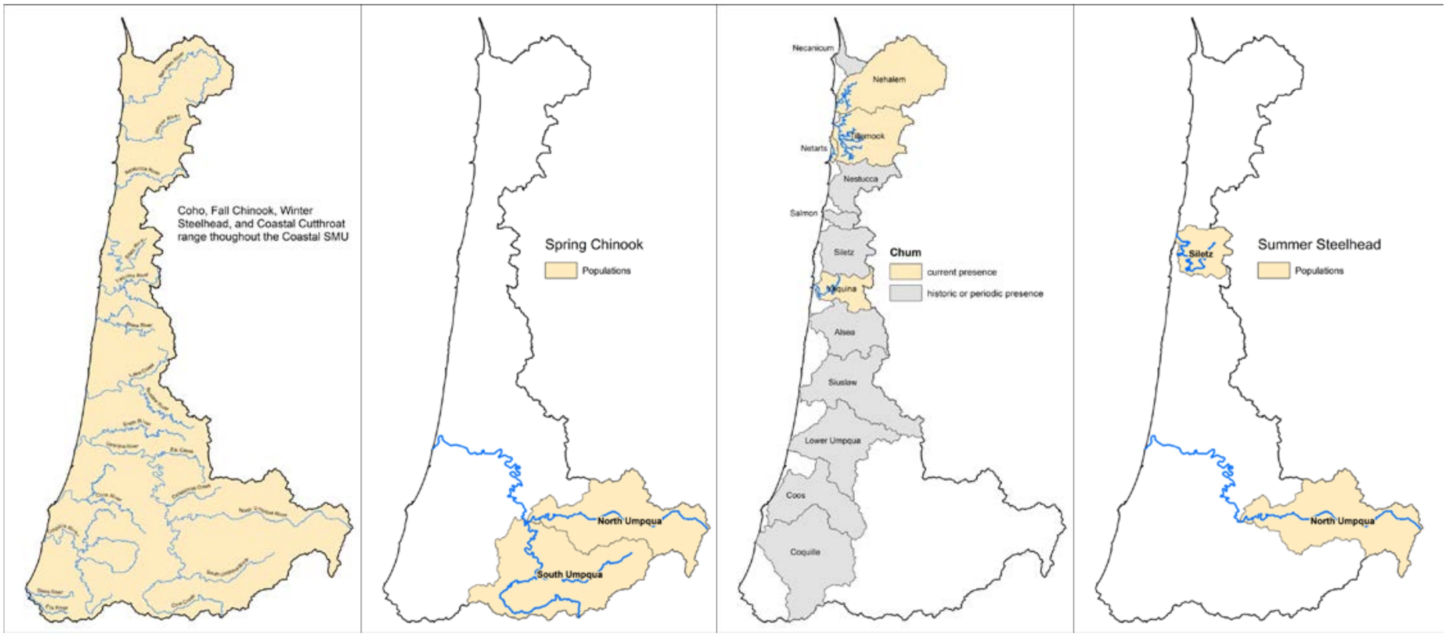


Figure 9. Population locations for the SMUs.

Unique Runs

- Nehalem: summer-run Chinook
- Tillamook: chum
- Siletz: summer steelhead
- Yachats Aggregate: winter steelhead
- Coastal lakes basins (especially Siltcoos, Tahkenitch, and Tenmile): coho
- North Umpqua: summer steelhead, spring Chinook, winter steelhead[6]

Other Direct Ocean Tributaries

In addition to those basins in which populations have been identified, there are numerous other small coastal direct ocean tributaries which support Chinook, chum, steelhead, cutthroat, and/or coho. These are identified in **Appendix I – Additional Background Information**. For convenience, all of these locations are collectively referred to as "NADOTs" (Non-Assessed Direct Ocean Tributaries).

Other Management Scales

Even though the population is the primary management scale called for in the NFCP, limitations in scientific information, the ability to monitor, and the ability to affect actions, as well as other management needs, require other management scales to be considered. SMUs constitute the largest scale for the CMP, and each has different species management needs. Another scale, the Stratum, consists of groupings of different populations; this scale is used for status assessment purposes, harvest management decisions, and monitoring. Many populations are also sub-divided into Management Areas, usually corresponding to distinct tributaries within a larger basin, for the purpose of making hatchery and harvest management decisions, and associated monitoring needs, at a finer scale than the populations. Finally, habitat guidance is framed in a non-species-specific approach at the Watershed scale, which includes smaller drainages within a population or management unit.

[6] A large percentage of North Umpqua winter steelhead migrate to the ocean at an older age (age 3) and also return at an older age (age 5 and older; ODFW, unpublished data), likely due to the cold water present in this Cascade Range tributary.

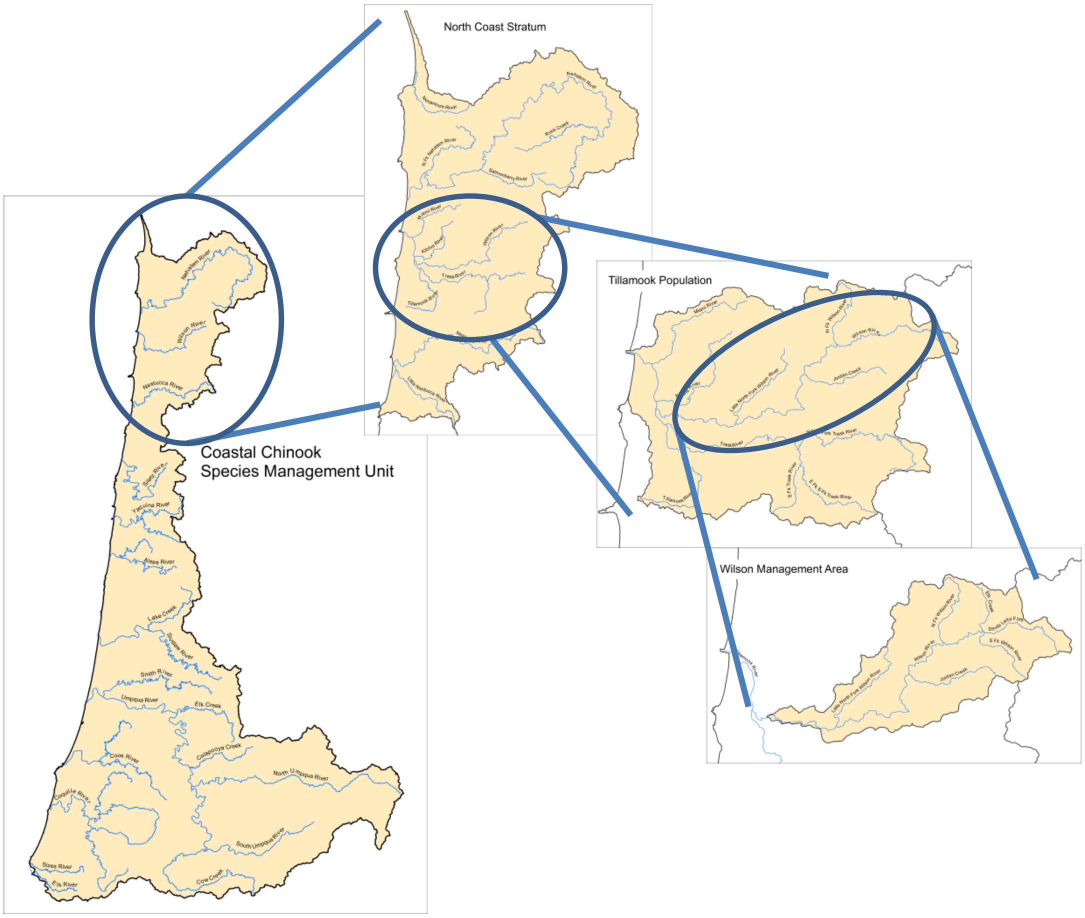


Figure 10. Nested spatial scales used in the CMP. SMUs were divided into strata, which contain populations, which contain management areas, which contain watersheds (not pictured).

<u>Basins</u>

In the Coastal area, population boundaries are generally defined by larger direct ocean tributaries, referred to as "basins". The only exceptions to this are the Yachats area, which includes several smaller direct ocean tributaries, and the Umpqua River, a single basin which is broken into four separate population areas given its size and different geographic features. In the CMP, "basin" refers to large rivers in which one or more anadromous salmonid populations are present (and in the case of the Umpqua, four population areas, each with multiple populations).

Table 3. Basin and population area descriptions. Abbreviations for land ownership: P=private; S=State; F=Federal. Abbreviations for land use: F=forestry; A=agriculture; U=urban.)

	Basin Size[a]	Estuary Size[b]	# SMUs[c]	# Mgmt Areas	Land Ownrshp (% P:S:F)	Land Use (% F:A:U)
Necanicum R	small	small	5	1	96.6 : 1.4 : 2.0	79.6 : 3.5 : 14.4
Nehalem R	large	medium	5	4	61.1 : 38.0 : 0.9	95.0 : 2.9 : 1.8
Tillamook	medium	large	5	6	33.2 : 61.6 : 4.7	89.6 : 5.8 : 3.5
Nestucca R	medium	medium	5	3	32.8 : 5.4 : 61.8	88.7 : 8.0 : 2.3
Salmon R	small	small	5	1	72.6 : 2.0 : 25.4	89.0 : 3.7 : 7.0
Siletz R	medium	medium	6	4	78.2 : 3.6 : 16.9	92.7 : 4.5 : 1.3
Yaquina R	medium	large	5	3	73.6 : 11.5 : 14.6	87.4 : 7.5 : 4.3
Alsea R	medium	medium	5	3	36.5 : 0.2 : 63.3	92.2 : 6.8 : 0.9
Yachats Aggregate	small	small	4	1	15.6 : 2.0 : 82.4	96,9 : 2.4 : 0.6
Siuslaw R	medium	medium	5	3	47.8 : 0.1 : 52.1	93.4 : 4.2 : 2.0
Lower Umpqua R	medium	large	5	3	48.9 : 6.2 : 44.9	90.7 : 7.6 : 0.9
Middle Umpqua R	medium	*N / A*	4	1	77.2 : 0.1 : 22.7	53.9 : 44.2 : 1.8
N Umpqua R	large	*N / A*	5	2	24.0 : 0.0 : 76.0	86.0 : 11.3 : 2.1
S Umpqua R	large	*N / A*	5	2	48.6 : 0.8 : 50.6	71.0 : 25.3 : 3.5
Tenmile Lk/Crk	small	small	3	1	57.5 : 36.6 : 5.9	77.0 : 8.1 : 6.6
Coos	medium	large	5	4	81.2 : 9.0 : 9.7	88.2 : 4.9 : 6.1
Coquille R	large	large	5	5	66.6 : 0.3 : 33.0	81.5 : 15.2 : 2.1
Floras/New R	small	small	4	1	93.5 : 2.3 : 4.2	70.5 : 25.7 : 2.3
Sixes R	small	small	4	1	71.1 : 0.7 : 28.2	94.7 : 4.8 : 0.1
Elk R	small	small	4[c]	1	19.6 : 0.0 : 80.4	91.4 : 4.8 : 3.0

[a] Basin Size: determined by total stream distance, with thresholds of 500 and 2,000 km between the three categories.
[b] Estuary Size: determined by total acres, with thresholds of 3,000 and 8,000 acres between the three categories.
[c] SMUs include coho and in Elk River include three species outside of the Coastal SMUs.

<u>Estuaries</u>

Largest: Coos, Tillamook
Smallest: Yachats, Tenmile, Sixes, Elk

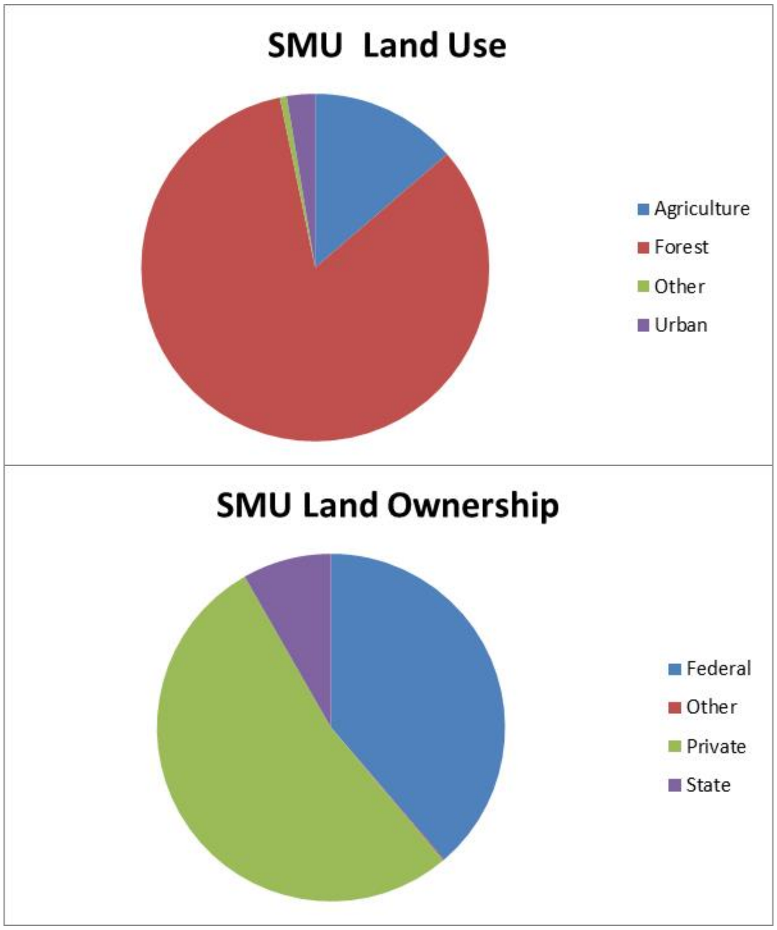


Figure 11. Land use and land ownership summaries for the Coastal planning area.

Fishing Preferences

As previously stated, ODFW contracted with Oregon State University's Survey Research Center to conduct opinion surveys of anglers and non-anglers who reside in Oregon west of the Cascade crest. A summary of how the surveys were conducted and their results can be found in **Appendix VI – Opinion Survey**. The survey assigned anglers, based on where they lived, to one of seven regions in Western Oregon. Four of the regions matched the areas that contain the four strata defined in the CMP (North Coast, Mid-Coast, Umpqua, and Mid-South Coast). The rest of western Oregon (outside of the plan area) was divided into three regions (North Coast Willamette Valley, Mid-Coast Willamette Valley, and Southern Oregon). Equal numbers of surveys were sent to randomly selected anglers in each of these regions. This approach allowed regional differences in how anglers responded to survey questions to be distinguished.

Based on the survey results, over half of all anglers (56%) who live in western Oregon (west of the Cascade crest) fished in coastal areas covered by the CMP. The proportions of anglers who fished on the coast were generally higher for those areas within the plan area and lower for those who lived outside of the plan area (Table 4).

Table 4. Percentage of surveyed anglers who fished in the bays and rivers covered in this plan - by region of residence.

Region	% of Anglers Who Fished in Plan Area
North Coast	62.4
Mid-Coast	81
Umpqua	76.9
Mid-South Coast	89
North Coast Willamette Valley	48.5
Mid-Coast Willamette Valley	63.4
Southern Oregon	28.3

The survey results indicated that western Oregon anglers fished over one million days in coastal basins (rivers and/or bays) covered in the CMP during 2012. The survey results also showed that some basins had much higher fishing pressure than others (Table 5).

Table 5. Estimated total number of days anglers fished in a basin (river and/or bay) in 2012.

Basin	Angler Days (all species)	Basin	Angler Days (all species)
Necanicum	13,682	Siuslaw	91,599
Nehalem	66,633	Umpqua	168,662
Tillamook	216,388	Tenmile Lakes/Creek	6,202
Nestucca	71,677	Coos	81,576
Salmon	25,589	Coquille	62,916
Siletz	68,511	Floras	1,352
Yaquina	28,595	Sixes	9,530
Alsea	76,874	Elk	14,922
Yachats Aggregate	3,879		

The results of the angler survey showed that anglers spent the most time fishing for fall-run Chinook, followed by winter steelhead (Table 6).

Table 6. Percentage of total days fished in 2012 that anglers fished for a salmon, steelhead or trout species/run.

Species/Run	% of total days	Species/Run	% of total days
Fall-run Chinook	38.3%	Summer Steelhead	6.3%
Winter Steelhead	28.6%	Cutthroat Trout	6.1%
Coho	12.0%	Chum	0.9%
Spring Chinook*	7.8%		

Current Status

Key Current Status Findings

- The overall condition of wild salmon, steelhead, and trout across the Oregon coast is remarkably good and the combination of wild and hatchery fish currently support robust retention and non-retention fisheries
- Wild Chinook, winter steelhead, and cutthroat can provide societal benefits and fishing opportunity, although gaps in data warrant management caution
- Wild summer steelhead and spring Chinook are unique and merit heightened management caution
- The true status of chum is not well understood

Overall Status Assessment Approach

The basic unit for status assessment is a salmonid population. Population delineation within the six SMUs addressed in the CMP has been previously described. For purposes of assessing population status across populations within the entire SMUs, as well as for making subsequent management decisions related to harvest, geographically similar and proximal populations are further grouped into strata. Populations, strata, and SMUs of Chinook, spring Chinook, chum, winter steelhead, summer steelhead, and cutthroat trout in Oregon's Coastal planning area are the biological units of this status evaluation.

The status assessment first determines which populations are viable and which populations are not based on measurable criteria that define viability relative to four biological Viable Salmonid Population (VSP) parameters. The VSP parameters are (McElhany et al. 2000): abundance, productivity, spatial structure, and diversity[7]. Once the viability of all populations is determined, the viability of the strata and the entire SMU can be assessed.

For each population, ODFW assessed the four VSP parameters as available data and information allowed. Each parameter's risk relative to the population's long-term viability was assessed on a scale of 1 to 5 so the parameters could be combined into a single viability score for the population. Criteria were developed for the score (or scores) in each parameter (described in **Appendix II – Current Status Methods and Results**), with 1 representing very low risk (i.e., high persistence) and 5 representing very high risk (i.e., low persistence). Given that the abundance and productivity parameters are often interrelated and difficult to separate as independent variables in their effect on a population's viability (i.e., abundance cannot be evaluated without the context of productivity, and vice versa), ODFW evaluated and scored these parameters as a single parameter (referenced as "A&P") through the use of spawner-recruit relationships and Population Viability Analysis (PVA) models.

When combining the four VSP parameters into a single score, the A&P parameter was weighted more heavily than the spatial structure (SS) and diversity (D) scores given that this parameter was generally the most direct quantitative evaluation of a population. A&P was weighted more heavily in two ways: directly in the equation combining all four parameters and by defaulting to the A&P score if the SS and D scores caused the population to appear more viable than indicated by the A&P score alone (i.e., SS and D scores only added to and did not alleviate viability "concerns", if present). The four VSP parameters were combined into a single score as the *greater* of the following (ODFW 2010):

$$2/3 * A\&P + 1/6 * SS + 1/6 * D$$

or

$$A\&P$$

In some populations, A&P data were unavailable. In these cases, the SS and D scores were simply averaged for the overall viability score. For chum, SS and D data were unavailable, and A&P scores were used for the overall score.

A population was considered viable if the resulting score was ≤ 2.5. The weighted average, based on each population's size classification used in the A&P assessment, of populations within a stratum was calculated to determine if the stratum was viable. A

[7] See **Appendix II – Current Status Methods and Results** for a detailed description of methods and results for the VSP parameter assessment.

stratum was considered viable if its score was also ≤ 2.5. SMUs were considered viable only if all (i.e., 100%) of the strata in the SMU were viable. These population, stratum, and SMU criteria assure that viable populations are spatially distributed across a viable SMU.

The viability score for an SMU was only one component used to determine its overall status. The completeness of data for VSP parameters, consistency in A&P PVA results where multiple models were used, and additional analyses relating to abundance trends (which are not directly assessed in a PVA model) are all items that were assessed in order to determine the confidence in an SMU viability score. Note that this "confidence assessment" was in addition to the statistical uncertainty which was incorporated directly into the A&P assessment, as well as the uncertainty about future conditions which was incorporated into setting the Desired Status for SMUs and populations. In addition to the viability results and confidence in the viability results, the level of threats and the intrinsic risk associated with having few populations (and limited range) within the planning area were also used to determine the SMUs final status (Table 7). Note that SMU status categories include designations within the state Threatened and Endangered List (OAR 635-100-0080 to 0160) and Sensitive Species List (OAR 635-100-0040). Note that these categories differ from those used in the 2005 Native Fish Status Report (ODFW 2005) given that they are based on long-term risk (i.e., the report contains an interim short-term risk assessment).

Table 7. SMU Status Categories, based on consideration of three different factors: viability results, confidence in results, and existing threats.

Considerations		SMU Status Categories					
		Strong	Strong – Guarded	Sensitive – Vulnerable	Sensitive – Critical	Threatened [a]	Endangered [a]
1) Viability	SMU	Viable	Viable	Viable	Viable or Unknown	Not Viable	Not Viable
	Strata	All Viable	All Viable	All Viable	All Viable or Unknown	≥1 Not Viable	≥1 Not Viable
	Population	Most Viable	Most Viable	Most Viable	Many Viable or Unknown	Some May Be Viable, Many Able to Persist Near-Term	Few or None Viable
2) Assessment Confidence		High	Lower	Varies	Varies	Varies	High
3) Threats, including Limited Range		Lower	Lower	Moderate Threats and/or Naturally Limited Range	High	High	High

[a] This designation is for State of Oregon purposes and does not imply or promote an association or consistency with status determinations under the federal ESA.

Strong SMUs are widely distributed, have little if any viability concerns across populations, high confidence in the status assessment, and a lower level of immediate threats that may affect viability in the future. The management approach for these SMUs allows for providing societal benefits and fisheries in a manner consistent with long-term viability.

Strong-Guarded SMUs are widely distributed, have little if any viability concerns across populations and a lower level of immediate threats that may affect viability in the future. However, either a lack of robust data relative to all VSP parameters or conflicting indications of viability warrant a cautious management approach when providing societal benefits and fisheries, especially with respect to potential threats and limiting factors.

Sensitive-Vulnerable SMUs have little if any viability concerns across populations but are naturally limited in their range within the planning area and/or have a moderate level of immediate threats that may affect viability in the future. Assessment confidence for these SMUs varies. A cautious management approach when providing societal benefits and fisheries, especially with respect to potential threats and limiting factors is warranted. Additionally, pro-active management of existing threats and limiting factors is warranted.

Sensitive-Critical SMUs are characterized by a high level of immediate threats that may affect viability in the future. The viability status may be either viable or unknown[8]. Assessment confidence for these SMUs varies. Pro-active management of threats and limiting factors is warranted.

Threatened[9] SMUs are not considered viable into the future, although individual populations may be viable and many may be able to persist in the near term, especially with pro-active management of threats and limiting factors. Assessment confidence for these SMUs varies and there is a high level of immediate threats that will affect viability in the future.

Endangered[10] SMUs are not considered viable into the future and few, if any, populations will be able to persist without prompt pro-active management of threats and limiting factors. Assessment confidence for these SMUs varies and there is a high level of immediate threats that will affect viability in the future.

SMU Results

Table 8 provides a general summary of the overall status results for each SMU, incorporating viability results and indicators of confidence into those results. See **Appendix II – Current Status Methods and Results** and Table A-II: 11 for specific abundance and productivity, spatial structure, and diversity viability assessment results for populations, strata, and SMUs, as well as a summary of indicators in viability result confidence and the overall current status for each SMU.

Table 8. Summary of viability results, indicators of confidence in results, and current overall status of SMUs. "N/A" indicates that an assessment was not able to be completed.

		Chinook[a]	Spring Chinook	Chum	Winter Steelhead	Summer Steelhead	Cutthroat
SMU Viability Results	Viable Populations	17	1	3	19	2	19
	Non-Viable Populations	1	1	1	0	0	0
	Populations with Unknown Viability	0	0	9	0	0	0
	Viable Strata	4/4	1/1	*N/A*	4/4	2/2	4/4
Indicators of Confidence in Results	Populations with Declining Trend	7	1	4[b]	2	0	*N/A*
	Populations with Incomplete Data	4	0	13	17	0	19
Current Overall SMU Status		Strong – Guarded	Sensitive - Vulnerable	Sensitive – Critical	Strong – Guarded	Sensitive - Vulnerable	Strong – Guarded

[a] Chinook had four populations with divergent viability results from two different Population Viability Assessment modeling efforts. Model averages are indicated in the SMU Viability Results section, but this also contributed to the Indicators of Confidence in Results for Chinook, as well as the Current Overall SMU Status.

[b] The three populations which were viable all had a positive trend, but the non-viable population and three other populations without enough data to complete a viability assessment had declining trends.

[8] This is due to the inability to complete a status assessment if there is a lack of information for all VSP parameters, an unknown historical population structure, or other assessment problems.

[9] This designation is for State of Oregon purposes and does not imply or promote an association or consistency with status determinations under the federal ESA.

[10] This designation is for State of Oregon purposes and does not imply or promote an association or consistency with status determinations under the federal ESA.

Chinook: Strong-Guarded

Viability assessments for all four VSP parameters were completed for most populations. The viability results indicated that the Chinook SMU is in good condition, with only one population (Elk River) considered non-viable. However, there were indicators that, although the SMU is viable, management warrants caution in order to maintain this viability. These indicators include four populations where one set of PVA results concluded the population was viable and another concluded the populations were not viable (Tillamook, Nestucca, Salmon, and Floras), indicating a level of uncertainty about the viability of these populations. Also, seven populations had a declining abundance trend over the data period used for the abundance and productivity assessment (1986-2011)[11]. Four populations did not have data to conduct an abundance and productivity assessment. Although threats exist for all Coastal SMUs, the information did not indicate there were imminent threats to the SMUs viability. The overall results indicate a "Strong-Guarded" status (per Table 8 and Table A-II: 11, with considerations identified in Table 7).

Note that Chinook abundance and productivity results do not include spring-run or summer-run life history variants where they are present. This is due to the inability to adequately account for them in the PVA models. With the models used, which are based on the expansion of peak counts, the fall-run component would continue to drive results as the most abundant run timing. Running separate models for spring-run and summer-run components would also not be appropriate, as these are not considered independent populations (note: it is possible that some may be considered independent with further genetic analyses).

Spring Chinook: Sensitive-Vulnerable

Viability assessments for all four VSP parameters were completed for both populations. North Umpqua spring Chinook were viable, though with a decreasing trend over the data period (1972-2010). South Umpqua spring Chinook had an extinction risk that indicated viability (<5%; McElhany et al. 2006) and an increasing trend over the data period (1972-2010)[12]. However, because this population is currently so small and the estimate of carrying capacity (*Neq*) was less than the Minimum Equilibrium Threshold (MET = 500), the PVA results did not pass the viability threshold and the population was considered non-viable (see **Appendix II – Current Status Methods and Results**). Both populations considered together were viable given the larger population size classification and strong viability results for the North Umpqua population. Although the SMU is viable, the one non-viable population, the one indicator of a lack of confidence in the results (i.e., decreasing trend for the North Umpqua), and the limited number of independent populations within the SMU warrant a "Sensitive-Vulnerable" status for the SMU. This status is different than currently identified on the State's Sensitive Species List (http://www.dfw.state.or.us/wildlife/diversity/species/docs/SSL_by_taxon.pdf), which will be updated based on this assessment when the list is revised.

Chum: Sensitive-Critical

Chum are currently present on the Oregon Coast in a few places consistently and in other places either in low numbers or only periodically. Although early commercial catch records indicate that chum were much more abundant 40 or more years ago than they are today, population-specific historical information on chum is limited. Given this, it is not possible to identify an historical population structure for chum because it is unknown which populations acted independently (warranting a full viability assessment) and which were not independent (in which case it is inappropriate to conduct an independent viability assessment). Only potential population areas were identified for chum, and a viability assessment was conducted only where there were enough data for a particular parameter. Only four chum locations had data on which to perform the abundance and productivity assessment. One of these populations was non-viable, and assumptions going into the PVA model for all four populations warrant a very cautious acceptance of the viable results for the other three. Note that historical population size classification and *Neq* are not applicable to chum abundance and productivity assessment because peak counts were used for the PVA which could not be expanded to abundances. There are peak count data for three other locations (Necanicum, Nestucca, and Siletz) for which a stock-recruit relationship and PVA analysis could not be developed, but which had enough

[11] See **Appendix II – Current Status Methods and Results** for a description of how the data periods were determined.

[12] This population has persisted at low levels since the 1940's and the current primary resting pool locations are within USFS land, which is protected from development.

information to indicate a declining trend. These results suggest that if these three locations were historically independent then they may be non-viable currently, possibly existing as dependent on other populations for continued occupancy in these locations. The other potentially-historical locations without any PVA or trend data are also currently likely dependent, or functionally extirpated (though there is no conclusion at this time about whether this is a change from the historical population structure).

The historical distribution of chum salmon along the Oregon Coast has not been well documented and there has been limited investigation into the population structure of chum salmon in Oregon, so it is not possible to assess the relationship between current and historical spatial structure or diversity of chum anywhere. Given the large amount of uncertainty regarding historical population structure and viability of chum and the likelihood that they have experienced significant declines in abundance and distribution in many areas, which also indicates a high level of threats to this SMU, chum status is "Sensitive-Critical". Chum do not warrant listing at this time on the state Threatened and Endangered List given the unknowns around historical population structure and distribution. Also, both genetic information (Small et al. 2011) and the National Marine Fisheries Service's (NMFS) management unit designation indicate that Oregon's Coastal chum are part of a larger Evolutionarily Significant Unit (ESU) which does not warrant listing under the federal ESA (NOAA 1998).

Winter Steelhead: Strong-Guarded

Abundance and productivity assessments were conducted on two populations, with one of those being represented by a sub-component of the population (i.e., Salmonberry within Nehalem). Both of these populations are viable, although both also had a slightly declining trend over the data period (1946 and 1973 to 2011 for the North Umpqua and Nehalem, respectively). All other populations are also considered viable based on spatial structure and diversity assessments. Given that all populations are viable but all of them also had an indicator of lower confidence in the results than is ideal, this SMU's status is "Strong-Guarded". This status is different than currently identified on the State's Sensitive Species List, which will be updated based on this assessment when the list is revised.

Summer Steelhead: Sensitive-Vulnerable

Both populations of summer steelhead are viable and have no indicators of concern with the viability results. However, the limited number of independent populations within the SMU requires an SMU status of "Sensitive-Vulnerable".

Cutthroat Trout

Given the prevalence of occupancy data and lack of abundance data, only spatial structure and diversity were assessed for cutthroat trout. Cutthroat are widely distributed and present, and all populations are viable. However, given the lack of abundance and productivity assessment, this SMU's status is "Strong-Guarded".

<u>Management Categories and Historical Context</u>

Populations (and thus the viability results) are affected by existing conditions within four Management Categories during the data period used in the assessment: 1) **Habitat** (tributary, estuary, and ocean), 2) interactions with **Other Species** (e.g., pathogens, prey, competitors, and **predators**), 3) **Fishing/Harvest** levels and pressures, and 4) the genetic and ecological influence of **Hatchery Fish**. If these conditions persist into the future there is an assumption that the SMU status will be maintained, subject to the following:

a) actions contained in the CMP are intended to change (within the State of Oregon's collective control) the future condition of the Management Categories in order to improve the populations' viability, increase confidence in future assessments, and reduce threats in order that populations will become stronger and contribute to increased fishing opportunity,

b) potential threats and benefits that the Management Categories currently exert on the SMUs manifest themselves in the VSP parameters of the viability assessment, and were therefore not independently assessed as part of that viability assessment, and

c) the historical context of the populations is only assessed in the SS and D parameters of the viability assessment, and, except for determining population size classification for the PVA models, the historical A&P context for a population is not a factor in the A&P score. Therefore, *the viability and current status designation of a population, stratum, or SMU does not imply any condition relative to historical abundance levels* (which are generally assumed to be greater than they are currently given anthropogenic impacts within one or more of the Management Categories through time).

Summary

Overall, with the possible exception of chum, all SMUs are currently viable and should allow for societal benefits. However, there is cause for cautious management to protect and improve these populations and to continue and improve monitoring due to indicators about confidence in the viability results or their naturally limited range and number of populations within the Coastal planning area. Chum require protection, improvement, and a greater understanding in all locations in order to better assess SMU status and to improve from its currently presumed critical condition.

Desired Status and Limiting Factors

Key Desired Status Outcomes

- The overall condition of wild salmon, steelhead, and trout across the Oregon coast is viable and improved for all populations, with all providing societal benefits and fishing opportunity
- Chinook, winter steelhead, and cutthroat are desired to provide societal benefits and fishing opportunity, with data gaps filled allowing management confidence
- Summer steelhead and spring Chinook are improved and remain unique with heightened management protection
- The true status of chum is understood, and habitat is protected and restored

Key Limiting Factor Outcomes

- Although not generally identified as primary or secondary limiting factors to SMUs or populations, hatchery programs are so extensive that a reduction in the number of Management Areas stocked is merited to reduce conservation risk
- Life cycle harvest rates are thought well within conservation needs, except that rates for Chinook are high enough to merit attention
- Predation by non-native fish, marine mammals, and birds is something that must be better understood and managed
- Watershed function is the most common factor limiting all SMUs

Desired Status

Goals for SMUs are driven both by the ODFW mission "*to protect and enhance Oregon's fish and wildlife and their habitats for use and enjoyment by present and future generations*" and the Native Fish Conservation Policy goals (OAR 635-007-0503) to:

1) *prevent the serious depletion* of any native fish species by protecting natural ecological communities, conserving genetic resources, managing consumptive and non-consumptive fisheries, and using hatcheries responsibly so that naturally produced native fish are sustainable,
2) maintain and restore naturally produced native fish species, taking full advantage of the productive capacity of natural habitats, in order to *provide substantial ecological, economic, and cultural benefits* to the citizens of Oregon, and
3) *foster and sustain opportunities for sport, commercial, and tribal fishers* consistent with the conservation of naturally produced native fish and responsible use of hatcheries.

Based on these goals, the desired status for the SMUs covered in the CMP is first, to assure that all populations that are currently viable remain so and that those not viable become so, and, second, to have all populations viable and productive enough that they can provide greater ecological and fisheries benefits than is currently being provided. In terms of the abundances of wild salmon, steelhead and trout (see **Appendix III – Desired Status and Limiting Factor Metrics and Goals** for details), the CMP calls for significant increases (10-200%) in the average abundances as compared to current levels. Achieving this desired status will result in healthy and thriving SMUs that support a healthier environment and stronger, more consistent fisheries.

The "Gap"

To accomplish these goals, individual populations require improvements in abundance, productivity, spatial structure, and/or diversity through reductions in risk associated with the Management Categories that are affecting the populations. What is referred to as the "gap" is the difference in VSP metrics (e.g., abundance) between Current Status and a "Desired Status" for a population, which are the goals relative to VSP metrics. The populations' Desired Statuses are driven by a Desired Status for each SMU. The CMP identifies both SMU and population Desired Statuses (called "goals"), as well as limiting factors within Management Categories affecting the gap. Limiting factors are identified in order to determine general management strategies and more specific actions within Management Categories that are consistent with achieving, and *will allow for* achieving, the Desired Status (which includes improved fishing opportunity).

The overall goal for the SMUs is to have all populations be highly viable (i.e., with a viability score ≤1.5 and ER<1%; especially currently non-viable populations) so they can provide societal benefits and fishing opportunity. To achieve this goal, the CMP seeks to guard against future threats by protecting and improving the status of all populations and life history variants and reducing the lack of confidence associated with future viability results. These goals are represented generally in Table 9 (specific measurable criteria for primary biological attributes, including those for abundance, are in **Appendix III – Desired Status and Limiting Factor Metrics and Goals**, Table A-III: 1 and Table A-III: 2).

The overall desired status classification of three SMUs is intended to improve (Chinook, chum, and winter steelhead). The basis for improvement of Chinook and winter steelhead is two-fold: first, there needs to be improved confidence, with more data, in the next assessment, and second, the populations need to become more productive and achieve their abundance goals to provide the greater opportunities inherent in the Desired Status. The basis for improvement of chum is a better understanding of the historical population structure and SMU viability, protection of existing habitat, and restoration of other habitat to foster an increase in chum distribution and abundance. The status classification for spring Chinook and summer steelhead is “unable to improve” given the naturally limited number of populations in the SMUs, although within their current classifications higher productivity and abundance targets are identified and achievable. The remaining SMU (cutthroat trout) is expected to maintain its strong but guarded status because obtaining complete VSP data (i.e., abundance estimates) is not feasible. The SMU-scale improvements indicated in Table 9 (i.e., changes in the number of viable populations, number of populations with a decreasing abundance trend, and the number of populations with unknown viability or incomplete data) will be achieved by improvements of individual populations relative to the VSP parameters, as affected by actions within Management Categories, and improvements in the data collected for populations. See **Appendix III – Desired Status and Limiting Factor Metrics and Goals** for details about improvements in specific metrics associated with VSP parameters and Management Categories. See **Appendix V – Monitoring Approach** for a description of monitoring improvements.

Table 9. Summary of desired viability and confidence goals for SMUs. “TBD” indicates that uncertainties need resolution before goals can be determined.

		Chinook	Spring Chinook	Chum[a]	Winter Steelhead	Summer Steelhead	Cutthroat
SMU Viability[a]	Viable Populations	18	2	TBD (≥3)	19	2	19
	Non-Viable Populations	0	0	TBD	0	0	0
	Unknown Viability	0	0	0	0	0	0
Indicators of Confidence in Viability	Populations with Declining Trend	0	0	0	0	0	N/A
	Populations with Incomplete Data	0	0	TBD	0	0	19
Desired Overall SMU Status		Strong	Sensitive – Vulnerable	Sensitive – Vulnerable[b]	Strong	Sensitive – Vulnerable	Strong – Guarded

[a] A key uncertainty for chum is historical population structure and distribution. Until this is addressed, as called for in this plan, population-specific goals cannot be set.

[b] If additional historical populations are identified within those of unknown viability, their restoration would allow for the Desired Status to be Strong. The Desired Status of Sensitive-Vulnerable is based on the limited number of currently identified populations.

Limiting Factors

To achieve the SMU goals and improvements in VSP metrics, general limiting factors associated with four Management Categories are identified. Limiting factors are defined as biological, physical, or chemical conditions altered to such an extent by anthropogenic (i.e., human-related) activities that they impede achievement of population biological performance goals. These goals are measured through the biological VSP parameters: abundance, productivity, spatial structure, and diversity. Generally, each limiting factor has the potential to affect fish population performance through any or all of the four VSP parameters. Limiting factors were identified based on professional judgment of local biologists and co-managers, informed by data interpretation and experience. Table 10 describes different limiting factors within the Management Categories, and Table 11 identifies limiting factors for the SMUs. See **Appendix III – Desired Status and Limiting Factor Metrics and Goals** for details about the metrics associated with limiting factors within the Management Categories.

Table 10. Description of limiting factors. Descriptions are from the perspective of interactions or effects on naturally-producing native fish. Note that habitat-based limiting factors may include estuary habitat. Limiting factors in the ocean are not addressed here; even though these have a large effect on populations, there is no ability to control these through local management actions.

Management Category	Limiting Factor	Description
Hatchery Fish	Genetic Introgression	inter-breeding with hatchery fish resulting in reduced population fitness, reproductive success, or productivity
	Predation	consumption by hatchery fish
	Competition	interaction with hatchery fish for a limited environmental resource (i.e., food, refuge, spawning gravel)
Fishing / Harvest		reduction in spawners through removal (intentional or not) in ocean, near-shore, estuary, and tributary fisheries, as well as influence on population demographics or diversity through selective pressure on potential spawners
Other Species	Predation: Pinnipeds	consumption by seals or sea lions (collectively referred to as "pinnipeds"), including injury affecting fitness or reproductive success
	Predation: Avian	consumption by birds
	Predation: Other	consumption by other animals
	Pred.: Non-Nat. Fish	consumption by non-native fish
	Comp.: Non-Nat. Fish	interaction with non-native fish for a limited environmental resource (i.e., food, refuge)
	Competition: Other	interaction with other organisms for a limited environmental resource (i.e., food, refuge)
	Hybridiz.: Non-Nat. Fish	inter-breeding with non-native fish resulting in reduced population fitness, reproductive success, or productivity
	Food Source	availability of food, including prey, for nutrition and growth
	Disease	pathological condition resulting from infection
	Other	other factors associated with a biotic interaction that is not included on this list
Habitat: Water Quality	Temperature	altered physical, chemical, or biological water characteristics (e.g., temperature, dissolved oxygen, suspended sediment, pH, toxic pollutants in the water column and sediment, etc.)
	Toxic Pollutants	
	Sedimentation	
	Other	
Habitat: Water Quantity	Low	altered hydrology (i.e., timing and magnitude of flows)
	Flashy Hydrology	
Habitat: Access	Inundation	impaired access to spawning and/or rearing habitat (e.g., submerged due to impoundment, instream obstructions, off-stream diversions, developed or inaccessible off-channel [peripheral] habitat such as estuaries, wetlands, side-channels, and floodplains, etc.)
	Upstream	
	Downstream	
	False Attraction/Injury	
	Peripheral Connection	
Habitat: Physical	Instream Structure	altered structure and complexity of physical habitat within the bed and banks of the stream channel (e.g., large wood, boulders, beaver dams, and sinuosity affecting the composition of pools, riffles, and glides)
	Gravel	altered sediment routing and composition of channel substrate, affecting spawning ability, egg incubation, and food source production

Table 11. Limiting factors affecting SMUs. "❶" indicates a primary limiting factor, believed to contribute significantly to the gap between current and desired status. "②" indicates a secondary limiting factor, believed to contribute to a lesser degree to the gap between current and desired status. "?" indicates a risk addressed in the CMP or a potential limiting factor which requires additional information or assessment. Indicated limiting factors generally apply to all basins in which the SMU has a population unless only specific basins are noted in parenthesis. Other limiting factors may affect populations within the SMU, but primary and secondary limiting factors warrant priority to close the gap.

		Chinook	Spring Chinook	Chum [c]	Winter Steelhead	Summer Steelhead	Cutthroat
Hatchery Fish	Genetic Introgression	❶ (Elk); ② (Salmon); ? (if present)	? (if present)		? (if present)	? (if present)	
	Predation			?			
	Competition	?	?	?	?	?	
Fishing / Harvest		②	②				
Other Species	Predation: Pinnipeds	?					
	Predation: Avian	?					
	Predation: Other						
	Pred.: Non-Nat. Fish	❶ (Umpqua, Tenmile/Lakes); ② (Coquille)					
	Comp.: Non-Nat. Fish						
	Competition: Other						
	Hybridiz.: Non-Nat. Fish						
	Food Source						
	Disease						
	Other		② (S Umpqua: holding disturbance)				
Habitat: Water Quality	Temperature	❶ (Umpqua, Tenmile/Lakes, Floras, Sixes, Elk); ② (all others)					
	Toxic Pollutants		② (S Umpqua)				
	Sedimentation	②	②	❶	②	②	
	Other						
Habitat: Water Quantity	Low	②	❶ (S Umpqua)				
	Flashy Hydrology		② (S Umpqua)				
Habitat: Access	Inundation						
	Upstream			②	②	②	②
	Downstream						
	False Attraction/Injury						
	Peripheral Connection	❶					
Habitat: Physical	Instream Structure	❶					
	Gravel	❶ (S Umpqua ChS); ② (Nehalem; Tillamook; Yaquina; Alsea; Middle, N, and S Umpqua; Coos; Coquille)					

Hatchery Fish have the potential to cause either genetic or ecological (i.e., competition or predation) impacts on any population with which they spatially and temporally overlap (Araki et al. 2008; Buhle et al. 2009; Chilcote et al. 2011). However, specific effects of Coastal hatchery programs have not been systematically assessed[13]. Although there are no chum hatchery programs, other hatchery fish may predate upon or compete with them.

Fishing/Harvest is a secondary limiting factor for Chinook and spring Chinook, which are caught in ocean and tributary fisheries. Other SMUs have limited fishing-related impacts because harvest is not allowed or there is little effort directed toward harvest.

[13] Information exists that hatchery winter steelhead stray onto spawning grounds in some locations, although exact rates are difficult to assess because few fish are seen during redd surveys, those that are seen are alive and difficult to positively identify as hatchery or wild, and this information has not yet been analyzed to account for allowances of more hatchery fish near rearing and release locations (per Table A-III: 4).

Predation due to pinnipeds and birds (principally cormorants) is also thought to have impacts across all SMUs to some degree at some life history stage, although population-level impacts (i.e., effect on abundance and viability) are not well understood at this time. Predation by non-native fish is an issue in several locations as well.

Generally, **Habitat** limiting factors have impacts across all SMUs at some life history stage. These limiting factors also tend to be similar across all of the basins to varying degrees. In particular, the loss of both peripheral stream connections (i.e., access to estuarine, wetland, side-channel, and floodplain habitat) and instream structures and complexity (i.e., large wood, boulders, sinuosity) are prevalent across all SMUs and basins. Estuary habitat conditions are especially important for Chinook and chum juveniles that rear for extended periods in the estuary. Water temperature, sedimentation, upstream passage (for SMUs that have wider distributions within basins), and the availability of gravel (e.g., O'Connor et al. 2009) are also generally issues.

Limiting Factors for Non-Viable Populations

Elk River Chinook – Estuary and lower river rearing habitat (peripheral connection and instream structure) and hatchery fish are primary limiting factors. Harvest (especially in low abundance years) is a secondary limiting factor.

South Umpqua Spring Chinook – Lack of spawning gravel is a primary limiting factor for this population. The lack of instream structures to capture and hold gravels in mainstem areas allows migrating gravel to move through these areas and makes some spawning beds susceptible to scouring. Water temperature and quantity (i.e., low flows) are also primary limiting factors and are affected by changes in peripheral connections and instream structure. Non-native fish predation is another primary limiting factor. Harvest, disturbance of holding pools, toxic pollutants from mining, and sedimentation also affect this population.

Limiting Factor Confidence

Given that interactions between salmon and trout, other species, and their habitat are complex, it is difficult to precisely judge the relative importance and exact limiting factor that produces a life stage "bottleneck" which limits abundance across other life stages. Primary limiting factors may also vary spatially and temporally. To account for some level of uncertainty associated with the limiting factor analysis, the CMP identifies limiting factors within broad categories ("primary", "secondary", "potential") in which there is a higher level of confidence. In addition, the management approach is to try to address all primary and secondary limiting factors (in priority order) and to seek a better understanding of the unknowns. As localized data are available, this will help determine more specific actions to undertake. In addition to the uncertainty about the limiting factors, there are different abilities to affect change in the different Management Categories. Habitat actions in general have the most uncertainty around them given the large scope of restoration that is needed, other societal benefits that may conflict with the needs of fish, the voluntary nature of much restoration work, the dispersed management authority for habitat across many entities, and the wide range of land ownership in which fish reside.

A Note on Toxins

The effects of toxin pollution from anthropogenic chemical compounds (pesticides, industrial effluent) as a limiting factor for salmonid populations has received less attention than physical habitat restoration (NRC 1996). While acute pollution events such as toxic spills have a clear and direct mortality impact, examining the indirect effects at appropriate spatial scales must overcome the ecological complexity of exposure routes across trophic groups, time, and space, and the combinatorial toxicity of co-occurring pollutants from both point and non-point sources (see reviews in Macneale et al. 2010 and Ross et al. 2013). In addition, it is now recognized that most chemical toxins affect individual fish health and populations through protracted and convoluted biological processes. These include effects at low concentrations that alter metabolism and behavior, influence sexual differentiation, degrade immune function, and limit growth and development (Ross et al. 2013, Baldwin et al 2009). The result is a reduction in fitness that can have consequences for population performance (e.g., increased vulnerability to disease and predation, pre-spawn mortality, and homing ability).

Given the complexities noted above, the relative role of toxins as a limiting factor on salmonid performance is poorly understood. Better integration of ecological, biological, and environmental toxicology disciplines will likely help guide strategies for mitigating the indirect effects of pesticides (Macneale et al. 2010, Ross et al. 2013). Given the 1) current state of the ecotoxicology science, 2) existing pollution abatement policies, 3) foreseeable economic reliance on pesticides, and 4) existing land-use infrastructure (road networks, urban areas, water withdrawals, etc.), ODFW believes a pragmatic exposure reduction strategy for fish is to optimize actions that control toxins at their source, and to buffer aquatic systems with natural features (riparian zones, wetlands) and artificial features that are proven to mitigate urban run-off (rain gardens, etc.). A combination of these actions will lessen toxin transport to aquatic systems and decrease the exposure to fish.

Management Actions

To achieve the Desired Status goals of the CMP it will be necessary to address those limiting factors identified for species and populations. The highest priority conservation goals in the CMP are to address the limiting factors in the two populations found to be non-viable (Elk fall-run Chinook and South Umpqua spring Chinook) and to ensure that the status of the chum salmon SMU improves to a greater level of viability. These will be addressed in several overarching ways.

Pilot Implementation Programs

For the Elk River fall-run Chinook population, ODFW will implement a Pilot Implementation Program focused on the primary limiting factors identified (estuary/lower river habitat and hatchery fish on the spawning grounds) and on evaluating the success of the actions implemented to address them. The intent is to implement this pilot program immediately after the CMP is approved to improve the health of the population as soon as possible. All new actions and projects will be contingent on available funding and staff. There is a greater likelihood of improving the productivity of the wild fall-run Chinook population in the Elk if both limiting factors are addressed at the same time. ODFW is committed to reducing the level of naturally spawning hatchery fish through a range of actions including reducing hatchery releases, physically removing hatchery adults prior to spawning, and increasing the level of harvest of the hatchery fish. The Oregon Hatchery Research Center will be enlisted to help develop and test techniques to get more hatchery fish entering the hatchery trap. Local groups, including Kalmiopsis Audubon Society, the South Coast Watershed Council, and landowners in the lower river have worked cooperatively to develop a priority list of habitat actions that are focused on improving the habitat in the lower river and estuary. ODFW helped to develop this priority list and will strongly support efforts to fund and implement all elements of the action plan. ODFW will also prioritize maintaining into the future adequate monitoring in Elk River in order to assess the effectiveness of the actions to reduce spawning hatchery fish and to detect improvement in the wild fall-run Chinook population's productivity.

For the South Umpqua River spring Chinook population, ODFW will implement a Pilot Implementation Program focused on the limiting factors identified (spawning gravel, water temperature and harvest) and on evaluating the success of the actions implemented to address them. As with the Elk River pilot program, the intent is to implement actions in the South Umpqua immediately after the CMP is approved to improve the spring Chinook population as soon as possible. All new actions and projects will be contingent on available funding and staff. Improving the productivity of the population through both better habitat and lower mortality from the in-river fishery increases the chances that its health will improve at a more rapid pace than if only one of the factors is addressed. ODFW has taken steps to address harvest by previously eliminating harvest in the South Umpqua and reducing retention limits on wild spring Chinook in the Umpqua mainstem fishery with a sliding scale to allow adjustments based on trends in abundance. ODFW is also committed to supporting and facilitating the implementation of habitat restoration projects in the upper South Umpqua that are intended to reduce the limitations on the productivity of the spring Chinook population. ODFW will work with the US Forest Service, the Cow Creek Band of Umpqua Tribe of Indians, Partnership for the Umpqua Rivers watershed council, Douglas County, local landowners, and others shortly after plan adoption to prioritize the actions identified in watershed action plans developed by the US Forest Service (majority landowner of major spring Chinook spawning and rearing habitat in the Upper South Umpqua River) and others that will most benefit South Umpqua spring Chinook. ODFW will also prioritize, in cooperation with the US Forest Service, maintaining into the future adequate monitoring in the South Umpqua River in order to assess the effectiveness of the actions to reduce harvest impacts and to detect improvement in the wild spring Chinook population's productivity.

Chum Restoration Strategy

Given the poor current status of the chum SMU (Sensitive-Critical), the lack of information on current abundance, population structure, and historical distribution, and the restricted spatial structure and abundance of provisional chum populations, ODFW is committed to a restoration effort for chum. This includes a number of initiatives. First, to better understand the current distribution and abundance of chum in the planning area, existing monitoring efforts and results will be analyzed to map potential chum "hot spots" (i.e., with annual or periodic consistent returns and suitable habitat) and incorporate new "standard" chum survey sites (i.e., which are annually surveyed). Second, with additional funding, ODFW will further expand monitoring and research efforts for chum; beyond improvements in current incidental efforts, there is a need to better understand the chum population structure, to get more spatially extensive information on current and potential chum spawning sites, to identify sites for restoration and preservation, and to collect data for future status assessments. This entails conducting molecular genetic studies to potentially define independent and dependent chum populations and to verify the amount of gene flow or dispersal occurring between them. It also entails additional on-the-ground monitoring to identify existing and potential chum spawning habitat. This monitoring will be executed strategically, leveraging another effort for chum restoration. Current efforts to re-establish chum in tributaries of the lower Columbia River will provide key information that can be used to better understand habitat factors limiting coastal chum SMU production. ODFW assumes that chum salmon are exposed to many of the same habitat factors as other salmonid species, but given their unique life history, they also have two habitat requirements that limit their distribution. Chum are known to seek upwelling ground water for spawning and incubation (Giest et al. 2002, others), and juveniles rear in estuaries/tidal wetlands after a very short residence in natal streams. A habitat suitability model being developed for chum in the Lower Columbia River will be applied to coastal basins to identify areas that potentially have these and other characteristics to support chum spawning and egg incubation. The habitat suitability model will be used to identify candidate sites or streams that can be monitored for chum reproduction, and if verified, the areas will be evaluated for finer-scale attributes of habitat limiting factors to determine if restoration or protection is needed or feasible.

A third chum restoration initiative entails strategically protecting and restoring chum habitat based on current information and results of the first two initiatives. Although little is known about the metapopulation dynamics of coastal chum populations, the current structure looks like it is derived from large variation in habitat quality and patch size. The Tillamook basin appears to contain a large patch of good quality habitat and supports a source ("mainland") chum population that is relatively resistant to extinction. Sub-ordinate source populations with good habitat but moderate patch sizes are likely the Nehalem to the north and the Nestucca, Siletz and Yaquina to the south. Source populations are probably fundamental to the persistence of the metapopulation (SMU). Other basins appear to have smaller habitat patches of moderate to poor quality that cannot support populations with positive growth rates (these are either "sink" or "island" patches), and therefore have high population turnover due to localized extinctions and re-colonization from source populations. Therefore the larger SMU habitat strategy for chum will be to facilitate "risk spreading" by promoting north-south dispersal of chum across a heterogeneous coastal Oregon landscape. The first priority is protecting existing chum productivity by protecting good upwelling habitat in lower reaches of north and mid-coast streams that support current source population strongholds, and possibly expanding the patch size by improving the connectivity of usable habitat within the source population areas (through removal or improvement at barriers [e.g., tide gates, culverts]) or creation/restoration of functional habitat within currently accessible area. Once these source areas have been stabilized, restoration and rehabilitation of presumptive sink basins (patches) should occur in a spatially outward direction from source areas. This implies that dispersal and re-colonization are most likely to occur in sink basins in closer proximity to source basins. Once the quantity and distribution of suitable chum habitat has been determined in source and sink habitats and the ability to protect and restore its use has been documented, ODFW will work with other appropriate entities, including watershed councils, landowners, and funding agencies, to identify goals and implement on-the-ground projects.

Finally, the last initiative entails implementing conservation hatchery programs if successful restoration work does not improve the local abundance of chum. This work will proceed only if other efforts do not achieve results, and it is not expected to occur prior to the next status assessment for chum.

To address the limiting factors causing the gap between Current and Desired Status, the CMP identifies short- and long-term strategies and actions for the appropriate Management Categories, and these are summarized in the following sections. The habitat actions taken to implement the habitat strategies will not only help achieve the Desired Status for the salmon, steelhead and trout covered by the CMP, they will also be beneficial to all other native fish species residing in these streams. Those actions taken to implement the hatchery, harvest and predation strategies should have very little impact to other native fish species present.

Hatchery Fish Actions

> **Management Strategy:** *Manage hatchery programs to provide optimal harvest opportunities while being consistent with Desired Status targets for wild populations identified in the CMP.*
>
> **Management Strategy:** *Manage for wild fish emphasis or hatchery fish programs in the appropriate Management Areas as outlined in Figure 13 of the CMP and obtain Commission approval for starting new or eliminating existing hatchery programs in a Management Area relative to those in Table 13 and Table 14 of the CMP (excluding educational and research programs).*

Hatchery programs, consistent with their original intent, are vital to providing fishing opportunity and supplementing harvest of wild fish. ODFW and volunteers within ODFW's Salmon and Trout Enhancement Program (STEP) are operating Coastal hatcheries at or near their capacity. These hatcheries currently produce almost 6 million smolts/pre-smolts per year.[14] The CMP calls for a slight increase to over 6.3 million smolts/pre-smolts per year[15], with new programs identified in several locations (see the following sections below for specifics: **Detailed Hatchery Fish Actions** and **Description of Hatchery Fish Actions**). However, the CMP also recognizes the growing body of scientific information that indicates hatchery fish can pose a risk to wild fish populations. Thus, in addition to the increase in production and new programs, the CMP identifies changes to hatchery programs intended to lower the potential risk. This will be accomplished primarily by shifting some hatchery programs to nearby areas, designating areas where hatchery fish will not be released, and by setting allowable levels of spawning hatchery fish in areas where hatchery fish are released (see the following sections below for specifics: **Detailed Hatchery Fish Actions** and **Description of Hatchery Fish Actions**, as well as **Appendix III: pHOS Targets**).

Addressing the Risk from Hatchery Fish

Many studies over the past 25 years have found that hatchery produced salmon and steelhead have a poorer ability to reproduce successfully in the wild than naturally produced fish (e.g., Leider at al. 1990, Fleming and Gross 1993, Araki et al. 2007, Ford et al. 2012). This lower reproductive success in the wild has been documented to occur with domesticated hatchery stocks as well as hatchery stocks using a wild broodstock. Some studies have found that increasing levels of hatchery salmon and steelhead spawning in the wild causes the productivity of wild populations to decline (Chilcote 2003, Buhle 2009, Chilcote et al. 2011). These studies do not identify the mechanisms causing this relationship, but it can occur through ecological interactions (e.g., competition for limited space or resources, predation, predator attraction) or genetic interactions (e.g., passing on maladaptive traits which were not selected against in the hatchery environment[16]). As a result of these various studies, some scientific panels (WLC-TRT 2007, ICTRT 2007, HSRG 2009) have recommended that efforts be made to keep hatchery fish from spawning with wild fish when the program's goal is to provide for harvest.

Reducing the productivity of wild populations can reduce their contribution to ecosystem health and fisheries, as well as jeopardize their sustainability. Based on the results of these past studies, ODFW concludes that hatchery salmon and steelhead programs constitute a risk to the conservation of wild salmon and steelhead populations, but this risk can be effectively managed to keep the risk from significantly impacting wild population conservation. How much risk a particular hatchery program has on a particular population is difficult, if not impossible, to determine without conducting a lengthy and very complicated study of the impact in one particular location. The level of risk imparted on wild fish from hatchery fish appears to vary, and the level of hatchery risk that can jeopardize the persistence of a wild population is not likely to be consistent from population to population, or hatchery program to hatchery program.

ODFW has limited ability to assess the risk that current hatchery programs have on wild populations in the planning area. The current monitoring of Chinook in most basins only surveys a few stream segments that may not be representative of what is occurring throughout the basin. For winter steelhead, spawning surveys have been conducted randomly since 2003 but at a coarser scale than individual basins. As a result of these limitations, ODFW has used what information is available and

[14] An additional 500,000 unfed fry, excluding those for educational purposes, are also produced each year.
[15] This includes the potential need for some new rearing or acclimation facilities, which are described elsewhere in the CMP.
[16] It is a paradox that the purpose of raising fish in a hatchery environment is to provide a survival increase over a portion of development. By definition this is the removal of natural selection pressures, which potentially allows maladaptive traits (relative to existence in the wild environment) to occur.

professional opinion to assess the hatchery risk (see **Desired Status and Limiting Factors**) and has identified monitoring needs to improve information in this area (see **Appendix V – Monitoring Approach**).

ODFW believes that hatchery risk needs to be balanced across populations and SMUs. Inherent in the CMP are the assumptions that some low level of hatchery risk will not jeopardize the sustainability of a wild population and that an SMU can have some populations with a greater potential risk as long as the number of such populations is low and they are distributed widely across the SMU's range. Hatchery risk should be considered in the context of other risks facing populations and SMUs, as well as the importance of the wild fish to fisheries or the persistence of the SMU.

Hatchery Programs[17] and Wild Fish Emphasis Areas

Table 13 identifies all of the Management Areas defined in the CMP and shows the level of hatchery fish releases for the Management Areas. Hatchery fish for harvest opportunities will be provided in those Management Areas identified to receive hatchery fish. While the management direction will be to provide hatchery fish for harvest, it will not be at the expense of the long-term viability of the wild populations residing in those Management Areas. For example, the Nestucca River has healthy Chinook and winter steelhead populations, as well as important hatchery programs; the objective in this situation is to make sure that wild populations remain viable and productive while maintaining the hatchery programs that provide an additional, quality fishing opportunity. The targets for the proportion of naturally spawning hatchery fish on the spawning grounds (pHOS) identified in Table A-III: 4 are intended to prevent the risk from hatchery programs being so great that the wild populations' viability is jeopardized. As described in **Appendix III – Desired Status and Limiting Factor Metrics and Goals: pHOS Targets**, ODFW will be adaptively managing hatchery programs to achieve pHOS targets, but the true management objective is to ensure adequate productivity and viability of wild populations, which will be periodically assessed (see **Implementation**) along with the adequacy of the pHOS targets. ODFW will also be working, in coordination with the Oregon Hatchery Research Center, to better understand the impact of hatchery fish on wild populations, as well as how best to assess that impact more directly than through measurements of pHOS (e.g., measuring genetic introgression).

Those Management Areas in Table 13 that are identified to receive no hatchery releases of any species are termed "Wild Fish Emphasis Areas" and are shown in blue in Figure 13[18]. These areas will be managed to keep the risk from hatchery fish at very low levels, but may be open to wild fish harvest in some instances (see Table 17). Wild Fish Emphasis Areas are defined as Management Areas which are not stocked with any hatchery fish and whose pHOS is expected to be less than 10%. The management emphasis in these areas is only related to hatchery risk and does not suggest that these areas should be priorities for restoration or protection, though the prioritization processes described in the **Habitat Actions** section may identify some of them as such.

Overview of Hatchery Program Changes

The array of hatchery programs in place today throughout the Oregon Coast has developed over a period of time starting in the 1960's (though hatchery fish have been released in many coastal basins for a much longer time). Each program was approved with some consideration for its impact on the immediate area in which it would be located, but the available information was more limited than it is today and no concerted effort was made to look at the cumulative effect of a proposed program on top of those already in place throughout the coast.

Through the 1980's it was widely believed that there was little difference between hatchery and wild fish and that the freshwater habitat and ocean environment were limitless and could support greater numbers of fish. In recent decades, the understanding of fish interactions and habitat utilization has changed. It is now recognized that wild fish are important to maintain the ecosystems they are a part of in the coastal rivers and streams and for maintaining hatchery programs. The current understanding of population and groupings of populations (meta-population) dynamics has highlighted the importance of maintaining healthy wild populations throughout the range of the meta-population. A growing body of scientific information is showing that fish brought into a hatchery

[17] A hatchery program is defined here as all of the fish of a given species and run type (i.e., fall-run Chinook, spring-run or spring Chinook, winter steelhead, summer steelhead, or coho) which are stocked into a Management Area. Currently there are 39 programs in the Coastal area. The number of hatchery programs identified in the CMP is 37, after accounting for three new and five shifted programs. See Table 13 for details.

[18] Of the >7 million acres within the Coastal planning area, 47% are in Wild Fish Emphasis Areas (including NADOTs).

environment do not perform as well in the wild as wild fish, and can reduce the fitness or performance of a wild population. Much of this newer information was collected after the current hatchery programs were in place and up to this point there has not been a formal process to review these programs.

With the adoption of the NFCP and the development of this conservation and management plan, ODFW has an opportunity to consider the array of hatchery programs in place along the coast and whether that array of programs is consistent with the conservation of the wild salmon, steelhead and trout native to those rivers. Using the best available scientific information, ODFW has assessed the status of the SMUs and constituent populations, along with threats to their conservation, and developed a portfolio of hatchery programs intended to ensure the conservation of wild salmon, steelhead and trout while maintaining or increasing fishing opportunities in the coastal SMUs covered in this plan.

Hatchery release locations and numbers are will be adjusted in several locations to better utilize the hatchery product and to reduce the risk to wild fish from hatchery fish. There are currently 39 hatchery programs in Management Areas within the Coastal planning area. Overall, five locations where hatchery smolts/pre-smolts are currently released are identified in the CMP to no longer receive hatchery fish. In all of those locations, the smolts will be added to nearby stocking locations. The CMP identifies three areas for new hatchery programs. The portfolio here results in an increase (~6%) in the overall number of hatchery smolts/pre-smolts to be released within these SMUs, while also reducing the risk to wild populations by stocking two fewer Management Areas.

The implementation details for the CMP-identified changes to existing hatchery programs listed below have not been completely worked out. As a result, it may be determined during implementation that some changes identified in this plan require additional resources (labor, equipment, funding) to occur. The changes discussed below are contingent on any additional resources needed to implement each change being secured for a long-term implementation. Changes may not go forward if it is uncertain whether the resources can be secured for implementation for a minimum of 10 years. This plan does not cover every aspect of hatchery operations. Decisions regarding broodstock selection and collection numbers, and specific release locations for hatchery programs, will be discussed during the development of Hatchery Program Summaries. ODFW will develop Hatchery Program Summaries during implementation, and any changes to current programs will be identified in ODFW Hatchery and Genetic Management Plans (provided to the National Oceanic and Atmospheric Administration-Fisheries Service [NOAA] for ESA coverage of hatchery programs).

Actions for hatchery coho programs along the coast were identified in the *Oregon Coast Coho Conservation Plan* (ODFW 2007) that was adopted in 2007 and can be found on the web at http://www.dfw.state.or.us/fish/CRP/coastal_coho_conservation_plan.asp. Those actions have already been implemented and are not discussed below. The current release levels for coho are included in Table 13.

Release strategies

Almost all of the previous and CMP-identified hatchery programs are intended to provide fish for fisheries and are not intended to address a conservation concern for wild fish. It has been shown that the greatest contribution to fisheries comes from releases of smolts or pre-smolts. It is the intention of this plan to restrict all releases for fisheries purposes to smolt or pre-smolt releases.

Unfed fry releases, through the use of hatchboxes, have been used as a simple way to release large numbers of fish without the need for significant infrastructure. This release strategy can be effective at jump-starting a wild population in an area where natural recolonization is unlikely to occur, but there is very little need for jump-starting wild production in the SMUs covered in the CMP. As a result, the majority of unfed fry/hatchbox releases in these SMUs are intended to enhance a fishery. These fish survive at a very low rate and produce fewer adults than would be produced if the same number of fish were reared to the pre-smolt or smolt stage and then released. Unfed fry can compete with wild fry for limited resources and can reduce the potential survival of the wild fish (Nickelson et al. 1986). Unfed fry are also too small to externally mark, so they cannot be identified as hatchery fish which limits their harvest if a mark-selective (hatchery only) fishery is required to protect wild fish.

The majority of the current unfed fry releases in the coastal SMUs are identified in the CMP for phase out because of their limited benefits to the fisheries and the risk to wild populations. This will reduce the negative impacts on wild fish populations from these releases without impacting the fisheries to any noticeable amount. Those unfed fry programs not identified in this plan for phase out will be reviewed for their effectiveness at meeting program goals and could be phased out in the future if found ineffective. Unfed fry releases may still be used in these SMUs if it is determined that there is a conservation need for such releases. The use of classroom incubators, and the release of the small number of unfed fry produced in them, will continue.

Responsible Use of Hatchery Fish

ODFW's Fish Hatchery Management Policy (FHMP) calls for the responsible use of hatchery fish to provide fishing opportunity while protecting native fish. The first goal of the FHMP is to:

> "*Foster and sustain opportunities for sport, commercial and tribal fishers consistent with the conservation of naturally produced native fish*." (OAR 635-007-0543)

To ensure the hatchery programs described in the CMP will be operated in a way that is "consistent with the conservation of naturally produced native fish," the Plan and FHMP call for clear and measurable goals to be set for each hatchery program that will allow for the evaluation of the effectiveness of each program in achieving those goals. Hatchery Program Summaries will be completed in the early stages of implementing this plan for each program identified in the tables below. These summaries will identify measurable goals for the hatchery program, but also document all of the relevant information related to the spawning, rearing and release of program fish. The program summaries will be catalogued in such a way that the goals or details of particular programs can be easily accessed, and progress toward goals as well as program performance will also be accessible. Once these summaries are developed, any program changes will be required to go through an internal review process.

In addition to Hatchery Program Summaries, the CMP specifies hatchery risk targets for each wild population of Chinook, spring Chinook, winter steelhead and summer steelhead (see Table A-III: 4). Hatchery risk will be measured as the percentage of all naturally spawning fish that are of hatchery origin (referred to as "pHOS"). The level of naturally spawning hatchery fish is currently the most feasible way of assessing hatchery risk, though it may not capture the magnitude of all potential risks that hatchery fish might have on wild populations (competition, predation, disease). Studies have shown a link between the level of naturally spawning hatchery fish and wild population productivity (Chilcote 2003, Buhle et al 2009, Chilcote et al 2011) without identifying the mechanism for the impact to productivity, so pHOS appears to be a metric that can assess hatchery risk to productivity regardless of the source of the impact. The pHOS targets identified in **Appendix III – Desired Status and Limiting Factor Metrics and Goals** will be assessed through the adaptive management process and annual reports described in the CMP (see **Implementation**) to determine whether additional actions are necessary to achieve these targets, or not. Achievement of the pHOS targets will be based on a nine-year average to account for potential variation in the levels from year-to-year. ODFW will be working with the Oregon Hatchery Research Center to better understand the risks hatchery fish impose on wild populations and to develop methods to better measure the level of risk from hatchery fish.

<u>Detailed Hatchery Fish Actions</u>

The "*portfolio*" approach includes hatchery program modifications based on risk and fishing opportunity in different *areas*. The mix of opportunities is generally similar to current opportunity, with adjustments in several Management Areas to meet Desired Status and fishing opportunity objectives. The decision framework to determine hatchery program changes includes the following considerations:

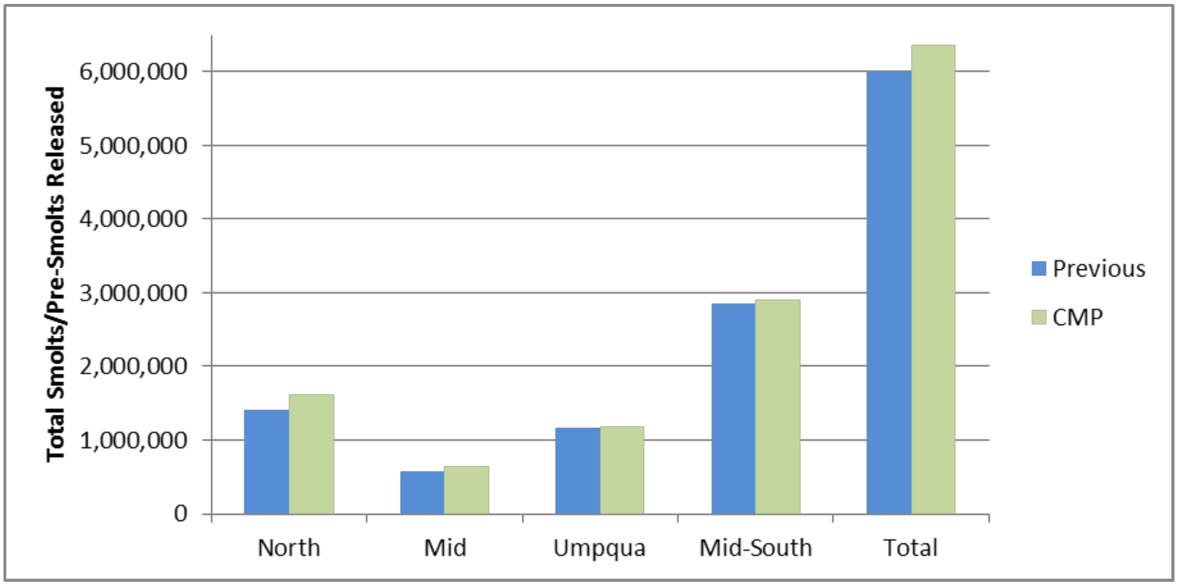
- Intent to disperse hatchery risk spatially across strata and SMU
- Intent to protect rare species and life history expressions
- Intent to maintain full use of hatchery infrastructure
- Intent to create new or enhanced retention opportunities for hatchery fish

- Intent to reduce the number of Management Areas stocked
- Intent to increase hatchery contribution efficiency (i.e., harvest a greater percent of the hatchery fish that return)
- Intent to avoid significant alterations to large hatchery programs, depending on results of species status assessments
- SMU gap between current and desired status, and limiting factors
- Observed abundance trends and estimated productivity
- Monitoring capacity
- Stakeholder, opinion poll, and public advice regarding social traditions, preferences and economics

Management actions identified in the CMP differ from previous programs in the following ways:

- Total SMU smolts/pre-smolts increase very slightly from 6.0 to 6.36 million
- Eleven hatchery programs will be increased and three new programs will be implemented
- Three hatchery programs will be reduced and five programs will be wholly shifted to other Management Areas; three of the five programs shifted from a Management Area involve releases of 40,000 fish or less and two of these three programs will also be replaced by new wild fish harvest opportunities

The following figures and tables summarize and indicate hatchery program management changes. ODFW intends that the following hatchery programs will be maintained at the identified levels until the CMP is re-evaluated or adaptive management findings suggest changes are warranted. Additional actions and a description of the changes follow.



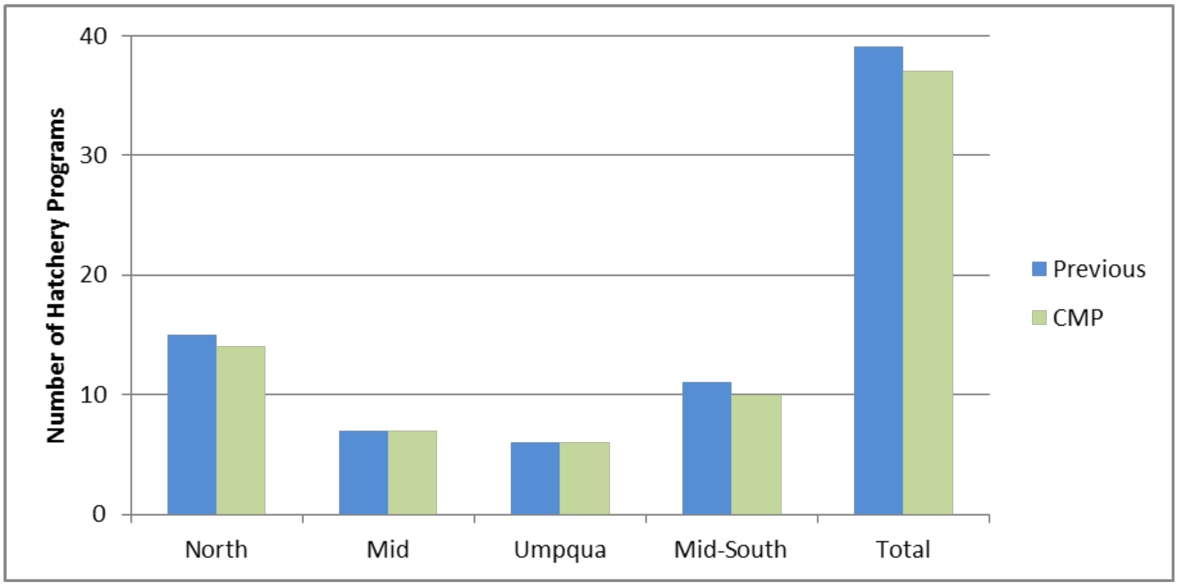


Figure 12. Smolt/pre-smolt releases and hatchery programs in strata and the Coastal planning area (i.e., "Total").

Table 12. A comparison by species of CMP changes in the number of Management Areas (MAs) by stratum stocked with hatchery fish. "*" indicates MAs identified as not historically having early-returning Chinook and steelhead life-histories.

Stratum	Fall Chinook		Spring Chinook		Winter Steelhead		Summer Steelhead		Coho	
(# MAs)	Previous	CMP	Previous	CMP	Previous	CMP	Previous	CMP	Previous	CMP
North (14)	3	3	3	3	5	4	2*	2*	2	2
Mid (15)	1	1	0	1*	5	4	1	1	0	0
Umpqua (8)	2	2	1	1	1	1	1	1	1	1
Mid-South (13)	4	3	0	1*	7	6	0	0	0	0
SMU Total (50)	10	9	4	6	18	15	4	4	3	3

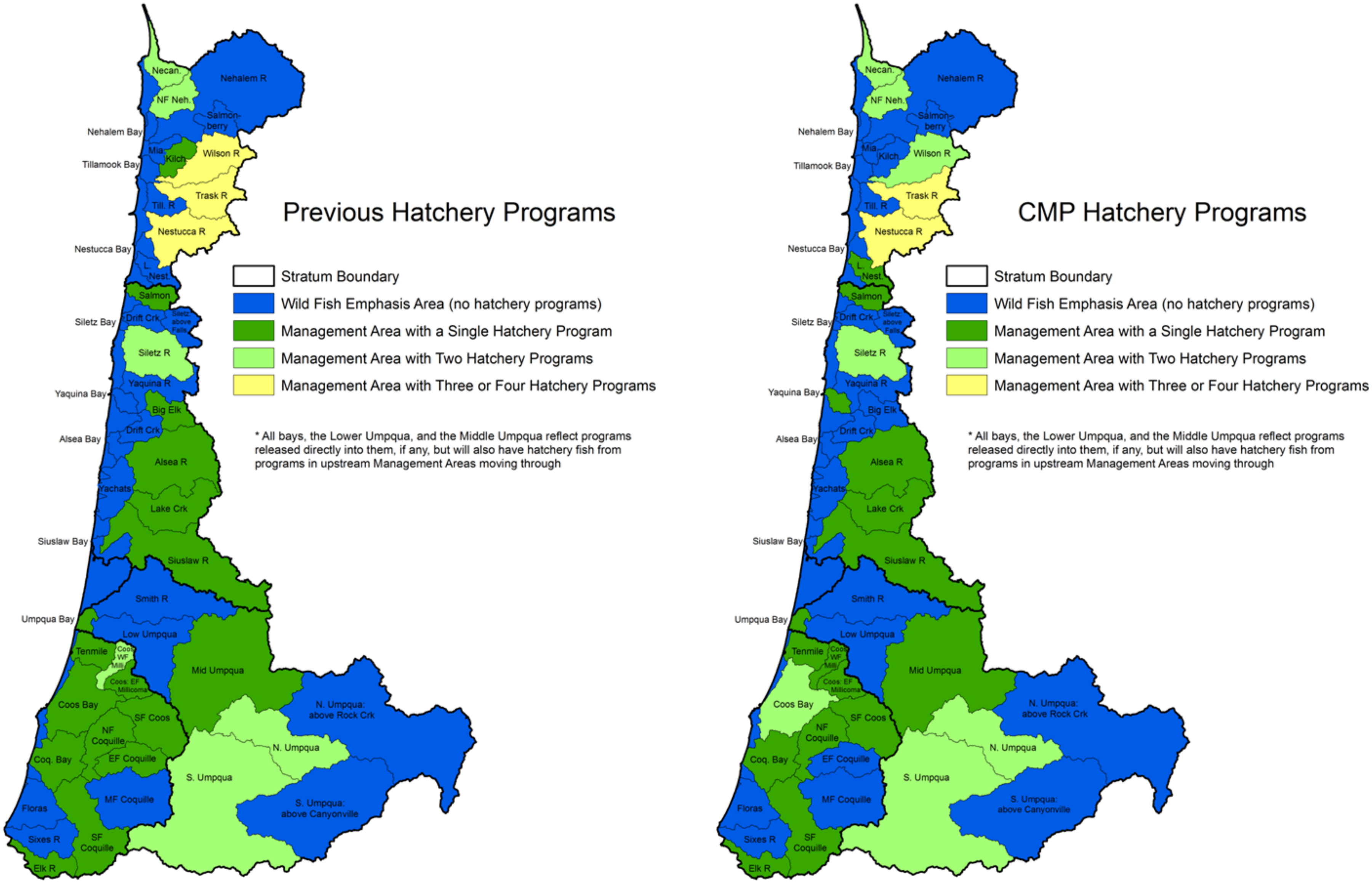


Figure 13. Numbers of previous and CMP-identified hatchery programs and Wild Fish Emphasis Areas in Management Areas within the planning area (all SMUs combined).

Table 13. Hatchery smolt/pre-smolt program changes. Educational and short-term research programs are not documented and are assumed to have little conservation or fishing opportunity impacts. Cells that include the word "to" indicate that there is a change in the program level; there is no change if there is only a single number in a cell. Empty cells are locations which do not receive the respective run of hatchery fish. "*" indicates a modification that may require additional funding. Abbreviations are: CO = coho, ChF = fall-run Chinook, ChS = spring-run or spring Chinook, StW = winter steelhead, and StS = summer steelhead.

		Hatchery Smolt/Pre-Smolt Program Summary and Changes				
Management Area	Stratum	CO	ChF	ChS	StW	StS
Necanicum R	North Coast Stratum		25,000		40,000	
Nehalem Bay						
NF Nehalem R		100,000			90,000	
Nehalem R						
Nehalem - Salmonberry R						
Tillamook Bay						
Tillamook - Miami R						
Tillamook - Kilchis R					40,000 to 0	
Tillamook - Wilson R				125,000 to 0	140,000 to 150,000	30,000 to 50,000
Tillamook - Trask R		100,000	113,000 to 150,000	220,000 to 400,000 *		
Tillamook R						
Nestucca Bay						
Nestucca R			100,000	110,000 to 200,000 *	110,000 to 140,000	70,000 to 50,000
Little Nestucca R				0 to 30,000 *		
Salmon R	Mid-Coast Stratum		200,000			
Siletz Bay						
Siletz R					50,000	80,000 to 50,000 [a]
Siletz - above Falls						
Siletz - Drift Crk						
Yaquina Bay				0 to 100,000 *		
Yaquina R						
Yaquina - Big Elk Crk					20,000 to 0	
Alsea Bay						
Alsea R					120,000 to 140,000	
Alsea - Drift Crk						
Yachats Aggregate						
Siuslaw Bay						
Siuslaw - Lake Crk					15,000	
Siuslaw R					85,000	
Umpqua Bay	Umpqua Stratum		170,000 [b]			
Umpqua - Smith R						
Lower Umpqua R						
Middle Umpqua R			300,000 [b]			
N Umpqua R				342,000		165,000
N Umpqua - above Rock Crk						
S Umpqua R		60,000			120,000 to 150,000 *	
S Umpqua R - above Canyonv						
Tenmile Lk/Crk	Mid-South Stratum				21,000 to 25,000	
Coos Bay Frontal			1,993,000 to 2,093,000	0 to 100,000 *		
Coos - EF Millicoma R					53,000	
Coos - WF Millicoma R			100,000 to 0		35,000	
SF Coos R					37,000	
Coquille Bay			175,000			
NF Coquille R					25,000 to 45,000	
EF Coquille R					20,000 to 0	
Middle Fork Coquille R						
SF Coquille R					70,000	
Floras/New R						
Sixes R						
Elk R			325,000 to 275,000			
NADOTs	*mixed*					
TOTAL Smolts/Pre-Smolts		260,000 to 260,000	3,501,000 to 3,488,000 [c]	797,000 to 1,172,000	1,091,000 to 1,125,000	345,000 to 315,000
		5,994,000 to 6,360,000				

[a] Effectiveness of the Siletz StS hatchery programs will be evaluated with the potential for increases (see below for details).

[b] Focused monitoring will determine if release number is appropriate or should be changed.

[c] ChF totals do not include unfed fry releases (see Table 14).

Table 14. Hatchery unfed fry program changes.

		Hatchery Unfed Fry Program Changes	
Management Area	Stratum	ChF	ChS
Necanicum R	North Coast Stratum		
Nehalem Bay			
NF Nehalem R			
Nehalem R			
Nehalem - Salmonberry R			
Tillamook Bay			
Tillamook - Miami R		*50,000 to 0*	
Tillamook - Kilchis R		*50,000 to 0*	
Tillamook - Wilson R		*65,000 to 0*	
Tillamook - Trask R		80,000 to 0	*42,000 to 0*
Tillamook R		*27,500 to 0*	
Nestucca Bay			
Nestucca R		*50,000 to 0*	*65,000 to 0*
Little Nestucca R			
Salmon R	Mid-Coast Stratum		
Siletz Bay			
Siletz R			
Siletz - above Falls			
Siletz - Drift Crk			
Yaquina Bay			
Yaquina R			
Yaquina - Big Elk Crk			
Alsea Bay			
Alsea R			
Alsea - Drift Crk			
Yachats Aggregate			
Siuslaw Bay			
Siuslaw - Lake Crk			
Siuslaw R			
Umpqua Bay	Umpqua Stratum		
Umpqua - Smith R			
Lower Umpqua R			
Middle Umpqua R			
N Umpqua R			
N Umpqua - above Rock Crk			
S Umpqua R			
S Umpqua R - above Canyonv			
Tenmile Lk/Crk	Mid-South Stratum		
Coos Bay Frontal			
Coos - EF Millicoma R			
Coos - WF Millicoma R			
SF Coos R			
Coquille Bay			
NF Coquille R		*50,000*	
EF Coquille R			
Middle Fork Coquille R			
SF Coquille R		*50,000*	
Floras/New R			
Sixes R			
Elk R			
NADOTs	*mixed*		
TOTAL Unfed Fry		422,500 to 100,000	107,000 to 0

Other actions in addition to the program changes in Table 13 and Table 14 are:

General Hatchery Fish Actions

- ODFW will work toward marking all hatchery fish released with an external identifying mark (typically an adipose finclip), excluding those released for research purposes[19]
- Complete and track Hatchery Program Summaries, including determining program goals; document program modifications (e.g., broodstock, stock locations), after internal review and involvement of cooperating and interested parties (as warranted), in revised Hatchery Program Summaries and Hatchery Management Plans
- Monitor and adaptively manage programs to meet performance targets for (in priority order): 1) impacts to wild populations (pHOS) and 2) contribution to fisheries identified in Hatchery Program Summaries
- Refrain from collecting wild brood if Critical Abundance criteria are met (see Table A-III: 2)
- Obtain Oregon Fish and Wildlife Commission approval for starting new hatchery programs in a Management Area (i.e., in addition to those indicated in Table 13 and Table 14) and for eliminating existing hatchery programs in a Management Area (i.e., those indicated in Table 13 and Table 14), excluding educational and research programs
- Unless holding facility limitations, transport to off-site collection locations, or other extenuating circumstances do not allow it, live-spawn wild brood and recondition kelts to some degree for wild steelhead brood programs
- Consider chum reintroduction opportunities if habitat restoration occurs and natural re-colonization does not (track similar work in lower Columbia River)

Hatchery Fall-run Chinook Actions

- Salmon ChF - in order to reduce pHOS: 1) improve weir effectiveness, 2) do not pass hatchery fish above weir, and 3) use <10% wild brood during very low returns; consider other actions if pHOS and fishery objectives are not being met
- Lower Umpqua ChF - monitor pHOS: increase releases if low, reduce releases if high
- Middle Umpqua ChF - monitor pHOS: reduce releases if high
- Millicoma ChF - continue rearing at Millicoma Interpretive Center, but shift releases lower in the Coos
- Shift the Hall Creek release of 55,000 pre-smolts to a location in the lower estuary, exploring the feasibility of a release near public fishing areas in Bandon
- Review unfed fry releases in the Coquille for effectiveness
- Elk ChF - in order to reduce pHOS:
    - o Prioritize funding for Elk River Hatchery threat improvement and RME
    - o Specify that a management objective relative to the hatchery program is to protect wild fish
    - o Trap during entire return period
    - o Remove hatchery fish from Anvil and Rock Creeks through use of weirs and traps if feasible
    - o Improve genetic diversity when gathering broodstock (e.g., take later and older fish)
    - o Improve ladder outlet (for attraction) at the hatchery
    - o Explore additional attractant options at the hatchery (increased flow, chemical attractant)
    - o Enlist the help of the Oregon Hatchery Research Center to develop better attraction into the hatchery
    - o Explore options to harvest more hatchery fish (e.g., beach seine, additional allowance in troll "bubble" fishery, obtain additional bank/boat angling access on Elk River, pursue development of a public boat ramp at the Port of Port Orford)
    - o Improve nutrient enrichment above the hatchery if there are no disease concerns
    - o Achieve the goal for the allowable proportion of hatchery fish on the spawning grounds (pHOS): 30% averaged across the basin
    - o If the pHOS target has not been met within seven years of plan adoption, reduce hatchery production by an additional 25,000 or more
    - o At the District level, manage emergency closures for fisheries if needed (e.g., to protect early returns in dry years)
    - o Support, help secure funding and help implement the Pilot Implementation Program to improve estuary and lower river habitat, including actions such as:

[19] A marking trailer is included in **Implementation: Cost** to address this action.

- creating/accessing off-channel habitat (wetlands, channels, sloughs)
- enhancing/restoring mainstem large wood of appropriate size (e.g., cottonwood)
- riparian plantings (e.g., cottonwoods) and protection to remove invasive plants and restore LWD processes
- ensuring other actions in Elk River complement and do not degrade estuary restoration

Hatchery Spring Chinook Actions

- L Nestucca ChS - look into tidewater fishery (develop acclimation site) and stock 30k if feasible (new production)
- Yaquina and Coos ChS - program size based on number of fish needed to evaluate the new programs' fishery contribution and impacts to wild populations; contribution and impacts will be reviewed in 5 years, which may lead to program increases or decreases
- New Yaquina ChS program will be monitored well enough to determine effects to nearby wild ChS life-history variants (Siletz and Alsea) and include surveys that look for carcasses (as opposed to float surveys that count live fish) to determine the stray rate of hatchery fish into the wild spawning areas
- N Umpqua ChS - remove hatchery fish at Rock Creek Hatchery Dam trap[20]; account for hatchery fish that pass above Winchester Dam

Hatchery Chum Actions

- Establish conservation hatchery programs outside of the currently viable locations only if and after habitat needs are understood, habitat restoration has been completed, and these locations are not colonized naturally, incorporating lessons from the lower Columbia reintroduction program underway
- Fishery augmentation hatchery programs will not be established

Hatchery Winter Steelhead Actions

- Necanicum StW - in order to reduce pHOS: 1) identify a tributary for releases, 2) possibly use weirs to retain returning hatchery adults
- Tenmile StW - remove hatchery fish at Eel Lake trap
- SF Coquille StW - identify new access opportunities
- Address mortality incidents of hatchery StW currently reared (or partially reared) at Cole Rivers Hatchery

Hatchery Summer Steelhead Actions

- Siletz StS - if fishery declines significantly, add back 30,000 smolts to production; explore limited wild brood infusion to improve the fishery and ensure the hatchery stock remains healthy
- N Umpqua StS - remove hatchery fish at Rock Creek Hatchery Dam trap[21] and use adaptive management to achieve pHOS target if trapping at Rock Creek Hatchery is not effective

<u>Description of Hatchery Fish Actions</u>

The emphasis for each SMU in general and the rationale for each identified change are provided in the discussion below. Only those hatchery programs where changes are identified in the CMP are discussed in this section. Previous hatchery programs that are not discussed below will continue and are identified in Table 13.

Chinook

Fall-run Chinook

Natural production supports the vast majority of bay/river harvest (over 80%) of fall-run Chinook coast-wide and is important to maintain and improve these fisheries. This species is harvested at a higher rate than any other species covered in this plan (approaching or exceeding 50%), and is close to the maximum safe rate for maintaining population

[20] This is dependent on completion of the trap facility and funding to operate the trap.
[21] This is dependent on completion of the trap facility and funding to operate the trap.

health. Management will focus on easing risk from harvest to all populations and hatchery programs in some areas, and on protecting and enhancing habitat. In the Elk, where health status is a concern, management strategies will attempt to reduce the risk from both harvest and the hatchery program.

Fall-run Chinook hatchery releases are currently made into nine of the 18 Chinook population areas in this SMU (Necanicum, Tillamook, Nestucca, Salmon River, Lower Umpqua, Middle Umpqua, Coos, Coquille, and Elk). Hatchery releases are made into 16 management areas in these nine populations. To attempt to reduce some level of risk from these releases while maintaining as much fishing opportunity as possible, release changes are identified in five of the nine populations. These changes eliminate the majority of unfed fry releases in the SMU and reduce pre-smolt or smolt releases reducing the number of management areas where hatchery fall-run Chinook are released to nine. The remaining nine populations (Nehalem, Siletz, Yaquina, Alsea, Yachats, Siuslaw, South Umpqua, Floras, and Sixes) are identified to be managed for wild fish with no hatchery fall-run Chinook releases.

Tillamook

The unfed fry releases throughout the population area (272,500 total) are identified in the CMP for phase-out over a 10-year period to reduce risk to the wild population. This population receives greater fishing pressure than most Chinook populations due to its close proximity to the Portland Metro area. To maintain the current harvest opportunity, the CMP identifies an increase in the smolt release of fall-run Chinook into the Trask River from 113,000 to 150,000 annually to mitigate for the adult Chinook lost by the phase-out of the unfed fry releases. .

Nestucca

The unfed fry releases in this population area (50,000 total) are identified in the CMP for phase-out over a 10-year period. The loss of adults in the fishery produced from these releases should be very minimal, and the change may potentially be offset by improved survival of the wild population due to a lesser risk from the hatchery program.

Salmon River

The hatchery program in this population area serves as an Exploitation Indicator Stock under the Pacific Salmon Treaty and is required to release 200,000 hatchery fall-run Chinook smolts annually. To reduce the proportion of hatchery fish spawning in the wild, the CMP identifies modified operations at Salmon River Hatchery to remove more returning hatchery adults before they reach the spawning grounds and to use fewer wild fish in the hatchery broodstock when returns are low to protect the wild population. These changes should not significantly affect the current fishery opportunity for fall-run Chinook in the Salmon River population area.

Lower Umpqua

Expanded monitoring will explore whether hatchery fall-run Chinook adults from releases into Salmon Harbor and Winchester Bay (currently a total of 170,000 smolts and pre-smolts annually) are spawning in significant numbers in the wild. If the numbers are not significant and there is potential to rear more hatchery fall-run Chinook at STEP facilities, ODFW will explore increasing the release numbers of hatchery fall-run Chinook in the Lower Umpqua population area. If the level of hatchery adults spawning in the wild is found to be too high, ODFW will consider reducing the number of hatchery fall-run Chinook released in the Lower Umpqua population area to address the risk.

Middle Umpqua

All hatchery fish in this program should be marked. Also, ODFW will monitor the Middle Umpqua population area to determine whether the number of hatchery fall-run Chinook adults returning from the recently expanded release of pre-smolts in Calapooya Creek (currently 300,000 annually) and spawning with wild fall-run Chinook is significant. If the level of hatchery adults spawning in the wild is found to be too high, ODFW will consider reducing the number of hatchery fall-run Chinook released in the Middle Umpqua population area to address the risk. Also, if these fish are not contributing to the fishery, ODFW will evaluate the reasons for this and explore options for improving the program's effectiveness.

Coos

This population area contains the largest hatchery release of fall-run Chinook along the entire Oregon Coast, and this carries a potential for risk to the wild population, although there is no evidence of actual impacts to date. The risk from competition between the hatchery and wild Chinook is thought to be minimized by the large bay and estuary in the Coos as compared to the size of the entire basin. This provides considerable space for Chinook to rear in the bay and estuary without competing for resources. Still, there is potential for risk from the hatchery program if there is competition for limited high quality estuarine habitat or too many hatchery fish spawning in the wild. As a precaution, the CMP identifies that the releases of pre-smolts into the West Fork Millicoma River will be shifted to areas lower in the bay. This change will focus all of the hatchery releases into the lower bay and sloughs where wild Chinook production is minimal while also reducing the risk in the Millicoma River where wild production is more significant and higher proportions of naturally spawning hatchery fish have been observed. The fishery in the Millicoma River primarily harvests wild fall-run Chinook (as much as 90% of the catch based on district records), so the shift of these releases into the lower bay should not significantly reduce opportunity.

The Millicoma Interpretive Center STEP facility will continue to rear its current number of hatchery fall-run Chinook under this plan. The only change in operation at this facility will be that none of those fall-run Chinook will be released into the West Fork Millicoma. They will be released lower in the Coos system.

Coquille

The Coquille population area has the potential to rear a large number of Chinook juveniles. This potential will be increasing with the recent agreement to restore rearing habitat in the area known as Winter Lake. The wild Chinook population will likely become more productive and abundant in the next decades as this habitat becomes accessible and improves in quality. The current wild Chinook population is relatively large, and the contribution of the hatchery program to the overall fishery is thought to be fairly small. Part of the reason the contribution of hatchery fish to the fishery has been small is the inability of ODFW to rear the release goal of 175,000 smolts. ODFW will pursue efforts to rectify disease problems at Cole Rivers Hatchery to allow the full 175,000 smolts release goal to be met. To address issues with the Hall Creek rearing and acclimation site (i.e., low flows and poor water quality), the 55,000 smolts targeted for release there will be shifted to the lower estuary. To hopefully increase the harvest of these hatchery fish, ODFW will explore the feasibility of acclimating and releasing the 55,000 fish near public access areas in Bandon.

Elk

The current hatchery fall-run Chinook program in this population area releases 325,000 smolts annually. The status assessment of the Elk population of fall-run Chinook indicated that the population has low probability of persisting in the long term when the abundance and productivity of the population were assessed. One of the primary reasons for the poor health of the population was the large proportion of hatchery fish spawning with wild Chinook (routinely over 60%). To ensure the improved productivity of the wild Elk fall-run Chinook population, ODFW will immediately implement a cooperative Pilot Implementation Program with local landowners and the South Coast Watershed Council. As part of the pilot program, hatchery releases of Chinook in the Elk population area would be reduced by 50,000 to 275,000 annually (a 15% reduction) to help address the poor condition of this population. ODFW will take other actions to get more hatchery fish caught in the fishery, remove hatchery fish at the hatchery or weirs in tributaries, and increase the productivity of the wild population through habitat improvements (see Hatchery Fall-run Chinook Actions above). It is expected that this release change may have some negative effect on the fishery opportunity for fall-run Chinook in the Elk population area.

Spring-run Chinook

In Coast Range drainages the spring-run/summer-run life-history strategies are limited (naturally, and exacerbated by human impacts) by suitable habitat. In most areas where these life-histories still exist, they will be protected through actions to reduce harvest and hatchery risk. There are no hatchery programs derived from summer-run Chinook in the

Coastal Chinook SMU. Hatchery programs have been derived from spring-run Chinook and are referred to as "spring Chinook" hatchery programs (as opposed to "spring-run Chinook").

Hatchery "spring Chinook" are currently released in two populations (Tillamook and Nestucca). The Tillamook and Nestucca historically have had a spring-run of Chinook that return in the spring and hold in the river through the summer. The CMP-identified hatchery management for spring-run Chinook in coastal basins focuses on reducing the hatchery risk in the Wilson River while maintaining or increasing the fishery opportunities for spring-run Chinook in these and other areas – including new programs in the tidewater portions of the Yaquina and Coos rivers. The four populations with a spring- or summer-run life-history variant (Nehalem, Siletz, Alsea and Coquille) that do not currently have any spring Chinook hatchery releases are identified in this plan to be managed for wild fish with no hatchery "spring Chinook" releases.

The CMP includes three new spring-run Chinook hatchery programs (Little Nestucca, Yaquina Bay, and Coos Bay), which will be implemented only if (1) new, long-term, secure funding can be obtained for all aspects of the program (rearing, acclimating and monitoring) and (2) there are firm commitments from volunteer or partner groups to spearhead the development of new facilities and implementation of the programs. ODFW will not undertake these programs until these elements are in place.

Tillamook

Natural production of spring-run Chinook in the Tillamook population occurs in the Wilson and Trask rivers. Hatchery releases of "spring Chinook" are currently made into both streams, and both streams have a significant proportion of hatchery adults spawning in the wild (> 60%). Despite releases of over 100,000 hatchery smolts into the Wilson River annually, harvest of spring-run Chinook in the Wilson River has generally been very low during the history of the program. The release of hatchery "spring Chinook" unfed fry into the Tillamook population area (42,000) will be phased out over a 10-year period, and smolt releases into the Wilson River will be terminated (125,000 smolts). Both of these changes are intended to reduce the risk to the wild early life-history variant. The hatchery smolts that have been previously released into the Wilson River will be released into the Trask River along with an additional 55,000 smolts to bring the total "spring Chinook" release into the Trask River to 400,000 annually. The increased "spring Chinook" releases are intended to provide an enhanced fishery opportunity for spring-run Chinook in Tillamook Bay and the Trask River. ODFW expects that the fishery as a whole will see benefits from these changes.

Nestucca

To reduce the risk to the wild spring-run Chinook, ODFW will phase out releases of hatchery "spring Chinook" unfed fry in the Nestucca population area (65,000) over a 10-year period. To offset the termination of unfed fry releases and to provide an enhanced fishery opportunity for spring-run Chinook in the Nestucca, the smolt release of hatchery "spring Chinook" will be increased by 90,000 for a total release of 200,000 smolts annually. ODFW will also explore the feasibility of acclimating and releasing up to 30,000 "spring Chinook" smolts in the tidewater portion of the Little Nestucca River to create a fishery in this area. Any resources needed to implement the acclimation will need to be secured prior to being approved. ODFW expects that the fishery as a whole will see benefits from these changes.

Yaquina

It is unlikely that the Yaquina River supported wild spring-run Chinook due to poor over-summer holding habitat for early returning adults. ODFW will experiment with a release of 100,000 hatchery "spring Chinook" annually in Yaquina Bay to determine if a fishery opportunity for spring-run Chinook can be established without negatively impacting the wild fall-run Chinook and other native fish populations within the Yaquina River or nearby rivers. ODFW cannot implement this program under existing budgets and staffing. This experimental program will not proceed until a long-term source of funding can be secured to provide the resources to implement the program and to monitor the effectiveness of the program in providing a fishery while avoiding impact to wild fish populations. This program is also contingent on commitment from local volunteers to develop the infrastructure needed and to implement the program over the long-term. If successful, this program will provide an additional fishery opportunity for spring-run Chinook along the coast without imposing significant risk on wild populations.

Coos

Just as in the Yaquina, it is unlikely that the Coos River supported wild spring-run Chinook due to poor over-summer holding habitat for early returning adults. ODFW will experiment with a release of 100,000 hatchery "spring Chinook" annually in Coos Bay to determine if a fishery opportunity for spring-run Chinook can be established without negatively impacting the wild fall-run Chinook and other native fish populations within the Coos River or nearby rivers. ODFW cannot implement this program under existing budgets and staffing. This experimental program will not proceed until a long-term source of funding can be secured to provide the resources to implement the program and to monitor the effectiveness of the program in providing a fishery while avoiding impacts to wild fish populations. This program is also contingent on commitment from local volunteers to develop the infrastructure needed and to implement the program long-term. If successful, this program will provide an additional fishery opportunity for spring-run Chinook along the coast without imposing significant risk on wild populations.

Spring Chinook

For the two spring Chinook populations in the spring Chinook SMU, efforts to protect the South Umpqua population focus on reducing harvest risk and protecting and restoring habitat. For the much stronger North Umpqua population, where harvest is allowed, efforts focus on reducing the potential risk from the hatchery program, but the population will also benefit from reduced harvest targeted at the South Umpqua population.

North Umpqua

ODFW will undertake efforts to reduce the number of hatchery adult spring Chinook that spawn with wild spring Chinook in the North Umpqua population area. A new fish ladder and trap at the hatchery on Rock Creek will facilitate removal of hatchery adults that are captured there. ODFW will make an effort to account for most of the hatchery spring Chinook counted at Winchester Dam to determine the proportion that may be spawning in the wild. If efforts to reduce the number of spring Chinook spawning in the wild are not successful, ODFW will consider reducing the number of hatchery spring Chinook smolts released. The removal of hatchery adult spring Chinook at the Rock Creek trap should have no noticeable effect on fishery opportunities.

Chum

The Oregon Coast is at the southern-most range for chum salmon, and there are small pockets where natural production occurs on a regular basis. Management for chum will focus on keeping hatchery and harvest risk low while trying to better understand the status of chum populations and opportunities to enhance them. There are no hatchery chum programs in the SMU and none are proposed, although there is the possibility of a conservation reintroduction program in the future in locations outside of the currently viable locations only if and after habitat needs are understood, habitat restoration has been completed, and these locations are not colonized naturally, incorporating lessons from the lower Columbia reintroduction program underway.

Winter Steelhead

Almost all steelhead harvest is currently supported by hatchery programs, and harvest will continue to be largely supported with hatchery fish, but with less risk. In some areas where hatchery risk is being reduced significantly, ODFW will implement a conservative wild harvest intended to replace the hatchery-driven fisheries while keeping risk low. These fisheries will be evaluated and could potentially be expanded to other areas, reduced or eliminated.

Hatchery winter steelhead are the most widely distributed species along the coast, with releases currently made into 12 of the 19 winter steelhead population areas in this SMU (Necanicum, Nehalem, Tillamook, Nestucca, Siletz, Yaquina, Alsea, Siuslaw, South Umpqua, Tenmile, Coos, and Coquille). Aggregated information from 10 years of random spawning surveys (ODFW unpublished data) suggests that the level of hatchery fish seen on the spawning grounds is higher in some population areas where hatchery fish are released than in others (i.e., Necanicum, Nehalem, Yaquina, Alsea, Siuslaw, Coos, and Coquille). Hatchery releases are made into 18 management areas within these 12 population areas. The hatchery management actions identified in this plan seek to reduce the risk to wild winter steelhead from hatchery releases by reducing the number of management areas where winter steelhead are released, including in those populations where hatchery smolts are released into multiple management areas. The changes identified in this plan reduce the number of management areas with hatchery releases to 15, while keeping overall smolt release numbers in the SMU very close to current levels (103%). The plan identifies seven populations where hatchery fish are currently not released (Salmon, Yachats, Lower Umpqua, Middle Umpqua, North Umpqua, Floras, and Sixes) and the management areas in the other populations that currently do not have hatchery fish released.

Necanicum

The hatchery program in this population area releases 40,000 winter steelhead smolts annually. Releases are made directly into the river with no acclimation. There are no adult traps to remove returning hatchery winter steelhead adults before they reach the spawning grounds. ODFW will explore the feasibility of developing an acclimation site, or tributary release location, with an adult trap in the Necanicum, and to develop them if they are found feasible to reduce the risk of the hatchery program on wild winter steelhead. ODFW does not expect these changes to affect fishery opportunities for winter steelhead in the Necanicum population area. If these efforts to reduce risk are not successful, ODFW will work with local interests to explore, implement, and experiment with management options around hatchery risk reduction[22] with the understanding that a) there will be no net loss to existing fishing opportunity, b) a local interest group will take the lead to organize discussions with all interested parties and implement any actions above and beyond what current ODFW staff levels can accomplish, and c) any implemented management changes require support of both wild fish conservation and consumptive fishery interests.

Tillamook

Hatchery winter steelhead are released into two of the three major management areas that produce wild winter steelhead in the Tillamook population (the Kilchis and Wilson Rivers). This plan identifies the elimination of the release of hatchery winter steelhead smolts in the Kilchis River (40,000 smolts), an increase the release of smolts in the Wilson River (from 140,000 to 150,000 annually), and a shift of the remaining 30,000 to the Nestucca (from 110,000 to 140,000). ODFW intends for these actions to reduce the hatchery risk in the Kilchis while focusing the hatchery releases in the very popular Wilson and Nestucca rivers. The program in the Kilchis currently uses a non-local broodstock and has no acclimation areas at release sites or adult traps to capture and remove returning hatchery adults that are not caught in the fishery. This increases the risk from the hatchery program. ODFW expects that this change will lead to some reduction in the opportunity to harvest a hatchery winter steelhead in the Tillamook population area.

Nestucca

The current release of 110,000 hatchery winter steelhead into the Nestucca River and Three Rivers will be increased by 30,000 (the remaining amount removed from the Kilchis) to a total of 140,000. This will slightly increase the risk to the Nestucca wild winter steelhead population. The larger release should also increase the fishery opportunity in the Nestucca.

While the risk from hatchery winter steelhead in the Nestucca will be increased, the Desired Status for the Nestucca wild winter steelhead population is to maintain and improve viability. ODFW will adjust current monitoring efforts or seek new funding to allow the monitoring of the Nestucca population to determine if the hatchery risk is jeopardizing the viability of the population. If monitoring shows the pHOS targets for the Nestucca are being met but are not adequately protecting the wild winter steelhead population, ODFW will take action to develop a new pHOS target, along with actions necessary to meet the new goal. The upper portion of the Nestucca basin (above Blaine) is expected to have pHOS levels well below the

[22] There is local support to explore other management options to reduce hatchery risk if the identified actions are not successful. Other options may possibly include utilizing wild fish in the consumptive fishery to offset hatchery program reductions, given on-going habitat conservation and restoration efforts and assuming adequate monitoring.

basin-wide goal. This area is the focus of collaborative efforts to restore habitat for winter steelhead, and having more productive wild steelhead in this area will allow the population to reap the full benefits of the habitat work.

Yaquina

The release of hatchery winter steelhead smolts into Big Elk Creek (20,000 smolts) will be eliminated under this plan. This release has no acclimation or adult trapping capabilities and hatchery winter steelhead are observed spawning throughout Big Elk Creek. The broodstock used for release into Big Elk Creek is an out-of-basin stock (Alsea) and thus creates a greater risk. ODFW will shift the release of these smolts to the Alsea River (from 120,000 to 140,000). The opportunity to harvest a winter steelhead in Big Elk Creek will be mitigated by implementing a conservative wild winter steelhead harvest fishery (see Fishing/Harvest Actions Section).

Alsea

The current hatchery program in this population area releases 120,000 winter steelhead smolts annually. Under this plan, ODFW will increase the release by 20,000 (the amount eliminated from the Big Elk Creek Management Area) to a total of 140,000. Changes have recently been made with the winter steelhead hatchery broodstock used in the Alsea and in the release strategy. Returns from the new release strategy (releasing some hatchery smolts in Five Rivers to enhance the lower river fishery) are just beginning to return as adults, and the strategy has not been evaluated. ODFW will evaluate these recent changes to determine if the lower river releases are harvested at higher rates, and whether the new release strategy (which does not acclimate the smolts) leads to higher levels of hatchery winter steelhead spawning in the wild. If the occurrence of hatchery winter steelhead adults on the spawning grounds is found to be too high, ODFW will explore changes to the current release strategy.

South Umpqua

The South Umpqua is a large basin with hatchery winter steelhead releases (120,000 smolts annually) into Canyon Creek, with a small educational release into Deer Creek. Spawning surveys in the South Umpqua do not document very many hatchery winter steelhead spawning, which indicates the risk from this program is not significant. For this reason, ODFW will increase the fishery opportunity for hatchery winter steelhead in the Mainstem and South Umpqua by increasing the smolt release to 150,000 annually.

Tenmile Lakes

The hatchery program in this population releases 21,000 hatchery winter steelhead smolts annually at three locations (Saunders Creek acclimation site, Tenmile Creek acclimation site and Eel Lake acclimation site). Currently, hatchery winter steelhead adults are not removed from the Tenmile Lakes population area except through harvest and for broodstock. Under this plan, if required to meet pHOS targets, ODFW will undertake efforts to remove hatchery adult winter steelhead at Eel Lake trap to reduce the risk from this program on wild winter steelhead. Hatchery adults that currently return to Eel Lake trap and are not needed for broodstock are released into the lake to provide for a lake fishery. Under this plan, ODFW will increase the smolt release to 25,000, likely providing an increase in fishery opportunity despite the possible loss of the lake fishery for steelhead in Eel Lake.

Coquille

The current winter steelhead hatchery program in this population releases 115,000 smolts annually in three of the five management areas identified for the Coquille population (25,000 at an acclimation site in the North Fork Coquille River, 20,000 in the East Fork Coquille River[23], and 70,000 at two acclimation sites in the South Fork Coquille River). Four of the five management areas in the Coquille population that support wild winter steelhead (including the much larger South Fork Coquille) are currently at some risk due to hatchery smolt releases occurring in them. To reduce the risk for the entire Coquille population, ODFW will eliminate the smolt release in one of the management areas. ODFW believes the East Fork Coquille has the smallest fishery and eliminating that smolt release would have the least impact to fishery opportunities in

[23] This includes 5,000 fish released into Cunningham Creek.

the Coquille population area. Under this plan, all 20,000 smolts currently going into the East Fork Coquille River will be transferred into the North Fork Coquille release for a total of 45,000 smolts. ODFW will mitigate the lost opportunity to harvest a hatchery winter steelhead in the East Fork Coquille River by initiating a conservative harvest fishery for wild winter steelhead in the East Fork Coquille (see Fishing/Harvest Actions Section). ODFW expects that these changes will maintain close to the current level of fishery opportunity for winter steelhead in the Coquille population area.

Summer Steelhead

There are only two historic populations of summer steelhead in this Species Management Unit and both are unique, requiring protection and enhancement. Management will focus on continuing the prohibition on harvest and reducing the potential risk from hatchery programs.

There are currently four hatchery summer steelhead programs in coastal rivers. Two of these programs are in population areas with wild populations of summer steelhead (Siletz and North Umpqua). The other two hatchery summer steelhead programs are in population areas without wild summer steelhead populations (Tillamook and Nestucca). Under this plan, the hatchery management of summer steelhead seeks to reduce the risk from these programs on wild summer steelhead where they coexist and to reduce the risk from these programs where they interact with wild winter steelhead.

Tillamook

Summer steelhead are not native to this population. The hatchery summer steelhead program utilizes a stock that originated in the Siletz River. The current program releases 30,000 hatchery summer steelhead smolts annually into the Wilson River. The catch efficiency of released hatchery summer steelhead smolts is higher in the Wilson River than in the Nestucca River. The CMP identifies a shift of 20,000 smolts from the Nestucca release to the Wilson River to increase the release to 50,000 smolts[24]. This change should increase the harvest opportunity in the Wilson for hatchery summer steelhead.

Nestucca

Summer steelhead are not native to this population. The hatchery summer steelhead program utilizes a stock that originated in the Siletz River. The program releases 70,000 hatchery summer steelhead smolts annually into Three Rivers and the Nestucca River. Sampling conducted in 2005 through 2007 found a significant number of hatchery summer steelhead spawning in areas where wild winter steelhead were present. To help reduce the risk from these naturally spawning hatchery fish, the CMP identifies a shift of 20,000 smolts from the Nestucca release (from 70,000 to 50,000) into the Wilson River (from 30,000 to 50,000). ODFW expects that this change will slightly affect the fishery opportunity for hatchery summer steelhead in the Nestucca. The reduction in hatchery summer steelhead releases in the Nestucca should help achieve the low pHOS targets for the upper Nestucca (above Blaine) where collaborative efforts to restore winter steelhead habitat are proposed/underway.

Siletz

This population area supports a wild summer steelhead population that spawns almost exclusively in areas above Siletz Falls. The current hatchery summer steelhead program releases 80,000 smolts annually in mainstem areas below Siletz Falls. Hatchery summer steelhead adults are not passed above Siletz Falls (which has a trap on the fish ladder that fish utilize to get above the falls) so the risk from this program to wild summer steelhead is reduced. Hatchery summer steelhead adults do spawn in areas downstream of Siletz Falls where wild winter steelhead spawn, and ODFW considers this to be a risk to the wild winter steelhead population. To reduce the risk of the hatchery summer steelhead program on wild winter steelhead, the CMP identifies a reduction in the release of hatchery smolts to 50,000. ODFW expects that this change will lead to only a slight reduction in fishery opportunity. If the fishery is significantly impacted by this change, ODFW will explore reinstating the 80,000 smolt release.

[24] In shifting Nestucca StS to the Wilson, logistical flexibility will be needed in release numbers and location in order to meet broodstock needs.

North Umpqua

This population area supports the largest wild summer steelhead population in the SMU. The hatchery summer steelhead program releases 165,000 smolts into Rock Creek. To reduce the risk from the hatchery summer steelhead program on the wild summer steelhead population, hatchery summer steelhead adults will be removed at the new trap at Rock Creek Hatchery before they can spawn in the wild. Currently, there is a significant proportion of hatchery summer steelhead adults that pass Winchester Dam that are unaccounted for by harvest or removal and may be spawning in the wild. Removing hatchery adults that enter the Rock Creek trap will ensure that these fish are not interacting with the wild population. ODFW expects that this change will have no impact on the hatchery summer steelhead fishery opportunity in the North Umpqua population.

Cutthroat Trout

Coastal cutthroat trout are widely distributed and healthy. Cutthroat management will focus on maintaining their distribution, health, and harvest opportunities. A reduction in harvest risk in the North and South Umpqua will seek to address the continued low number of cutthroat trout documented migrating above Winchester Dam each year. Better understanding the current status of cutthroat in the North Umpqua is a critical research need. There are no hatchery coastal cutthroat trout programs in the SMU and none are identified in the CMP.

Fishing/Harvest Actions

> **Management Strategy:** *Manage recreational and commercial fisheries to provide harvest and angling opportunities consistent with conservation of naturally produced salmon, steelhead and trout, and achievement of desired status goals for each SMU.*

Harvest rules for wild salmon, steelhead and trout within their respective SMUs have changed significantly in the last 35 years. In the late 1980's and early 1990's, harvest was allowed on wild fall-run Chinook, spring-run Chinook, coho, winter steelhead, summer steelhead, and cutthroat trout in almost all of the population areas. Rules changed in the 1990's with first wild steelhead and then wild coho being prohibited to harvest. Coastal cutthroat trout followed with all coastal streams closed to the harvest of trout in 1997.

Wild steelhead harvest was closed in part to help stave off an ESA listing. Because there was limited information on these fish, eliminating potential threats was seen as a way to ensure they would persist regardless of their actual status. For coho, the elimination of harvest of wild fish came at a period in the 1990's when spawning escapements were very low and there was concern that some populations might get too low to recover. In the case of coastal cutthroat trout, a decline in the number of searun trout seen in estuaries and streams created a concern for some anglers that led to a proposal to the OFWC to prevent further harvest of all cutthroat trout on the coast. With very limited information on cutthroat or the relationship between searun and resident fish, the OFWC chose to be cautious and adopted the no harvest rule.

At the time these wild fish harvest fisheries were suspended, ODFW implemented an extensive monitoring program in these coastal SMUs to gather better information on the status of the various populations. This program included improved spawning surveys for coho to provide more accurate estimates and the implementation of spawning surveys for steelhead to support estimates of the number of spawners along the coast. ODFW also initiated juvenile surveys to provide a picture of how widespread coho, steelhead and cutthroat were distributed in coastal basins. Life-cycle monitoring sites developed in a several streams allowed the estimation of adults into a stream and smolts out. These data are used to calculate survival from smolt to spawner for coho, providing an insight into the marine survival of these fish over time and the magnitude of its variability. These sites also allow estimates to be made of the number of migratory cutthroat trout leaving a stream each spring.

Today there are 10 to more than 15 years of data that have been collected through the coastal monitoring program. This information has improved our understanding of the current status of coho, steelhead and coastal cutthroat trout in the SMUs covered in this plan. Research has also been conducted on fall-run Chinook to provide better estimates of spawner escapement and harvest impacts which occur both terminally and in fisheries well beyond Oregon's borders. The amount and quality of the data for these SMUs is greater than anywhere else in the Pacific Northwest and provides the best opportunity to assess the status of the SMUs and the implications of harvest management on these fish populations. Based on the information that has been accrued, ODFW has identified in this plan a harvest management program that ensures the long-term conservation of each SMU while also allowing for fishery opportunities, including harvest on wild coho, steelhead and coastal cutthroat trout in some areas.

In addition, this harvest management program seeks to modify the current fishery opportunity to harvest wild fall-run and spring-run Chinook. These populations currently incur the greatest harvest mortality of the SMUs covered in this plan, and ODFW believes this impact needs to be better managed to ensure the long-term security of these fisheries. This includes some tools to provide consistent decision-making strategies.

Actions identified in this plan address harvest levels of wild fish, how changes in those harvest levels will be determined, and the general time periods harvest will be allowed. As part of implementing this plan, it may be necessary to adjust the streams (or sections of streams) open to wild fish harvest, or fishing in general. It may also be necessary to change gear or fish size requirements. These changes may be needed to protect spawning fish, unique runs of fish, or overly vulnerable fish. Any changes to these types of regulations will be consistent with the intent of the CMP and will follow the process for modify angling regulations.

The following discussion in the CMP of fishing/harvest actions pertains primarily to the harvest of wild salmon, steelhead, and trout. The CMP does not identify any changes to the allowable harvest limits of hatchery fish, although the opportunity to catch hatchery fish may be affected in some locations (i.e., where hatchery fish releases are shifted, increased, or reduced [see **Hatchery Fish Actions**] and where there are angling deadline changes noted in this section). The allowable harvest of hatchery salmon and steelhead will remain at two fish per day and an unlimited number for the year as long as hatchery harvest tags are purchased and used to harvest more than 20 fish in one year (note: 20 is the number of wild and hatchery salmon and steelhead allowed to be harvested in a year with a Combined Angling Tag).

The CMP applies the "*portfolio*" approach to assign and allow different fishing risks to wild fish in different areas. In addition to a mix of locations, different fishing risks to wild fish are allowed at different times. This mix of opportunity in space and time is the foundation for the harvest management approach in the CMP. The mix of opportunities is generally similar to current opportunity, with adjustments in several Management Areas, harvest limits, and harvest periods for some of the SMUs to meet Desired Status and fishing opportunity objectives. The decision framework to determine areas and timing of harvest and catch-and-release includes the following considerations:

- Intent to disperse fishing risk spatially across strata and SMUs
- Intent to protect rare and sensitive species and life histories (chum, summer-run and spring-run Chinook, summer steelhead)
- Intent to reduce wild fish harvest mortality if warranted
- Intent to provide new or increased wild fish retention opportunities if feasible
- Intent to offset fishing opportunity reductions related to hatchery program changes
- Ability to reliably predict run-size and estimate escapement
- SMU gap between current and desired status
- Observed abundance trends and estimated productivity
- Measured or apparent contemporary harvest mortality rates
- Monitoring capacity
- Stakeholder, opinion poll, and public advice regarding social traditions, preferences, and economics
- Pragmatic enforcement challenges

The following provides an overview of fishing/harvest management for each SMU. See below for in-depth details about Fishing and Harvest actions. These management actions revise current harvest rules for wild salmon, steelhead, and trout in the following ways:

- Replace fixed seasonal retention rules with rules scaled to abundance cycles of each species
- Replace river-by-river harvest rules with stratum-based rules
- Establish measurable criteria to trigger emergency rules for all species
- Establish seasonal limits to protect early-run Chinook in the Nehalem and Siletz basins
- Establish seasonal limits to protect Umpqua spring Chinook
- Allow modest increase in coho harvest
- Allow modest increase in winter steelhead retention

<u>Overview of Fishing/Harvest Program Changes</u>

The actions described below are only those harvest-related actions that represent a change from current harvest strategies. CMP-identified and status quo strategies with respect to the retention of wild fish are listed in Table 17 and Table 18 and the subsequent actions.

Chinook

Fall-run Chinook

Natural production supports the vast majority of bay/river harvest (over 80%) coast-wide and it is important to maintain and improve these fisheries. A noticeably higher proportion of hatchery fish are caught in the Necanicum, Salmon, Coos, and Elk basins. Harvest retention of wild fall-run Chinook remains permitted in virtually all of the modest to large basins across the SMU (see Table 17). However, given that this SMU is exposed to ocean fisheries for 2-5 years before they mature and are also harvested when they return to spawn (with a total harvest rate at or exceeding about 50% - close to what ODFW considers the maximum safe rate), this plan identifies some harvest regulations to protect this run, including: 1) establishing lower daily retention limits where there is high fishing pressure (North Coast stratum), divergent model results regarding viability (Tillamook, Nestucca, Salmon, and Floras), and a non-viable population (Elk, with similar regulations implemented on the Sixes), and 2) implementing sliding scale harvest regulations for protection.

As part of this planning process, ODFW is seeking to provide consistency and certainty in harvest management of fall-run Chinook. In recent years, it has been necessary to adjust season dates, angling deadlines, and bag limits frequently for various populations to address Chinook abundance changes. While it is not possible to guarantee that management will remain consistent from year-to-year, this plan attempts to outline a harvest strategy that will allow ODFW to make significant progress towards this goal. However, it should be noted that managing these populations may require additional future actions not directly identified in this plan.

Sliding Scale Management

ODFW developed a sliding scale to manage bay and river fall-run Chinook fisheries' retention limits to adjust the impact of harvest from these fisheries based on the current abundance cycle the fish are experiencing (see Table 18). Most of the variability seen in Chinook abundance is believed to be a result of the marine survival conditions the fish experience. Marine survival has been documented to be somewhat cyclic with periods of up to 10 years having similar survival conditions, and thus similar Chinook abundances. The sliding scale seeks to take those cyclic patterns into account and adjust the harvest impact (through the allowable retention limit) accordingly to either minimize impact when survival is low, or maximize it when survival is high.

It is ODFW's intent that during periods similar to what was experienced in the late 1990's and early 2000's in the SMU (several years of near-record high abundances) the fisheries would be able to harvest more wild fall-run Chinook, and during periods similar to what was experienced in the late 2000's (a few years of very low abundances) the harvest would be reduced to protect spawner abundance. ODFW expects that this approach will better protect wild fall-run Chinook while also allowing greater opportunity to harvest when conditions are favorable and not unnecessarily constraining harvest when low periods occur. As this approach is implemented, and progress is made towards achieving the desired status of more productive and abundant wild fall-run Chinook populations, there should be a greater frequency of periods than in the past where high abundances are experienced and fewer periods where low abundances occur.

Marine survival is not consistent along the coast, so the abundance cycles will be assessed at the stratum level and the bag limits called for in the sliding scale will apply to all populations within that stratum. This will allow for protection, or utilization, of areas that are responding differently than populations elsewhere along the coast. Changes in the abundance cycle are expected to be gradual and cycles are expected to last for multiple years. Therefore, the sliding scale category is likely to remain in place for several years rather than varying from year to year.

During the initial implementation of this plan, ODFW will be exploring forecasting methods to develop the most accurate method of identifying abundance cycles. Variables to assess marine survival conditions such as ocean temperature and upwelling indices will be considered along with indicators of freshwater survival, such as flood and drought events. These variables will be considered along with age composition data from returning adults and ocean harvest information to explore any and all factors that may influence the survival of Chinook as they grow, mature and return to spawn. This work has just begun and may take enough time that better forecasting will not be in place by the first fall after plan adoption. All indications from recent returns and ocean indicators suggest that there should not be a drastic change in returning adult abundance in the next few years. Based on this expectation, retention limits using the average abundance category in the retention schedule will be the default until the new forecasting approach is developed and tested.

Differences in the CMP's identified daily and annual retention limits for wild fall-run Chinook are due to differences in expected fishing pressure, the presence and size of hatchery programs to supplement retention, and the status of the wild populations. For example, annual limits for wild fish retention under average conditions in the North Coast stratum are reduced relative to some other strata given the significantly higher harvest pressure in some of these populations resulting from their proximity to the Portland Metro area as well as the presence of adequate proportions of hatchery fish available to avoid constraining anglers' ability to retain higher annual numbers of fall-run Chinook.

For the Yachats population, the CMP maintains the current retention limit of 1 wild fish per day and 5 per year. The Yachats is a relatively small population that can be susceptible to over-harvest. The current retention limits were negotiated between local anglers and the watershed council and appear to have provided an agreeable balance between conservation and opportunity.

In the Elk River population area, the status of wild fall-run Chinook is at risk due in part to the very high level of hatchery fish spawning in the wild. To help alleviate this risk, the retention limit on wild fall-run Chinook will be lower than in other areas of the coast (1 per day/5 per year during low marine survival years, 1 per day/10 per year during average and high marine survival years). ODFW expects this lower retention limit to encourage anglers to focus their harvest efforts on hatchery fish and result in fewer hatchery fish spawning in the wild while also allowing more wild fish to escape harvest and spawn. The lower retention limits applied to the Sixes River and Floras population areas should discourage anglers that fish the Elk River from switching and fishing the Sixes or Floras instead because there is a higher retention limit. There are also significant numbers of Elk River hatchery fall-run Chinook that stray into the Sixes and spawn. The lower retention limit for wild fish in the Sixes may increase the harvest of hatchery fish in the Sixes population area and reduce the risk of those fish spawning with wild fall-run Chinook. A State Waters Terminal Area season is typically open in the ocean November 1 through November 30 between Cape Blanco and Humbug Mountain. This fishery targets Elk River fall-run Chinook. The lower retention limit for the Elk fishery will also be applied to the recreational terminal area fishery in aggregate with Elk and Sixes rivers. Season structure for the commercial terminal area fishery will be determined based on annual forecasts of abundance and could include changes in season length, landing limits, quotas, and restrictions on harvest of non-finclipped Chinook.

Pacific Salmon Treaty

Juvenile fall-run Chinook from the Oregon Coast migrate north through Oregon and Washington waters to eventually rear in marine waters off Alaska and British Columbia. Salmon fisheries managed under aggregate abundance-based management regimes in these waters harvest as many or more Oregon fall-run Chinook than fisheries in Oregon. The harvest of these fish off the coasts of Alaska and Canada (with minor amounts harvested in Washington) is managed under a treaty between the United States and Canada known as the Pacific Salmon Treaty (PST). Implementing the PST requires the Pacific Salmon Commission (PSC) to consider the impact of these international fisheries on all salmon stocks, including Oregon's Coastal fall-run Chinook. As a result, Oregon's requirements for returning spawners to maintain healthy populations is considered when harvest objectives are set in the PST process each year. However, the PST fisheries occur before Chinook return to Oregon, so if those fisheries harvest a greater proportion of Oregon's fall-run Chinook than is preferred, or if run size forecasts are overestimated fewer adults will return to Oregon bays and rivers – which can impact the bay and river fisheries, as well as the number of spawners that can perpetuate the populations of Chinook along the Oregon Coast. The converse can also occur if forecasts underestimate returns and northern fisheries harvest fewer fish than expected.

Most stocks covered by the PST, including many Oregon stocks, have a PST-adopted escapement goal or other management objective. If a stock is below goal or projected to be below goal, U.S. non-PST fisheries, including those conducted by the party managing the river of origin for that stock are required to reduce fishery harvest. By outlining a management program for Oregon Coastal Chinook in this plan that reduces the impact of freshwater fisheries when abundances are expected to be low, Oregon will be putting in place a mechanism to address this requirement as it may be applied to terminal tributary fisheries.

Oregon is represented on the PSC and this ODFW plan will be incorporated into the PSC process as necessary and appropriate. The current PST Chinook agreement will expire in 2018 and a new agreement will need to be negotiated. As in prior negotiations, ODFW will use this opportunity to ensure that both the spawning populations of Chinook and the Oregon fisheries will continue to be appropriately represented in the treaty.

Spring-run and Summer-run Chinook

Spring-run and summer-run Chinook salmon in basins originating in the coastal mountains of Oregon are thought to be a life-history variant of Chinook in the Chinook SMU. These life-histories evolved in areas with habitat types suitable for early returning fish to survive. Cannery records from the 1920's show that early returning Chinook were processed in several of the major river basins (Nehalem, Tillamook, Nestucca, Siletz, Alsea, Umpqua, and Coquille) in varying abundances. In most of these basins the size of the wild spring or summer run is currently small (Tillamook, Nestucca, Alsea, and Coquille). The CMP identifies *protective periods* when harvest is prohibited for these less abundant and unique life history variants. Unlike the sliding scale protections through time which vary across years, these *protective periods* will not vary and will occur within each year. Essentially, this period does not allow harvest of wild Chinook in most locations from April through July. This restriction does not apply to Umpqua spring Chinook, which are populations and not run variants. It also does not apply to the stronger Nehalem summer-run Chinook and Siletz spring-run Chinook runs, where some harvest is allowed using a sliding scale that changes based on the fall-run sliding scale.

In the Nehalem, the sliding scale retention limits for summer-run Chinook will be in place from the opening of the trout season in May (the 4th Saturday of the month) through September 15 of each year. The retention limits call for 1 wild Chinook per day and 1 per year during low marine survival years, 1 wild Chinook per day and 5 per year during average marine survival years, and 1 wild Chinook per day and 10 per year during high marine survival years.

In the Siletz, the sliding scale retention limits during the protective period for wild spring-run Chinook will be in place from April 1 through July 31 of each year. The retention limits call for 1 wild Chinook per day and 1 per year during low marine survival years and 1 wild Chinook per day and 2 per year during average and high marine survival years.

In the Tillamook and Nestucca, hatchery programs provide spring returning hatchery Chinook that support popular fisheries. These areas have been open to the harvest of only hatchery spring-run Chinook for a number of years, and that regulation will be maintained. In the Alsea, the season for harvesting wild Chinook currently opens late enough, and only in lower areas, such that any early returning Chinook are most likely protected from harvest. ODFW will maintain the later opening dates in the Alsea and implement similar measures in the Coquille population area to protect any spring-run Chinook.

Yaquina and Coos Bay Spring Fisheries

To provide more fishery opportunities along the coast in the spring, ODFW will experiment with the creation of hatchery spring-run Chinook fisheries in Yaquina and Coos Bays. These fisheries will be targeted on hatchery fish acclimated and released in the bays, and they are expected to mirror the popular fisheries in Tillamook and Nestucca Bays. Since neither basin has a native spring Chinook population or spring-run life-history variant, it is expected that these fisheries will have little effect on native fish in the basin. The habitat conditions in both basins in the summer and early fall make it unlikely that hatchery spring Chinook not caught in the fisheries will be able to successfully spawn and compete with wild fall-run Chinook.

ODFW will implement these programs if long-term funding is secured for a) rearing and releasing the hatchery spring-run Chinook and b) monitoring the potential effect of the hatchery fish on native populations of Chinook in these and nearby basins and the effectiveness of these programs in producing fish to be caught. These programs will only move forward if long-term funding is secured and local volunteers commit to develop and implement the facilities and program long-term. Specific details for these programs, including the logistics of raising and acclimating the hatchery fish, will be developed by ODFW with partners during implementation of the CMP.

Spring Chinook

ODFW has identified North and South Umpqua early returning Chinook as independent spring Chinook populations due to their spatial and temporal separation from fall-run Chinook and differing juvenile life-histories. These two populations are considered a separate SMU. It is likely that the South Umpqua spring Chinook population was historically a smaller population than the North Umpqua population. Currently, the South Umpqua population's status is precarious with indications that it is not very productive. The threats to this population include the loss of suitable habitat and high harvest rates. While efforts are underway to improve the habitat in the South Umpqua for spring Chinook, it will be a long process for improved habitat to develop sufficiently to increase the productivity of the wild spring Chinook population. For this reason, the CMP identifies a sliding scale for retention limits on wild spring Chinook in the mainstem Umpqua that is reduced from the previous retention limits to help improve the productivity of this population (see Table 18). The forecasted abundance levels of North Umpqua spring Chinook will be used for the abundance categories to use for both the North and South Umpqua populations. Retention limits for hatchery spring Chinook will remain unchanged.

The fishery for spring Chinook in the Umpqua Basin occurs from the lower river upstream into the North Umpqua. The majority of harvest occurs in the mainstem Umpqua below the confluence of the North and South Forks. The South Umpqua is currently closed to Chinook harvest year-round, while the North Umpqua is open to the harvest of wild spring Chinook up to Rock Creek. It is not possible to differentiate the two Umpqua wild spring Chinook populations, so a more conservative sliding scale is needed in the mainstem Umpqua below the confluence of the North and South forks. The sliding scale for wild spring Chinook on the mainstem Umpqua will be in place from February 1 through July 31 of each year, and the retention limits of wild spring Chinook will be 1 per day and 1 per year during low marine survival years, 2 wild spring Chinook per day and 5 per year during average marine survival years, and 2 wild fish per day and 10 per year during high marine survival years.

The North Umpqua spring Chinook population is a unique population in the area covered by this plan as it occupies habitat originating in the Cascade Mountains. It provides for a very popular spring Chinook fishery in the Mainstem and North Umpqua. It appears to be healthy with several thousand wild adults returning most years, though there has been a declining trend over the last 38 years (1972-2010). Since this is the only robust population of wild Spring Chinook in this SMU, it is imperative that it be managed cautiously to ensure its sustainability (including the fishery benefits it provides) into the future. ODFW will reduce the risk from harvest on this population with a sliding scale for the retention of wild spring Chinook in the North Umpqua River. The North Umpqua is also home to a large hatchery spring Chinook program that produces as many, if not more, adults than the wild population. Therefore, reduced retention limits will be implemented during the same fishery season as the mainstem Umpqua with 1 wild spring Chinook permitted to be kept per day and 1 per year during low marine survival years, 2 wild spring Chinook per day and 10 per year under average marine survival years, and 2 wild spring Chinook and 20 per year during high marine survival years. By reducing the retention of wild spring Chinook in the Umpqua Basin, ODFW expects that the hatchery adults (which will retain the current retention limits) will be harvested at a greater rate and that this will improve the utilization of the hatchery fish and reduce their numbers on the natural spawning grounds – thus reducing this risk as well.

Pacific Salmon Treaty and Pacific Fishery Management Council
Umpqua spring Chinook juveniles have been documented migrating north after ocean entrance but also rearing off of the Oregon coast. Fisheries in the ocean north of Washington are managed under the Pacific Salmon Treaty (PST), while fisheries off the Oregon and Washington coasts are managed by the Pacific Fishery Management Council (PFMC). Neither of these fishery management groups explicitly considers the status of wild Umpqua spring Chinook in determining fishery impacts. Little is known about the contribution of these fish to ocean fisheries, or the impact these fisheries have on the wild populations. ODFW has identified better understanding of the impacts of these fisheries on wild Umpqua spring Chinook as a critical research need.

Chum
The Oregon Coast is at the southern-most range for chum salmon, and there are small pockets where natural production occurs on a regular basis. Management for chum will focus on keeping hatchery and harvest risk low while trying to better understand the status of chum populations and opportunities to enhance them.

There are no harvest fisheries targeting chum in the SMU. Catch-and-release of chum is allowed only in the Miami and Kilchis Rivers where the runs are relatively strong. Fishing for chum is closed in all other areas of the SMU. ODFW believes that the catch-and-release fisheries in the Miami and Kilchis do not impose a significant mortality on chum adults such that the population's productivity is impaired. These fisheries will continue.

Winter Steelhead
Almost all steelhead harvest is currently supported by hatchery programs (the exception is the Sixes River where wild harvest is currently allowed). Under this plan, winter steelhead harvest will continue to be largely supported with hatchery fish, but with less risk. In two of the three areas where hatchery winter steelhead risk will be reduced significantly through the elimination of hatchery releases, a conservative wild harvest will be implemented. The wild fisheries are intended to replace the hatchery-driven fisheries while keeping risk low. ODFW will evaluate these fisheries, and they could potentially be expanded to other areas, reduced, or eliminated.

The harvest of wild winter steelhead has not been allowed in most of this SMU's streams since the mid-1990s. Since that time, harvest has been supported entirely with hatchery programs. Balancing harvest opportunities with the need to conserve wild populations has become an increasing challenge in recent years. Harvest rates in winter steelhead fisheries are rarely greater than 40% (as summarized by Kenaston 1989), which means it is difficult to remove the majority of hatchery fish in a fishery to avoid potential interaction with wild winter steelhead.

To address the risk from hatchery winter steelhead programs on wild winter steelhead, ODFW will shift some hatchery winter steelhead releases out of some areas and add them to other areas that have greater fishing pressure and should more effectively utilize the hatchery fish (see **Hatchery Fish Actions**). To offset the loss of opportunity to harvest winter steelhead in two of those areas in which hatchery programs will be removed, ODFW will implement conservative harvest fisheries on wild winter steelhead in those areas - Big Elk Creek (Yaquina population), and East Fork Coquille River (Coquille population). In addition, ODFW will implement a wild winter steelhead fishery in the Salmon River, where a moderately sized healthy wild population exists with no current hatchery program.

Angler sentiment appears to have changed since the 1990's in regards to harvesting wild winter steelhead. Recent regulation proposals to allow wild harvest have prompted vocal opposition that suggests there is a greater voice for wild winter steelhead protection than in the past. During Stratum Stakeholder Team meetings related to developing this plan there was significant opposition to these proposals for wild winter steelhead harvest in select areas - also suggesting attitudes have changed. ODFW believes that this advocacy for wild winter steelhead will result in a lower percentage of anglers harvesting a wild steelhead in the future than harvested them prior to the 1990's should wild harvest be expanded. These fisheries will have low daily and annual bag limits and are expected to be driven by the abundance of the population each year – higher angler pressure in years of high abundance and lower pressure in years of low abundance.

While there appears to be resistance to wild winter steelhead harvest, the Oregon State University opinion survey commissioned by ODFW showed that the majority of anglers and the general public support the harvest of wild winter steelhead when it will not jeopardize the health of the population (see **Appendix VI – Opinion Survey**). The support of anglers for wild winter steelhead harvest was nearly five times greater than those who opposed it (60% to 13% - with 14% unsure and 14% not responding/no opinion). It is for this reason that ODFW will implement a limited number of wild winter steelhead fisheries to offset hatchery adjustments and to create new opportunities.

ODFW believes that wild winter steelhead in these areas are healthy enough to provide a fishery without a significant risk to the populations' long-term persistence. All but one of these fisheries will be allowed in only a portion of any population area, and so only a portion of the population will be subjected to harvest. The fisheries will be designed to limit the number of wild winter steelhead that can be harvested to a low percentage of the population – no more than 10% of the wild fish exposed to the fishery. These populations persisted for many generations while being harvested at higher levels than identified in this plan. ODFW expects that the abundance of these populations will continue to primarily be driven by changes in marine survival and will not be significantly affected by harvest.

ODFW analysis indicates that wild winter steelhead populations can support harvest without affecting the populations' viability. For the North Umpqua, which has the most accurate information on wild winter steelhead abundance, the PVA Model found that the population could withstand a sustained harvest rate close to 50% without increasing its long-term risk of extinction (Figure 14). There is little information available to determine if the North Umpqua is a more productive winter steelhead population than others in the SMU or if it is similar to most. The only other population with adequate data to assess productivity (Salmonberry wild winter steelhead in the Nehalem) has higher productivity than the North Umpqua. While harvest on the North Umpqua or Salmonberry populations is not identified in the CMP, ODFW has no indication that the overall conclusion of this assessment (i.e., a small level of harvest will not jeopardize viability) should not be inferred to those management areas where harvest is identified in the plan. ODFW expects that improvements in habitat and the lower risk from shifted hatchery programs in two of the locations where harvest is identified[25] should also more than offset the minimal risk associated with a very modest harvest. The CMP does not identify wild harvest rates that have been shown to increase the extinction risk of wild winter steelhead populations. All of the wild steelhead fisheries identified in the CMP will be capped at 10% for those wild fish that are exposed to the fishery. ODFW will monitor in some of these areas to evaluate the impact of the wild winter steelhead fishery, and adjustments will be made to the fishery if harvest rates are found to be higher than the cap of 10%.

[25] Wild winter steelhead harvest is expected to off-set some of the lost local fishing opportunity in two of the locations where hatchery programs are shifted.

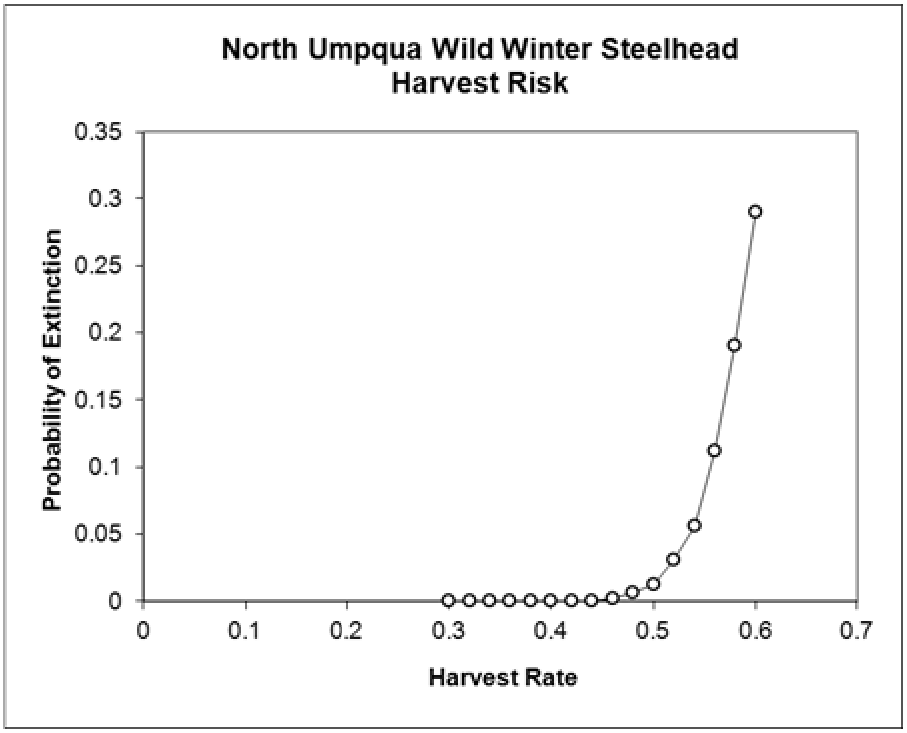


Figure 14. PVA model output of extinction risk of North Umpqua wild winter steelhead at various harvest rates over a 100 year period. Extinction risk surpasses 1 percent risk of extinction (1.3%) at a 50% harvest rate.

Wild Winter Steelhead Harvest Fisheries Specifics

Salmon River

The wild winter steelhead harvest fishery in the Salmon River population area will provide a new harvest opportunity (no hatchery winter steelhead program currently exists in Salmon River). This population area supports a healthy wild winter steelhead population, and it is an ideal location for a modest harvest fishery that is unlikely to receive high angler pressure. This population area once had a small release of hatchery winter steelhead, but it used an out of basin stock and was discontinued in the 1990's. This fishery will be managed for a low harvest impact by limiting the retention of wild winter steelhead to 1 per day and no more than 3 per season.

Due to the variability in river conditions throughout the winter steelhead season, it is likely that a significant proportion of the wild population will not be susceptible to the fishery in Salmon River. This population area is currently fished for winter steelhead by catch-and-release anglers. It is not anticipated that the harvest fishery will be heavily fished.

Yaquina

ODFW will eliminate the release of hatchery winter steelhead into Big Elk Creek. This tributary to the Yaquina River has the most productive winter steelhead habitat in the population area, and the elimination of the hatchery program will eliminate the risk associated with the program. The loss of hatchery winter steelhead harvest opportunity will be offset with a conservative wild winter steelhead harvest fishery. Like Salmon River, Big Elk Creek is unlikely to receive high angler pressure, and the wild winter steelhead population likely will not be susceptible to significant harvest.

The wild winter steelhead fishery will be managed with a conservative retention limit of 1 per day and 3 per season. The conservative limits combined with the smaller population size will combine to make it unlikely that the population can be harvested at a level higher than expected.

Coquille

Hatchery winter steelhead are currently released into three of the four identified management areas that support wild winter steelhead in the Coquille population area. ODFW will reduce the risk from hatchery fish by eliminating the hatchery winter steelhead release into the East Fork Coquille River and shifting all of those hatchery fish (20,000) into the North Fork Coquille River. With the risk from hatchery fish reduced in the East Fork Coquille River, the loss of opportunity to harvest a hatchery winter steelhead will be offset by implementing a conservative wild winter steelhead harvest fishery in the East Fork Coquille. This fishery will allow the harvest of 1 wild winter steelhead per day and 3 wild steelhead per season.

ODFW chose the East Fork Coquille River for implementation of the wild winter steelhead fishery because the current winter steelhead fishery attracts the fewest anglers of the three management area fisheries in the Coquille population area. Because this area is not currently heavily fished, it is anticipated that fishing pressure under the wild harvest fishery will be similar or less than current pressure, and the impact from the fishery will stay within the allowable level of 10% or less. Those anglers who enjoy fishing the East Fork Coquille River for steelhead will still have this opportunity and could still harvest up to three steelhead each year.

Sixes

The Sixes population area is currently the only river in this winter steelhead SMU that has been open to the harvest of wild winter steelhead. The current fishery allows 1 wild fish to be harvested per day and 5 per season. This fishery has been in place since 2003 and has reported catch of just over 150 fish per year. There have been no indications that the fishery has impacted the health of the wild population. For this reason, ODFW will maintain the current wild winter steelhead harvest fishery in the Sixes population area. The current retention limits will remain in place. The new wild winter steelhead harvest fisheries in other streams in the SMU have lower seasonal retention limits to ensure that new fisheries will not result in over-harvest of the wild populations. Since the fishery in the Sixes has already been proven to be conservative, the CMP does not identify changes to the existing retention limits.

Wild winter steelhead harvest in Salmon River, Big Elk Creek (Yaquina), and East Fork Coquille River will be adjusted if: 1) the harvest rate in these Management Areas is >10%, or 2) stratum level Conservation Abundance is reached and harvest is deemed a concern. Adjustment of harvest does not necessarily require eliminating it; season length, limits, deadlines, gear, or other management controls may be utilized. Harvest rates will ideally be determined with creel surveys and redd surveys, although alternative methods may need to be employed because creel surveys and redd surveys may not be feasible in all locations and are dependent on funding.

Summer Steelhead

There are only two historical populations of summer steelhead in this Species Management Unit (Siletz and North Umpqua) and both are unique, requiring protection and enhancement. Management will focus on continuing the prohibition on harvest and reducing the potential risk from hatchery programs.

The harvest of hatchery summer steelhead will continue in the North Umpqua River, Siletz River, Nestucca River and Wilson River. Those hatchery summer steelhead currently released in the Wilson and Nestucca (100,000 between the two) will be evenly split between the two basins (50,000 in both the Nestucca and Wilson) to try and get a higher proportion of the hatchery fish harvested – the Wilson fishery's catch-per-smolt released is higher than the Nestucca. This change will hopefully reduce any potential risk of the Nestucca program on the Nestucca wild winter steelhead population.

The hatchery program in the Siletz River will be reduced by 30,000 smolts to a total of 50,000 smolts. The current and very popular hatchery winter steelhead fishery in the Siletz is supported by a 50,000 hatchery smolt release. ODFW expects that the hatchery summer steelhead fishery can be just as successful with a 50,000 smolt release. Efforts will be made to monitor the fishery, and if it is found to have declined with the reduced release, ODFW will consider improving the broodstock or increasing the release back to 80,000 hatchery smolts.

Cutthroat Trout

The harvest of wild coastal cutthroat trout was reinstated throughout the SMU in 2004 and 2008. The harvest fishery in this area had been closed since 1997. ODFW has found that the angler pressure on cutthroat trout is considerably less than it was in the 1990's (ODFW unpublished data) and appears to present little risk to the wild populations.

Coastal cutthroat trout are widely distributed and healthy. Cutthroat management will focus on maintaining their distribution, health, and harvest opportunities. There is still some uncertainty as to the status of the anadromous life-history variant of coastal cutthroat trout (also known as searun cutthroat). There is little abundance data on this life-history. Counts over Winchester Dam on the North Umpqua River provide the only information on adult numbers. The numbers of searun cutthroat over time that have passed Winchester Dam have dropped significantly, but research information suggests that any cutthroat trout can produce searun offspring, and resident cutthroat in the North Umpqua have not shown a similar declining trend. Better understanding the current status of cutthroat in the North and South Umpqua is a critical research need.

ODFW will take a cautious approach to the searun cutthroat question. The tributaries in the North Umpqua River and both the mainstem and tributaries in the South Umpqua River will be closed within the range of anadromous salmonids to the harvest of cutthroat trout. The mainstem of the North Umpqua, as well as the mainstem Smith River and Umpqua River, are currently closed to the harvest of cutthroat trout, but there has been no significant increase in searun numbers passing Winchester Dam since these regulations were put in place. Since hatchery releases of cutthroat trout were terminated in the 1990's, closing the tributaries and mainstem South Umpqua to harvest is the most that can be done to protect the searun life-history in the Umpqua.

In addition to harvest closures in the Umpqua Basin, ODFW will close the harvest of cutthroat trout in tidally influenced mainstem reaches of other coastal basins if the marine survival of coho is seen to drop to very low levels. It is believed that the same ocean conditions that drastically reduced the survival of coho salmon juveniles in the mid 1990's may also have affected the survival of searun cutthroat trout. More searun cutthroat were anecdotally observed in the 2000's, when coho marine survival was much higher than were reported in the 1990's. To protect the searun cutthroat life-history, ODFW will close sections of mainstem rivers influenced by tidal exchange to the harvest of cutthroat trout during periods of poor coho marine survival. ODFW life cycle monitoring sites will provide the estimates of coho marine survival to determine when cutthroat fisheries in these areas need to be closed. In addition, ODFW will modify harvest if it is considered an issue for cutthroat when winter steelhead hit stratum-level Critical Abundances in consecutive years[26].

Coho

Harvest of ESA-listed ("threatened"; NOAA 2011) wild coho salmon from the Oregon Coast ESU is currently managed based on the Pacific Fishery Management Council's (PFMC) Amendment 13 (A-13) to their Salmon Fishery Management Plan (PFMC, 2012). Management using A-13 is sanctioned in the State of Oregon Coho Conservation Plan (ODFW 2007) and by NOAA Fisheries. Additional requirements for freshwater harvest of Oregon Coast wild coho salmon is provided in Fisheries Management and Evaluation Plans (FMEPs) for Coastal lakes (ODFW 2003) and Coastal rivers (ODFW 2009). Future direction for managing harvest of OCN coho harvest is provided in this plan with emphasis on fisheries in bays, rivers and lakes where the State of Oregon has greater management control.

A-13 sets an allowable maximum fishery impact on an annual basis based on categorical rankings of parental spawners and projected marine survival (PFMC 2013 - Preseason Report 1). These two categories are associated with a matrix that describes allowable impacts ranging from <8 % to 45 % (Table 15). As currently implemented, the allowable fishing mortality is for all fishing including ocean fisheries in all areas and includes post-release or by-catch mortality in fisheries where coho are caught, but not retained. Allowable impact rate in fisheries in bays, rivers and lakes is therefore the total impact under A-13 minus the expected impact in ocean fisheries as determined by the PFMC each year. As a result, the allowable annual impact for

[26] If harvest is considered a concern for cutthroat, the geographic scale of harvest reduction will range from local mainstem and/or tributary closures within Management Areas to within the entire stratum, depending on available information.

freshwater fisheries can only be determined during the annual PFMC planning process. ODFW ocean salmon fishery managers coordinate with freshwater fishery managers to ensure that in-river fishery impacts are represented in calculations of total fishery impact during this process.

Table 15. A-13 harvest matrix as modified by the OCN Workgroup. Percentages in cells are the total fisheries impact (ocean and freshwater combined) allowed for the Oregon Coast Coho ESU.

Parent Spawner Status	Marine Survival Index			
	Extremely Low	Low	Medium	High
High	≤ 8%	≤ 15%	≤ 30%	≤ 45%
Medium	≤ 8%	≤ 15%	≤ 20%	≤ 38%
Low	≤ 8%	≤ 15%	≤ 15%	≤ 25%
Very Low	≤ 8%	≤ 11%	≤ 11%	≤ 11%
Critical	0 – 8%	0 – 8%	0 – 8%	0 – 8%

For wild coho fisheries in coastal bays, river and lakes ODFW will structure seasons that:

1) have projected impact rates consistent with A-13 after projected ocean impacts,
2) seek to manage harvest impacts by limiting areas open to angling and bag limits, rather than with catch quotas,
3) use daily and annual catch limits to distribute the allowable harvest broadly among anglers and throughout the season,
4) focus fisheries in areas where snagging or fish harassment is minimal,
5) focus fishing in the same areas as fall-run Chinook angling to the extent feasible, and
6) are as simple and consistent as possible with recognition that simplicity and consistency will not maximize allowable harvest.

As with Chinook fisheries, a sliding scale will be used as a guide in establishing daily and annual retention limits for fisheries in streams and lakes where wild coho harvest is allowed. At the outset of the plan, Table 16 provides guidance for likely scenarios under A-13 and describes an initial strategy for establishing management approaches under varying levels of available OCN impacts for freshwater fisheries.

Table 16. Sliding scale guidance for wild coho harvest. Freshwater impact is the amount remaining under A-13 after ocean fishery impacts have been allocated.

Freshwater Impacts	Proposed Management Approach
if 0, then	Season closed by sub-aggregate
if < 4%, then	One per day, two per year in select waters
if 4-10%, then	One per day, two per year in most basins
if > 10%, then	One per day, five per year in most basins

In lieu of annual quotas, annual regulations for individual basins will be established based on recent performance of wild coho fisheries in that basin, and expected impact levels under different fishing regulations compared to the available impact allowance. Basins will have similar regulations to the extent feasible with effort made to group regulatory regimes by strata used in this plan, or by population sub-aggregates under A-13. For bay, river and lake fisheries, A-13 impact allowance will be considered at the sub-aggregate level. For example, if the northern sub-aggregate has low parental spawners that trigger a lower impact than other sub-aggregates, then ocean “mixed stock” fisheries and the weak sub-aggregate will be constrained at the lower level while the stronger sub-aggregates can have a higher allowable impact level in terminal fisheries. This strategy is consistent with historical and current practices.

ODFW believes the modifications to management of the wild coho fisheries will ensure the conservation of Oregon Coastal coho into the future and provide broad angling opportunity with as much consistency as possible. As the status of the Oregon

Coastal coho continues to improve, ODFW will consider if harvest limits can be increased while maintaining consistency with A-13. Conversely, a decline in coho performance will result in fishery cutbacks. Consistent with the management direction in this plan for terminal fisheries, ODFW will work with NOAA fisheries and others to adjust or modify FMEPs and other documents as necessary. ODFW will also continue to work proactively with the PFMC, NOAA and others to implement technical revisions to A-13 as necessary.

North Coast Stratum Coho Fisheries

Bays and rivers in the North Coast Stratum receive intense fishing pressure due to their proximity to the Portland Metro Area. As a result, it has been very difficult to develop bag limits and season structures for wild coho fisheries that do not exceed the allowable impact under A-13. For this reason, a consistent bag limit and season structure under the sliding scale is not possible. Wild coho fisheries in these bays and rivers will continue to be constructed annually to allow harvest while not exceeding the A-13 limits. These fisheries may contain smaller annual bag limits and open periods for a limited number of days each week. Quotas may continue to be used to ensure harvest impacts are not exceeded. As ODFW implements more years of these fisheries and experiments with methods to limit wild coho impacts, a consistent approach to these fisheries may be developed and implemented under the adaptive management process called for in the CMP (see Implementation Section).

Improved Estimates of Harvest

Estimates of salmon and steelhead harvest are currently based on the voluntary return of anglers' Combined Angling Tags (also known as the salmon/steelhead tags, or punch cards) and Daily Angling Licenses. An in-depth study was conducted in the 1960's to determine the corrections that needed to be made to the estimates from these Combined Angling Tags to account for bias and non-compliance with turning the tags in. This study has never been repeated, and it is likely that the corrections are no longer appropriate. To help ensure a better and more reliable estimate of salmon and steelhead harvest, ODFW will make the reporting of harvested salmon and steelhead mandatory by requiring the return of Combined Angling Tags, Hatchery Harvest Tags, and Daily Angling Licenses annually.

The details and process for implementing mandatory reporting have not been finalized. To be effective, the mandatory rule will need to be backed up with a fine[27], denial of future licenses for a period of time, or some other penalty for non-compliance in order to encourage anglers to turn their tags in. These and other details will be determined during the early implementation of this plan.

ODFW will also modify the Combined Angling Tag and Daily Angling License to better collect data on where fish were caught and whether the fish were hatchery or wild. One potential modification is providing space on the tag/license for documenting the number and types of fish that were caught and released by anglers. After changes are made to the Combined Angling Tag and Daily Angling License, it will be necessary to conduct analyses to determine if there are any biases in the tag data and how accurately the estimates from the tags reflect the actual number of fish harvested.

To provide more accurate information on harvest and other fishery impacts in a timelier manner than the Combined Angling Tags and Daily Angling Licenses, ODFW will work with fishing guides and the Oregon State Marine Board (OSMB) to implement a pilot guide log book program. ODFW will work with guides to develop a log book that they can fill out with information on the numbers and types of fish their boat and customers encountered each day, as well as the number of anglers fishing and other information. Efforts will be made to protect proprietary information and to develop a process that is not cumbersome on the guides. ODFW will develop the details for this program cooperatively with guides and guide organizations during the early implementation of this plan. A similar program exists in Alaska that may provide some guidance on development. If the pilot log book program proves to be effective and is not too cumbersome for guides, ODFW will work with OSMB and guide groups to expand the program to all guides.

[27] Fines for non-compliance (as was done for big game harvest tags) would require approval from the Oregon Legislature.

Critical Abundance Levels

The CMP identifies a critical abundance level for most Chinook, spring Chinook, and summer steelhead populations, as well as some winter steelhead populations. This critical level identifies the point where the conservation of the population could be in jeopardy if the downward trend continues. If this level is reached, harvest in the population will be curtailed, taking precedence over the sliding scale. The critical abundance level will be reached when a population's abundance has been at or below the critical level for one year and is forecast to be at or below it in a second. However, given uncertainty associated with the population abundance estimates and the forecasting results, a weight of evidence approach will be used to determine if the population in question is actually experiencing a serious decline in abundance. All available information, including the professional opinions of local biologists will be weighed in this decision process. If it is determined that the critical abundance level of a population has been observed, the wild harvest fisheries in that population area will be suspended. These thresholds are shown in Table A-III: 2. If critical abundance levels for an entire stratum are observed in two successive years, ODFW shall initiate an evaluation of additional actions that are warranted to protect the stratum from long-term decline[28].

ODFW will conduct annual reviews of population status, and biologists will be looking for declining trends that could signal concerns for the health of individual populations. ODFW will not wait until a critical level has been reached to adjust the management for a population. Reduced retention limits, shorter seasons, or other measures will be considered to prevent a declining population from falling to its critical level.

<u>Detailed Fishing/Harvest Actions</u>

Management actions for wild fish retention are summarized in the following tables and sections.

[28] Although not listed in Table A-III: 2, this applies to cutthroat trout strata as well, using winter steelhead as a surrogate.

Table 17. Management Areas where wild fish may be retained (i.e., harvested). "N" indicates no retention of wild fish is allowed. "Retention" indicates that harvest is allowed (see Table 18 for details of limits and seasons). Red stippling and an asterisk indicate a change from current management regarding wild fish retention. "NADOTs" include all direct ocean tributaries not listed elsewhere in the table. Note that coho retention is only intended to be to current deadlines, without expanding further into rivers (current deadlines are mostly within tidewater, including into some rivers above bays, but a few are above tidewater).

		Wild Harvest Locations						
Management Area	Stratum	CO	Chin	Protected Ch [a]/ChS	Chum	StW	StS	CCT
Necanicum R	North Coast Stratum	N	Retention	---	N	N	---	Retention
Nehalem Bay		Retention	Retention	Retention	N	N	---	Retention
NF Nehalem R		N	Retention	---	N	N	---	Retention
Nehalem R		N	Retention	Retention	N	N	---	Retention
Nehalem - Salmonberry R		N	N	N	N	N	---	N
Tillamook Bay		Retention	Retention	N	N	N	---	Retention
Tillamook - Miami R		N	Retention	N	N	N	---	Retention
Tillamook - Kilchis R		N	Retention	N	N	N	---	Retention
Tillamook - Wilson R		N	Retention	N	N	N	---	Retention
Tillamook - Trask R		N	Retention	N	N	N	---	Retention
Tillamook R		N	Retention	N	N	N	---	Retention
Nestucca Bay		Retention	Retention	N	N	N	---	Retention
Nestucca R		N	Retention	N	N	N	---	Retention
Little Nestucca R		N	Retention	N	N	N	---	Retention
Salmon R	Mid-Coast Stratum	N	Retention	---	N	Retention*	---	Retention
Siletz Bay		Retention	Retention	Retention	N	N	N	Retention
Siletz R		Retention	Retention	Retention	N	N	N	Retention
Siletz - above Falls		N	N	N	N	N	N	N
Siletz - Drift Crk		N	Retention	N	N	N	N	Retention
Yaquina Bay		Retention	Retention	---	N	N	---	Retention
Yaquina R		N	Retention	---	N	N	---	Retention
Yaquina - Big Elk Crk		N	Retention	---	N	Retention*	---	Retention
Alsea Bay		Retention	Retention	N	N	N	---	Retention
Alsea R		Retention	Retention	N	N	N	---	Retention
Alsea - Drift Crk		N	Retention	N	N	N	---	Retention
Yachats Aggregate		N	Retention	---	N	N	---	Retention
Siuslaw Bay		Retention	Retention	---	N	N	---	Retention
Siuslaw - Lake Crk		Retention*	Retention	---	N	N	---	Retention
Siuslaw R		Retention	Retention	---	N	N	---	Retention
Umpqua Bay	Umpqua Stratum	Retention	Retention	Retention	N	N	N	Retention
Umpqua - Smith R		N	Retention	N	N	N	N	Retention
Lower Umpqua R		N	Retention	Retention	N	N	N	Retention
Middle Umpqua R		N	Retention	Retention	N	N	N	Retention
N Umpqua R		N	N	Retention	N	N	N	N*
N Umpqua - above Rock Crk		N	N	N	N	N	N	N*
S Umpqua R		N	N	N	N	N	N	N*
S Umpqua R - above Canyonville		N	N	N	N	N	N	N*
Tenmile Lk/Crk (Silt/Tahk) [b]	Mid-South Stratum	Retention	---	---	N	N	---	Retention
Coos Bay Frontal		Retention	Retention	---	N	N	---	Retention
Coos - EF Millicoma R		N	Retention	---	N	N	---	Retention
Coos - WF Millicoma R		N	Retention	---	N	N	---	Retention
SF Coos R		N	Retention	---	N	N	---	Retention
Coquille Bay		Retention	Retention	N	N	N	---	Retention
NF Coquille R		N	Retention	N	N	N	---	Retention
EF Coquille R		N	N	N	N	Retention*	---	Retention
Middle Fork Coquille R		N	Retention	N	N	N	---	Retention
SF Coquille R		N	Retention	N	N	N	---	Retention
Floras/New R		Retention*	Retention	---	N	N	---	Retention
Sixes R		N	Retention	---	N	Retention	---	Retention
Elk R		*n/a*	Retention	---	---	*n/a*	---	*n/a*
NADOTs		N	N	---	N	N	---	Retention / N [c]

* – Denotes change from current management regarding wild fish retention

[a] "Protected Ch" includes the summer-run Chinook in the Nehalem

[b] Harvest for Siltcoos and Tahkenitch is the same as Tenmile (not other NADOTs)

[c] See *Oregon Sport Fishing Regulations* for cutthroat retention regulations in NADOTs (no changes)

Table 18. Sliding scale retention schedule, harvest limits, and retention periods for wild fish within strata, across strata within Coastal SMUs, and statewide. Retention is only allowed in locations indicated in Table 17.

				Daily/Annual Retention Limits: Wild Salmon, Steelhead and Trout SMUs						
				Coho SMU	**Chinook SMU** Primary Limits	**Chinook SMU** Protected Period	**Spring Chinook SMU**	**Chum SMU**	**Winter Steelhead SMU**	**Cutthroat SMU**
Limit Area	Stratum	Predicted Stratum Abundance Cycle	Expected Frequency	• 9/1 through 11/30 • Tenmile: 9/1 through 12/31	• 8/1 through 12/31 • Nehalem: 9/16 through 12/31 • Siuslaw-Lake Crk: 10/15 through 12/31 •Coquille: 7/1 through 12/31	• Nehalem: 5/2X through 9/15 • Siletz: 4/1 through 7/31 • Coquille: no retention 1/1 through 6/30 • All Others: no retention 1/1 through 7/31 or closed	• 2/1 through 7/31	• 9/16 through 11/15	• 12/1 through 4/30	• 5/2X to 10/31
Within Coastal Strata	North Coast	Low	3 of 20 yrs	*	1/5	1/1	---	N	N	N***
		Average	12 of 20 yrs	*	2/10	1/5	---	N		2 fish/day over 8", no bait
		High	5 of 20 yrs	*	2/20	1/10	---	N		
	Mid-Coast	Low	3 of 20 yrs	1/2**	1/5	1/1	---	N	1/3	N***
		Average	12 of 20 yrs	1/2	2/20 Salmon R: 2/10 Yachats: 1/5	1/2	---	N		2 fish/day over 8", no bait
		High	5 of 20 yrs	1/5	2/20 Yachats: 1/5	1/2	---	N		
	Umpqua	Low	3 of 20 yrs	1/2**	1/5	---	1/1	N	N	N***
		Average	12 of 20 yrs	1/2	2/20	---	2/5 N Umpqua: 2/10	N		2 fish/day over 8", no bait
		High	5 of 20 yrs	1/5	2/20	---	2/10 N Umpqua: 2/20	N		
	Mid-South Coast	Low	3 of 20 yrs	1/2**	1/5	---	---	N	1/3 Sixes: 1/5	N***
		Average	12 of 20 yrs	1/2	2/10 Floras, Sixes, Elk: 1/10	---	---	N		2 fish/day over 8", no bait
		High	5 of 20 yrs	1/5	2/20 Floras, Sixes, Elk: 1/10	---	---	N		
Coastal SMUs	All / Cross-Strata	All		2/20 for all salmon and steelhead combined, except no retention of chum salmon						no annual limits
Statewide	---	All		|------ All Salmon and Steelhead Combined (*1/1 through 12/31*): 2/20 ------|						---
SMU-Specific NOTES				• limits without a quota system in place and while still ESA-listed (approach requires NOAA approval) • when de-listed, limits reconsidered for liberalization		• Chinook caught during the Protected Period count toward the annual bag limit for Chinook (identified under Chinook "Primary Limits")	• Umpqua spring Chinook have their own bag limits (i.e., they are in addition to Umpqua Chinook Primary Limits)		• limited locations in each stratum • no retention of wild summer steelhead	• "no bait", except where bait specifically allowed for other species

* due to high angling pressure in North Coast Stratum rivers, bag limits, open periods and season length for wild coho harvest will be determined annually

** wild coho harvest allowed only in select basins under low abundance cycle, possibly also employing a conservative quota or other basin-specific regulations

*** cutthroat harvest not allowed in mainstems during low abundance cycle (based on extremely low marine survival of coho) to protect searun life history; tributaries will remain open to harvest

Other Notes for Table 18:

- Periods indicated are for wild fish retention; local closures/openers in the annual *Oregon Sport Fishing Regulations* take precedence over these but will generally address catch-and-release allowances and hatchery fish retention
- "5/2X" indicates the 4th Saturday in May
- Strata may be in different abundance cycles, determined annually for coho (also serving as a surrogate for cutthroat), Chinook, and Umpqua spring Chinook
- The Yachats fall-run Chinook fishery wild fish retention limit is 1 per day and 5 per year in all years (no sliding scale)
- The Protected Period for Chinook allows for harvest in locations where stable and relatively abundant spring or summer Chinook life history variants exist which are not currently considered independent populations
- Anglers will be able to harvest wild fish in multiple strata up to the statewide annual limit of 20 salmon and/or steelhead as long as fish harvested in a stratum do not exceed the stratum annual limit in Table 18
- Hatchery fish do not count toward limits identified in Table 18, but do count toward statewide limits unless recorded on a hatchery harvest tag

Other harvest actions include:

General Fishing/Harvest Actions

- The annual *Oregon Sport Fishing Regulations* may identify locations that are closed to angling in Management Areas that are open to wild fish retention
- Populations that reach critical abundance levels will be closed independent of this harvest management system (see Table A-III: 2 for a description of Critical Abundance thresholds)
- Develop a forecast model for North Umpqua Spring Chinook and improve forecast models for Chinook populations
- Require anglers to return the daily license, combined angling tag (a.k.a. "harvest card", "tag", or "punch card") and the hatchery harvest tag annually or face a penalty for not doing so ("mandatory return", penalty to be determined)
- Update the combined angling tag, considering: location (revised management areas and strata), catch date, marks (W, H), jack catch, fish caught-and-released, and other items[29]
- Conduct analyses to determine biases in new harvest card returns once implemented
- Efforts will be made to institute guide log books with the OSMB and fishing guides, with a pilot project as the first step and including provisions to protect proprietary information[30]
- Angling regulations deferred within the 2012 angling regulation development process will be presented to the Oregon Fish and Wildlife Commission with recommendations to adopt or reject based on the CMP and its development process
- Work proactively with PFMC, NMFS, and others to implement technical revisions to A-13 as needed
- Incorporate CMP harvest direction into the Pacific Salmon Commission (PSC) process as appropriate and necessary
- Continue to ensure that Oregon fisheries and Chinook populations are appropriately represented in future PST agreements
- As needed and on a site-specific basis, implement angling regulations (e.g., spatial and temporal closures/openers, gear requirements, size requirements, catch limits) to: 1) protect fish that are unique, spawning, holding, overly-vulnerable, juvenile, or outmigrating and 2) provide for improved fishing opportunity or experience; these regulations are found in the annual *Oregon Sport Fishing Regulations* (note: catch limits are identified in the Retention Schedule or emergency rules)
- Anglers should avoid fishing on spawning salmon, steelhead, and trout

Specific Fishing/Harvest Actions

- The Mid-South Coast stratum sliding scale for Chinook will not be implemented until almost all returning hatchery fish are marked with an adipose finclip (approximately 2017)

[29] Considerations for other species, including green and white sturgeon, will also be included.
[30] Details of what is contained in the log books have not been determined, but will consider similar information as contained in the revised combined angling tag by trip, as well as other potential items.

• Elk R ChF - explore options to mitigate the economic impact of Elk R hatchery reduction to the troll “bubble” fishery (e.g., allow harvest of extra hatchery fish in the terminal ocean fishery), when conditions (i.e., ocean survival) warrant
• Coquille ChS - adopt ChF fishing season dates that protect Coquille spring-run Chinook
• All new wild StW harvest locations (Salmon River, Big Elk Creek, EF Coquille River) - implement wild harvest after all hatchery fish return with a 10% harvest limit; monitor some locations intensively to assess limit
• Umpqua CCT - retention currently only in tributaries and not mainstem, except the South Umpqua mainstem; retention will continue in the tributaries of the Lower and Middle Umpqua (excluding the mainstem of Smith River where there is currently no retention), but there will be no retention in the mainstem Umpqua and the tributaries and mainstem of the North and South Umpqua within the range of anadromous salmonids

Specific Angling Regulation Changes
The guidance for conservation and opportunity in the CMP provides an overall direction for the management of fisheries and harvest opportunities for wild salmon, steelhead and trout into the future. The CMP also recognizes that there are uncertainties related to the effectiveness of the actions called for in the plan and relies on an adaptive management process (see **Implementation**) to ensure management can be adjusted to achieve desired status. Because there is a recognition that some aspects of management will need to change over time, the CMP does not include specific permanent angling regulation changes to help implement the plan. Instead, ODFW is proposing some angling regulation changes as part of a parallel process to the adoption of the CMP.

Every four years ODFW allows the general public to submit proposals for changes to the annual angling regulations. The last public period for angling regulation proposals occurred during the development of the CMP (2012). ODFW decided that it would be best to defer any regulations pertaining to streams in the planning area until the planning process was complete and proposed regulations could be considered for consistency with the intent described in the CMP. It was also decided to defer regulation changes proposed by ODFW staff until the CMP was completed.

Table 19 shows those angling regulation changes that have been proposed by staff and the public that are consistent with the management direction called for in the CMP and will be proposed for adoption by the Oregon Fish and Wildlife Commission in a separate action from adoption of the CMP. Those regulations submitted during the public process in 2012 that were not consistent with the CMP are not being recommended for adoption. While adoption of this plan is not intended to codify these regulation changes, ODFW includes them here as a way to share them with the public, show them in the context of overall management direction, and allow for public comment on the proposals. Once approved, these proposed changes may or may not remain in place permanently. New information may lead ODFW to make changes to these regulations if it is determined that such changes will better achieve the desired status called for in the CMP (see **Desired Status and Limiting Factors**).

Table 19. Angling regulation changes for 2015.

Population	Regulation
Necanicum	• Tributaries and stream sections not listed in Zone Regulations are closed to all angling.
Nehalem	• Mainstem – Closed to salmon angling above Foss Road (CC) Bridge (RM 15.1) entire year. • Bay and River tributaries not listed in Zone regulations are closed to all angling.
Kilchis	• Closed to salmon angling above the Tilden Bluff's Road (Barker's /Green) Bridge (RM 11.0) entire year.
Wilson	• Mainstem – Closed to salmon angling above Jordan Creek (RM 21.9) from Aug 1-December 31.
Nestucca	• Mainstem – Closed to salmon angling above First Bridge (RM 15.8) from Aug 1-December 31.
Siletz	• Drift Creek - Open for Chinook and fin-clipped coho upstream to Steel Bridge at Mennonite Camp (RM 10.0) from August 1-December 31. • Mainstem - Open for Chinook April 1 – July 31 upstream to deadline marker at the Moonshine Park boat ramp; Open for Chinook and coho August 1 – October 6 upstream to an ODFW marker located approximately 1,200 ft. upstream from Ojalla Bridge (RM 31); Open for Chinook and coho October 7 – December 31 upstream to deadline marker at Illahee Park boat ramp (RM 41).
Yaquina	• Big Elk Creek – Open for Chinook and coho upstream to Bear Creek (Updike Road). • Mainstem - Open for Chinook and coho upstream to Simpson Creek (Hwy 20).
Alsea	• Drift Creek – Open for Chinook and coho upstream to lower Wilderness Boundary (RM 10).
Siuslaw	• Lake Creek – Open for Chinook from October 15-December 31 and coho from October 15-November 30 upstream to Indian Creek. • Mainstem – Closed for Chinook and coho upstream from the confluence of Lake Creek and Siuslaw River.
Coos	• South Fork Coos – Open for Chinook and coho upstream to Dellwood (RM 10). • Tioga Creek up to concrete bridge located ½ mile downstream from Burnt Creek – Open for steelhead January 1-April 30.
Coquille	• Mainstem – Open for Chinook from July 1-December 31.

Predation Actions

> **Management Strategy:** *Quantify impacts of predation on wild and hatchery salmon, steelhead and trout; and develop and support programs to reduce predation.*
>
> **Management Strategy:** *Prohibit the introduction of non-native fin fish species into flowing waters, and develop and support programs designed to decrease illegal introductions of non-native species.*

Salmon and trout interact with other species in numerous, complex ways. Interactions such as predation, competition, and food availability have the potential to affect population status. Predation in particular is evident (Adrean 2013, Clements et al. 2011, Stahl et al. 2000, Wright et al. 2007) and of concern on the Oregon coast. However, to date, there are minimal population-level studies that indicate conservation viability impacts to anadromous salmon and trout and the extent of impact by predators on brood-year survival is not known. Regardless of whether there are conservation impacts, there are definite impacts to both the fishing experience (e.g., by seals and sea lions, collectively referred to as "pinnipeds") and Oregon's investment in hatchery resources (e.g., by double-crested cormorants, an avian [bird] predator on juvenile salmon and trout and other species).

Predation on adult salmon and trout by marine mammals and on juvenile salmon and trout by non-native fish, marine mammals, and avian predators is a matter of concern when developing management actions expected to support achieving Desired Status. In most cases, Oregon currently has no authority to lethally remove marine mammals and birds. Actions are generally limited to monitoring impacts and hazing. Oregon is actively pursuing hazing and research, and is also seeking permission to lethally remove some avian predators if this is the most effective means of achieving Desired Status. With respect to non-native fish, there is currently no effective means of controlling predation by them in river locations where they have become established. However, they can be controlled where they have been introduced and not yet become widely established, and in smaller streams where habitat for them is more marginal.

It should be noted that the issue of predators is socially complex, without solutions that are acceptable to everyone in the general public or even in the fishing community. For instance, pinniped control is contentious and litigious on the Columbia River. Additionally, bass and other warmwater species which may prey upon juvenile salmon and trout are valued sportfish for a large number of anglers.

<u>General Predation Actions</u>
Highlights of the actions include (see Table 20 for more details):

- Continue existing efforts and implement new studies that assess abundance and impacts of predators, which may support obtaining additional management tools through permits
- Continue efforts to obtain a cormorant depredation (i.e., lethal removal) permit from the USFWS
- Continue and expand hazing efforts with the help of volunteers and education
- Aggressively remove newly introduced non-native fish species
- Prohibit introduction of non-native fish into flowing waters
- In the Umpqua, explore additional options for modification or removal of bass harvest limits[31]

[31] Results of this will need to be consistent with a statewide policy for management of bass and other non-native sport fishes in altered and relatively unaltered systems, which ODFW is preparing to develop.

Hazing

Hazing is the non-lethal harassment of an animal in order to modify their behavior. Hazing is currently the primary tool for pinniped and avian predator control on the coast, and typically involves efforts to move them away from a certain location. Hazing programs for pinnipeds in Oregon currently occur in the Rogue River estuary, at Willamette Falls, and at Bonneville Dam and entail the use of boats, loud noises ("seal bombs"), and other means to accomplish objectives. This method is very effective in locations which are narrow and shallow and is much less effective in wider or deeper areas. Given this ineffectiveness and costs associated with an intensive program[32], focused efforts have been limited on the coast. Efforts will be made to identify other suitable locations for a focused program, but the primary use of hazing pinnipeds will be a more dispersed effort to scare individuals away from fish on anglers' lines. Anglers may currently haze some pinnipeds if they are in the act of taking a fish on an angler's line (http://www.westcoast.fisheries.noaa.gov/publications/protected_species/marine_mammals/sea_lion_removals/deterring_problem_seals.pdf), and educational programs that define the extent of this ability should be implemented.

Hazing of cormorants is coordinated through ODFW's Avian Predation Program and currently occurs in six coastal estuaries through the use of boats to scare cormorants toward the lower estuary where there are alternative forage species. In 2013, boat hazing projects were conducted in the Nehalem, Tillamook, Nestucca, Alsea, and Coquille estuaries[33]. Pyrotechnics were used as an additional tool on the Nestucca and Alsea projects. ODFW provides a small fuel stipend and hourly wage to offset the cost of these projects, but all boats, boat maintenance, pyrotechnics, and hazing activities are provided by volunteers. Expansion of these activities into additional estuaries will require identification of new volunteers.

Detailed Predation Actions

Table 20 identifies actions with respect to predators. These actions address the limiting factors identified in **Desired Status and Limiting Factors**. See **Appendix V – Monitoring Approach** for a description of monitoring associated with predator metrics.

Additional Actions for Other Species

In the Umpqua, research is also being conducted into the food web relationships between lamprey, Umpqua chub, and salmon and trout, in order to better understand if there are inter-dependent limiting factors that can be addressed for these species. Similar work is being conducted in the Coquille with respect to lamprey.

[32] Volunteers or paid staff, hazing equipment, fuel, and boats are required to conduct these programs.
[33] Work was also conducted in the Columbia River.

Table 20. Actions addressing known and potential limiting factors to salmon and trout and fishing opportunity for anglers by predators. Actions in *italics* are on-going.

Basin	Pinniped Predation Actions	Avian Predation Actions	Non-Native Fish Predation Actions
ALL	• seek funds for a position to aid with pinniped predation coordination • work with volunteers to identify and haze suitable locations with high angler conflict, with appropriate permits • educate anglers about hazing options	• if feasible, modify hatchery release practices to reduce attraction • *work with volunteers to expand cormorant hazing program, with appropriate permits* • *monitor coastal breeding population*	• aggressively remove newly introduced non-native fish species • prohibit introduction of non-native fish into flowing waters through the continuation and enforcement of fish transport permitting requirements (http://www.dfw.state.or.us/fish/private_ponds/index.asp) and prohibited and controlled non-native fish (OAR 635-056-0000) • *restore salmonid habitat and meet water quality standards*
Necanicum R			
Nehalem R		• *survey foraging population size* • *haze*	
Tillamook		• *research population-level impacts (diet study)* • *survey foraging population size* • *haze* • trophic re-balance – improve eagle habitat • *seek federal depredation permit for lethal removal of cormorants*	
Nestucca R		• *survey foraging population size* • *haze*	
Salmon R			
Siletz R		• *survey foraging population size*	
Yaquina R		• *survey foraging population size*	
Alsea R		• *survey foraging population size* • *haze*	
Yachats Aggregate			
Siuslaw R		• *survey foraging population size*	
Lower Umpqua R	• haze	• *research population-level impacts* • *survey foraging population size* • haze • *seek federal depredation permit for lethal removal of cormorants*	• *research population-level impacts* • *restore salmonid habitat and meet water quality standards* • explore innovative strategies to reduce non-native species (e.g., methods from other states) • increase education about bass predation • *modify or remove bass harvest limits as consistent with a statewide policy for management of bass and other non-native sport fishes in altered and relatively unaltered systems (under development)*
Middle Umpqua R			
N Umpqua R			
S Umpqua R			

Tenmile Lk/Crk	• haze		• *restore salmonid habitat and meet water quality standards*
Coos	• research population-level impacts	• develop a more detailed plan	• increase education about non-native fish predation
Coquille R		• *survey foraging population size* • *haze*	• *modify or remove bass harvest limits* • *targeted removal of bass* • *restore salmonid habitat and meet water quality standards*
Floras/New R			
Sixes R			
Elk R		• survey foraging population size	
NADOTs			

More information about on-going avian predation surveys, studies, and efforts (including the 2012 annual report) can be obtained from ODFW's Avian Predation Coordinator and at: http://www.dfw.state.or.us/conservationstrategy/avian_predation_mgmt.asp.

Habitat Actions

Management Strategy: *Work with habitat restoration implementers to complete or update watershed assessments (as necessary), prioritize watersheds for restoration, and implement watershed-scale restoration work to restore natural processes.*[34,35]

Management Strategy: *Work with habitat restoration implementers to increase restoration activities in lower mainstem rivers and estuaries.*[36]

Management Strategy: *Protect all habitat areas where chum salmon are currently known to spawn, and prioritize habitat rehabilitation and barrier removal work that expands the habitat base for chum.*

Management Strategy: *Actively pursue and promote habitat protection and restoration necessary to achieve the goals and management strategies for aquatic resources within the CMP area by means of the tactics identified in* Table 21*.*

Table 21. Habitat tactics for the CMP. Note: Determining which tactics apply to a given watershed will occur during the prioritization process outlined below.

• Reconnect existing stream channels, and assure proper hydrologic function of off-channel habitat (floodplains, side-channels, wetlands, alcoves, and tidally inundated areas/estuaries) [37]
• Maintain or increase in-stream flows during summer low flow periods[38]
• Restore riparian function (with goals of improving water quality and sourcing and retention of wood and other materials that promote formation of instream habitat complexity) [39]
• Reduce summer water temperatures where artificial warming occurs that is detrimental to fish
• Increase in-stream channel complexity
• Reduce artificially accelerated erosion rates and inputs of sediments into waterways
• Prevent chemical contaminants from degrading fish habitat
• Remove fish passage artificial obstructions[40]
◦ Permanent natural barriers to fish migration shall not be altered to allow fish passage and fish shall not be stocked above these barriers; however, existing fish ladders at natural barriers may be maintained
• Increase habitat area available to fish
• Restore channel forming processes and complexity in lower gradient reaches and confluence areas[41]
• Encourage the restorative role of beavers in smaller stream reaches
• Identify and develop seasonal protection strategies for summer holding refugia for salmon and trout[42]
• Identify and protect sources of cold water and spring-fed systems[43]

[34] Working at a watershed scale allows singular, multiple and interacting causes rather than symptoms of limiting factors for multiple SMUs to be addressed.
[35] The CMP contains a watershed prioritization process, new maps, and a threat pathways tool (described later in this section) that can be used for this management strategy.
[36] Mainstem reaches of rivers and estuaries are used by all anadromous populations and exhibit many limiting factors across species. Technical and social feasibility issues will need to be addressed in order to implement a comprehensive suite of actions in these areas.
[37] See **Hatchery Fish Actions** for Elk River fall-run Chinook for specific estuary habitat actions for Elk River
[38] This also entails determining instream flow needs for different salmonid life stages and securing instream flow rights where needed and possible.
[39] This also includes actions that reduce inputs of fine sedimentation/turbidity, including simple surface runoff and actions that reduce the probability of landslides in areas upstream or adjacent to high quality fish habitat.
[40] Obstructions that restore fish access to productive spawning and rearing habitat should be prioritized.
[41] Improvements in these locations will benefit multiple anadromous species.
[42] This will benefit spring-run and summer-run Chinook, spring Chinook, summer steelhead, and anadromous cutthroat trout.
[43] This will provide resilience to warmer temperatures associated with climate change.

Management Strategy: *Coordinate with and advise other agencies, tribes, landowners, water users, watershed councils, and others to implement habitat protection and restoration activities, with an emphasis on habitat protection and a focus on priority projects (as opposed to non-priority and opportunistic projects).*

Management Strategy: *Consistent with the Habitat Mitigation Policy (OAR 635-415-0000) and natural ecosystem processes, work to prevent or reduce potential losses of fish production from land and water use actions and habitat alteration to the extent possible, encourage utilization of Best Management Practices for habitat protection when conducting land and water use projects, and promote greater coordination among government partners to facilitate protective measures against emerging threats such as placer mining, climate change, and invasive species.*

Management Strategy: *Consider and demonstrate preference for alternatives which address both natural hazard damage mitigation and restoration of natural disturbance regimes and habitat function when implementing and making recommendations about natural hazard mitigation actions that address hazards such as flooding or fire.* [44]

Habitat Approach

Appropriate habitat[45] condition is an ecological foundation for native salmon and trout conservation and recreational opportunity. Protecting high quality habitat and rehabilitating degraded habitat benefits both of these interests and contributes to other ecosystem services. Poor habitat condition in freshwater and estuarine areas are the result of multiple and interacting stressors affecting the formation and maintenance of habitat, and in many cases this has a direct influence on short and long term salmonid population dynamics (i.e., influences the magnitude and frequency of density dependent mortality). In addition, threats from climatic change and habitat loss due to human population growth and economic development also manifest themselves through habitat stressors. Due to this, habitat protection and rehabilitation are vital for maintaining and improving productivity in native salmonid populations and their continued value as a natural resource.

The management approach presented here for obtaining the amount and quality of habitat needed to achieve the Desired Status goals in the CMP relies on two separate but equally important tracks. First, preventive efforts should be made to ensure existing habitat quality is not degraded due to human activities. Areas that currently contain high quality fish habitat should be identified and protected, and other areas with the potential to support high quality habitat, but are degraded, should be protected from further degradation. The second track for management of habitat is to identify those areas with the greatest unrealized potential to support high quality habitat and implement restoration projects with the highest likelihood of creating higher quality habitat. Pursuing both of these tracks simultaneously will ensure habitat in some areas is enhanced while the condition of existing habitat does not deteriorate.

Protection of existing fish habitat has been a higher priority for ODFW than habitat restoration and will continue to be a higher priority as the CMP is implemented[46]. Protection of fish habitat can be sought through regulatory means to prevent degradation, or through voluntary- and incentive-based approaches. While ODFW does not have regulatory authority over land use and development activities, ODFW does provide comments and recommendations to state agencies that do have regulatory authority. These agencies and the programs they oversee are listed in Table 25. ODFW is also committed to working with landowners on a voluntary basis to minimize habitat degradation and to supporting incentive programs that can establish conservation easements to protect habitat.

Habitat restoration or rehabilitation will be vital to achieving the Desired Status goals of the CMP. While protecting existing habitat is a higher priority, it is recognized that a larger amount of high quality habitat than currently exists is needed to make the fish

[44] This strategy supports Oregon's Natural Hazards Mitigation Plan, which is required by the Federal Emergency Management Agency for certain grant programs and disaster assistance.
[45] Unless otherwise specified, "habitat" in the CMP refers to physical, chemical, and biological habitat
[46] Habitat protection is a higher priority than restoration because it is much easier to maintain existing habitat quality than it is to create it.

populations covered in the CMP more productive and capable of achieving the Desired Status described in **Appendix III – Desired Status and Limiting Factor Metrics and Goals**.

The CMP outlines several steps that can assist watershed councils, SWCDs, land managers, others, and ODFW to formulize a decision support matrix to determine which watersheds within a larger drainage network should be prioritized for habitat rehabilitation and restoration. The effectiveness of these efforts will be based on multiple entities working collaboratively to help set habitat goals and objectives at the *watershed*[47] scale. The prioritization strategy is dependent on using process-based watershed assessments to identify habitat limiting factors, habitat goals and objectives for reducing these factors, and specific habitat actions in focal watersheds. Watershed assessments may need to be completed or updated in some locations to identify which watershed processes have been disrupted, how and where disruptions have led to aquatic habitat loss or degradation, how disruptions are affecting salmonid biological performance through limiting factors, and a prioritized list of specific actions that address the causes of the limiting factors .

The CMP also provides two new tools that can help set the context for development of watershed goals, objectives, and priorities. The first is a "threats pathway" that describes the principal causes of habitat degradation and limiting factors. This tool can be used in future watershed assessments and limiting factors analyses, and during revisions of action plans to evaluate how or where to intercede with habitat rehabilitation. The second tool is maps of salmonid ecosystem value (SEV) for watersheds in each of the SMU population areas, identifying their relative "intrinsic" importance for multiple salmon and trout species. The SEV rank scores can be used as an additional indicator of priority that can be integrated with previous or future prioritization processes (Nehlsen 1997, others).

During development of the CMP, ODFW attempted to summarize available habitat data and define restoration priorities at predefined watershed scales using USGS Hydrologic Unit Codings (HUC's). The Habitat Technical Work Group (see **Introduction: Plan Development Process**) was convened to provide guidance on how the assessment should be done, particularly on how to integrate existing localized assessments into a standardized roll-up to HUC's and the larger planning area. The result of that guidance was a strong preference for local implementers to develop limiting factor analyses, habitat action plans, and site-based actions using new, existing, or updated watershed-specific assessments. However, many of these assessments are weighted towards tributary habitats and don't adequately describe conditions in lower portions of watersheds that are important habitats for Chinook and chum salmon. In lower watersheds, the process of goal setting and identification of objectives and localized strategies for multiple salmon species will require the active participation of major public and private landowners. In recognition of this more comprehensive habitat approach, the CMP describes a habitat strategy and a set of procedural actions that are necessary for setting watershed goals and objectives that address improving watershed functions to benefit all SMU's. In summary, the habitat strategy in the CMP is intended to help guide revision of watershed objectives for multiple fish species, rather than prescribe the details for local protection and restoration efforts. *This approach is most consistent with and supports the existing habitat restoration infrastructure and approach in Oregon.*

Given the spatial extent of the CMP, the lack of comprehensive, consistent habitat data across this planning area which was identified by the Habitat Technical Work Group, and the need to address multiple salmonid species, the CMP cannot sufficiently prescribe site-specific habitat actions. As indicated by the habitat strategy in the CMP, these localized actions are best identified through watershed-specific assessments that provide context on local factors that limit salmonid performance. In many sub-basins, local watershed groups and others are already using watershed assessments to identify salmonid habitat actions and have developed watershed action plans to strategically implement those actions. Action plans are revised over time and in some watersheds have not yet been developed, but more importantly, many watershed-level "fixes" will require something more comprehensive than the voluntary opportunities forged through watershed councils. It will require the active participation and

[47] *Watershed* is defined in the CMP as the stream network within the confines of a topographic drainage divide. Watershed scales of relevance to habitat conservation planning for the CMP are based on the USGS hierarchical hydrologic unit coding (HUC) system, and include 10-digit HUCs (watersheds) and 12-digit HUCs (sub-watersheds). Hydrologic units are only synonymous with classic watersheds when their boundaries include all the source area contributing surface water to a single defined outlet point. For more detail see: http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1042207.pdf

collaboration of major public and private landowners (e.g. US Forest Service, US BLM, ODF, private industrial forestry and agricultural interests, municipalities, etc.), to identify watershed goals, objectives, and strategies, and to implement subsequent actions. In recognition of a more comprehensive habitat approach, the CMP summarizes several restoration strategies that promote habitat protection and rehabilitation at the watershed scale and for multiple species. The strategies also identify procedural actions that can help prioritize and focus localized habitat restoration strategies, and specific actions to address limiting factors. The habitat strategies, actions, and guidance identified in the CMP are intended to help guide, rather than dictate, local protection and restoration efforts.

The work identified in the CMP with respect to habitat improvement is intended to strengthen the status and resilience of native fish SMUs, consistent with ODFW's mission and the NFCP. This work is also consistent with two other important planning documents:

Oregon Plan for Salmon and Watersheds
In 1997, Oregon's Governor and its Legislature adopted the *Oregon Plan for Salmon and Watersheds* (Oregon Plan; http://www.oregon.gov/OPSW/pages/index.aspx) to begin state-led recovery efforts "to restore Oregon's native fish populations and the aquatic systems that support them to productive and sustainable levels that will provide substantial environmental, cultural, and economic benefits". The Oregon Plan has a strong focus on salmon because they are important indicators of watershed health and have great cultural, economic and recreational importance to Oregonians. The Oregon Plan organizes actions around the factors that contribute to the decline in fish populations and watershed health. Most of these focus on actions to improve water quality and quantity and restore habitat. Watershed councils and soil and water conservation districts lead efforts in many basins. Landowners and other private citizens, sport and commercial fishing interests, the timber industry, environmental groups, agriculture, utilities, businesses, tribes, and all levels of government also come together to organize, fund, and implement these measures, which rely on scientific oversight, coordinated tribal and government efforts, and ongoing monitoring and adaptive management to achieve program success. The Oregon Plan relies on Oregon's spirit of volunteerism and stewardship, along with public education and awareness, strong scientific oversight, coordinated tribal and government efforts, and ongoing monitoring and adaptive management to achieve program success.

Oregon Conservation Strategy
The *Oregon Conservation Strategy* ("Strategy"; ODFW 2006) was developed by ODFW in response to a national effort guided by Congress and the U.S. Fish and Wildlife Service (USFWS) to encourage states to develop comprehensive wildlife plans. The Strategy was approved by the Oregon Fish and Wildlife Commission (OFWC) in August 2005 and by the USFWS in March 2006. Oregon's approach was to establish a long-term vision and set specific goals not only for conservation actions to be implemented by ODFW, but also as a conservation blueprint for all Oregonians. The overarching goal of the Strategy is to "maintain healthy fish and wildlife populations by maintaining and restoring functioning habitats, prevent declines of at-risk species, and reverse declines in these resources where possible." The Conservation Strategy emphasizes the proactive conservation and management of 11 strategy habitats across eight state ecoregions. It addresses species conservation through a fine filter approach and identified 286 strategy species based on their population status or that represent the diversity and health of wildlife in Oregon. The species addressed in the CMP are "strategy species" in the Strategy, and CMP actions are consistent with addressing the six key issues identified in the Strategy, in addition to others.

Habitat Goals and Limiting Factors

Assuming projections in climate change scenarios and human population growth are generally correct, it is likely that *maintenance* of fish population status will require rehabilitated[48] and restored[49] habitat conditions to support *current* levels of life-stage survival in freshwater and estuarine zones.[50] It is also likely that *improvements* in population status will require *even greater* rehabilitation and restoration of habitat conditions to support *increased* levels of life-stage survival in these zones. Climate change is projected to change the frequency and magnitude of ecosystem production anomalies in the marine environment (ENSO and upwelling forcing)

[48] Improvement in current conditions.
[49] Returning a site to some pre-disturbed reference condition.
[50] Life stage productivity needs to demonstrate resilience over time in the face of greater stresses on that productivity.

and may lead to greater occurrence of density-dependent mortality in marine life stages. However, it is not clear how to buffer the negative effects of these drivers to enhance ocean life-stage specific productivity. Therefore in the presence of increased marine stochasticity the only apparent and feasible way to assure both fishery opportunities and sustainable and improved spawner escapement levels is through restoration and rehabilitation of freshwater and estuarine habitats.

Actions that address the limiting factors necessary for meeting desired status goals for fish populations are weighted heavily towards rehabilitation and restoration in freshwater and estuarine habitats. While it would be ideal to establish quantitative goals for habitat improvements (as measured through habitat-based metrics), the relationship between fish population goals that are established in the CMP and habitat characteristics need to be better understood. In the Coastal area, this relationship is best understood for coho, but quantitative relationships for other species have not been established. As a result, this plan does not establish any specific quantitative thresholds for habitat improvement. The CMP asserts that habitat goals should be scaled to the watershed or fish population area scales, and improvement would be indicated by an increasing positive trend in habitat-based metrics. Regardless of whether there are quantified habitat goals at the population scale, improvements in fish population status will require significant improvement in habitat.

The fish status assessments and limiting factors in the CMP were scaled at a population area ("basin") or greater scale. However, finer scale habitat assessments are needed for understanding specific aspects of the salmonid limiting factors and the specific habitat improvements that are necessary in any watershed. These finer-scale assessments are not compiled or provided in this plan, but OWEB maintains a restoration resource site at: http://www.oregon.gov/OWEB/Pages/resources.aspx. Watershed assessments have already been completed for many coastal sub-basins, and in a subset of these there are additional Limiting Factors Assessments (see Upper Nehalem Watershed Council example at: http://unwc.nehalem.org/?page_id=290). ODFW supports the development and use of these assessments to guide within-watershed habitat work (action plans) and in particular, ODFW believes a priority need to funding entities is development of Limiting Factor Assessments for sub-basins where they are lacking. However, in the context of closing biological performance gaps for multiple species with habitat actions, this plan recommends that assessing habitat limiting factors and resolving them is part of a more structured process for setting conservation objectives (described below) and includes a specific type of *watershed* assessment. The provisional status assessment process for this plan did not lead to a quantification of *how much* habitat restoration is needed to close a biological gap for any fish population (e.g., increasing life-stage productivity and capacity), but a more structured process can identify candidate measurable ecological objectives (surrogates for biological criteria) that are specific to anthropogenic habitat threats, and which would serve as points of progress towards closing the biological gap**. It is through this deliberate process of setting habitat objectives that habitat management actions can be identified and prioritized, and linked to an adaptive management process that evaluates the effectiveness of the actions towards improving fish population performance.**

<u>A Process for Setting Habitat Conservation Strategies and Priorities</u>
The structure of a habitat restoration planning process has been reviewed by Beechie et al. (2008) who outlined four steps to identify the most important actions to implement. This plan expands upon that guidance in the sections below.

Step 1: Identify Habitat Improvement Goals and Objectives
To guide this step in the habitat planning process implementers of habitat improvement projects are encouraged to follow the general outline in Tear et al. (2005) who reviewed several principles for setting scientifically-based conservation objectives, and argued the need to state clear goals and define measurable conservation objectives. For the CMP, habitat improvement goals are framed within the context of the fish conservation desired status goals. Generally the goal can be stated as *"watershed-scale ecological conditions that over the long term can be managed adaptively to maintain or improve salmonid life stage productivity and habitat capacity in freshwater and estuarine habitats.*[51] For many watersheds this may mean restoration of watershed processes and/or habitat from current conditions to some prior reference condition. At this point it is difficult to

[51] This does not imply a lack of "disturbance" but does imply that recovery thresholds (metrics) are within the range of metrics that are used to characterize natural ecosystem equilibrium. These might include measures of water discharge patterns, sediment loads, temperature regimes, and others.

set quantifiable habitat objectives towards a generalized habitat goal, but stating multiple supporting objectives and specifying short-term performance measures facilitates tracking progress and informing an adaptive management process. Tear et al. (2005) recommended separating science from feasibility, with conservation objective setting based on ecological values, and socio-economic-political feasibilities identified in the goal setting phase. Recent developments in decision support frameworks can help scope these feasibilities. These authors also suggested setting conservation objectives in accordance with the scientific method and anticipating change. Stating objectives within the context of reducing uncertainties and testing assumptions about the efficacy and scale of habitat improvements will increase transparency in decision making. This promotes an adaptive management process that formalizes the rationale for adjusting strategies when habitat actions do not appear to have an anticipated effect. Stating objectives this way also implies there is a commitment to monitor the effects of a habitat implementation strategy.

Within the goal/objective setting phase of habitat planning it is important to identify the temporal and spatial scales. This plan recommends adopting a long-term, watershed-scale fish conservation strategy for improving habitat throughout a sub-basin and reducing the effects of habitat limiting factors on salmon and trout. The strategy can be implemented within a more comprehensive watershed management framework, and assumes that the most ecologically sound way to improve fish habitat attributes is by restoring ecosystem process that form and sustain these attributes, rather than depending upon small scale symptomatic (enhancement) approaches. In the context of salmonid recovery the Independent Multidisciplinary Science Team (IMST 2002) made several recommendations for adopting a broader habitat approach. The CMP addresses these recommendations as follows:

- IMST recommendation 2 (landscape scale research, modeling and planning). The CMP incorporates landscape-scale analyses by summarizing modeled intrinsic habitat potential (IP) data (Burnett et al. 2007) and ODFW fish distribution data at the HUC sub-watershed scale. The objective was to differentiate these watersheds units by their current salmonid use and their inherent potential to support salmonid habitat formation in the future. This analysis was meant to provide another prioritization element to watershed planners when they develop prioritized lists of habitat actions. The plan also assists habitat restoration planning by summarizing the dominant watershed processes and how disruption of these processes leads to threat exposure pathways that subsequently are manifested into habitat factors that are limiting salmonid performance. The threat exposure pathways can be used to help focus future watershed assessments towards specific salmonid habitat needs.
- IMST recommendation 3 (inventory and assessment). ODFW currently implements aquatic habitat monitoring and assessment for “wadeable” stream reaches within and upstream of the distribution of the Oregon Coast Coho ESU. The scale-of-inference for this monitoring is the stratum, of which there are four in the Coastal planning area. The CMP calls for ODFW to spatially augment this monitoring program with surveys in “non-wadeable” stream reaches[52] to get SMU-level habitat quality information for steelhead, Chinook, and chum (see RME section).
- IMST recommendation 4 (prioritization). The CMP provides guidance for prioritizing habitat restoration work at watershed and sub-watershed scales to comprehensively integrate the habitat needs of all the salmonid SMUs in this plan (below). The plan also provides an assessment of the relative “salmonid ecosystem value” (SEV) for coastal sub-watersheds (below), based on intrinsic habitat potential (IP) scores and salmonid diversity metrics. When coupled with finer-scale assessments done by others of habitat threats and social and technical feasibility, the SEV scores can be used as an additional metric to prioritize sub-watersheds for restoration and protection.
- IMST recommendation 5 (monitoring and adaptive management). ODFW programs and other programs fund and implement restoration projects, and as noted above, ODFW monitors and reports on the status and trend of habitat conditions at the SMU and strata scales. Although there are measurable habitat criteria targets for the Oregon Coast Coho ESU to which an adaptive habitat management process can be applied, measurable habitat criteria targets that address the needs of all species and races in the CMP have not been established. In order to establish habitat goals and objectives for multiple salmonid species within specific watersheds, detailed watershed assessments need to be reviewed

[52] Hydraulically, these reaches can be defined as those with sufficient stream power to mobilize large woody debris as part of the bedload, but within a site selection process these sites will be identified through intrinsic potential models for active channel width or stream order.

or updated (some elements described below). Once established, an adaptive management framework and appropriate RME can be formulated.

- IMST recommendation 6 (selecting projects that maintain and restore landscape scale processes). The habitat portion of the CMP includes a hierarchical model of the primary pathways between watershed processes, threats, and the resulting habitat factors that contribute to limit salmonid populations (habitat limiting factors) from achieving desired biological status (below). By identifying where in the threat pathway it is most feasible to intervene, the model can aid development of habitat action plans. Implementers will be able to scope the scale of their projects and formulate implementation strategies that might require a greater level of coordination to implement larger process-based projects.

There are other reasons to conduct habitat assessments and craft restoration strategies in the context of the watershed drainage network. This scale is the most appropriate for resolving some of the more intractable impairments to larger-scale processes that form and sustain high quality aquatic habitat (Beechie et al. 1999, Colin Thorne, personal communication 2013), and it is now widely recognized that attention to watershed-level context will lead to greater probability of success towards restoring habitat for individual or multiple species.

Many managers have scaled their habitat strategies at HUC watershed and sub-watershed scales. The relevance of these scales for fish habitat conservation and restoration in Oregon has been identified in the restoration literature, past assessments, scientific reviews (see IMST 1999), and in supporting documents of the Oregon Plan (OCSRI 1997). Because these scales are defined by the underlying drainage network, they contain most of the fundamental ecosystem processes associated with habitat formation (Beechie and Bolton 1999; many others) from which protective and restorative habitat actions can be identified. Further support for habitat planning at the HUC sub-watershed scale is reviewed in Bio-Surveys LLC and Sialis Company (2003). Watershed unit scales were also used in past planning efforts to identify priority sub-basins in coastal Oregon (e. g. Bradbury Process 1995, Talabere and Jones 2002, Ecotrust WWRI, etc.)[53].

Step 2: Identify a Prioritization Strategy

Beechie et al. (2008) summarized six habitat prioritization strategies based on conservation goals, existing knowledge of limiting factors, data availability, and other considerations. In order to address the needs of all species, races, and life stages in the CMP, there needs to be greater emphasis on addressing habitat forming processes at the watershed scale. For this fish conservation plan ODFW recommends an analytical-based approach, based on Beechie et al. (2008) to prioritize salmonid habitat projects. In recognition of the special case for chum salmon, ODFW earlier described an approach weighted towards conservation of population strongholds. An analytical-based multispecies strategy addresses both the species needs for meeting biological performance criteria, and the condition of the suite of landscape processes deemed necessary to conserve multiple species. Information requirements include identifying currently important habitat areas for the focal species, and identifying stream reaches or watersheds with high potential to become important habitat areas in the future. With this information, priority restoration areas can be identified through an appropriate weighting scheme that considers such factors as the number of species or life stages a habitat area can support, the presence of unique habitat conditions or uncommon life-history traits, and the relative threats to different habitat types. The habitat strategy that is being endorsed with this multispecies approach is to improve habitat forming processes and functions, without direct regard to improving habitat conditions for a particular species. The strategy aims to restore habitat conditions for several anadromous salmonid species that are representative of overall aquatic ecosystem function; therefore an effective priority process would identify the best projects as those that can most improve population performance of all focal species, through improving the function of habitat formation and increasing habitat diversity.

Many implementers of habitat protection and restoration projects in coastal Oregon watersheds already use some type of prioritization process to make investment decisions. For example, in developing the Aquatic Conservation Strategy under the Northwest Forest Plan, federal land managers identified *key watersheds* that “serve as refugia for aquatic organisms, particularly in the short term for at-risk fish populations, to have the greatest potential for restoration, or to provide sources of

[53] For quick review of differences, strengths and weaknesses of these prioritization approaches, see http://www.pacificwatersheds.net/priorities/

high-quality water". For assessment protocols in estuaries, the CMP defers to those described in Aldous et al. (2008) and Brophy (2007), and for estuary project priorities this plan defers to reports developed by for the USFWS and coastal watershed councils (see http://www.greenpointconsulting.com/gpcprojects.html). ODFW desires to supplement these processes with additional information on habitat potential and salmonid life history diversity contained in coastal watersheds. To that end, the CMP provides a watershed-level valuation metric for salmon and trout that can be used as part of more comprehensive prioritization processes. To help support a multi-species strategy for habitat prioritization, ODFW summarized information on salmonid intrinsic habitat potential (IP; Burnett et al. 2007) and other salmonid data. The data are compiled as scores of relative Salmonid Ecosystem Value (SEV)[54] at the watershed-level (USGS HU-12 codes; 6th level; hereafter HU-12's[55]). The relative scores serve as an indicator of which HU-12's have the highest combination of high IP, current fish distribution, unique salmonid races, and estuarine proximity upon which restoration actions could provide the most comprehensive conservation benefit across the several coastal salmonid species. **However, final prioritization of habitat projects involves the weighting of several factors, including, but not limited to, localized conditions, existing restoration partnerships and other prioritization considerations, technical and political feasibilities.** For example, it may be a higher watershed priority to restore fish access to historically accessible stream reaches that have been lost due to anthropogenic barriers. Within HU-12's, a more spatially defined limiting factor analysis can identify more specific habitat actions and locations. For example, stream sections within HU-12's can be identified as *core areas,* and *anchor sites* within these areas defined as containing all of the essential habitat features needed to support the entire freshwater salmonid life history (Bio-Surveys LLC and Sialis Company 2003). These analyses themselves should be based on updated watershed analyses and assessments.

SEV Scoring Methodology and Results

Each HU-12 that contained ODFW fish distribution for any SMU was scored for its relative salmonid ecosystem value (SEV). The following data layers were processed through GIS software and summarized into HU-12 metrics from which SEV scores were generated:

- Magnitude of Salmonid Habitat: This metric is the sum of lineal kilometers (kms) in the HU-12 that are considered currently available to some life stage of salmon and trout. These distances were obtained from ODFW GIS-generated fish distribution layers.[56]
- Intrinsic Potential: This metric represents the potential of the underlying geomorphologic template within a HU-12 to create and support the finer-scale aquatic habitat features important to salmon and trout. Details of IP modeling can be found at the Coastal Landscape Analysis and Modeling Study (CLAMS) website and in a report by Burnett et al (2007)[57]. IP values for coho were developed by CLAMS[58]. For Chinook and steelhead IP, ODFW developed internal IP products using NetMap software.[59]
- Salmonid Diversity: This metric represents for purposes here the presence within a HU-12 of fish distribution kms of chum salmon, a spring run variant of Chinook salmon, and a summer run variant of steelhead.

Table 22 below summarizes how each HU-12 was scored for SEV, where italics are used as example scores to demonstrate the methodology for an example HU-12. In step I, each HU-12 is given a score (0-5) for each of the three metrics above, except in the case of salmonid diversity where the metric score was either 0 or 5, based on whether there was ODFW fish distribution for spring Chinook (ChS), summer steelhead (StS), or chum. In the example HU-12 there is "StS" distribution so the HU-12 receives a score of "5" for that metric. In step II the metric scores are totaled to give a Cumulative SEV score (SEV_c). In step III the SEV_c scores of all the HU-12s were put through the Excel analysis tool **rank percentile** function to identify SEV_c quintiles and then each HU-12 was given a relative SEV score. In the example below, the final SEV score would have been a "4". However, because this method aggregated scores across species it did not reflect the SEV value of

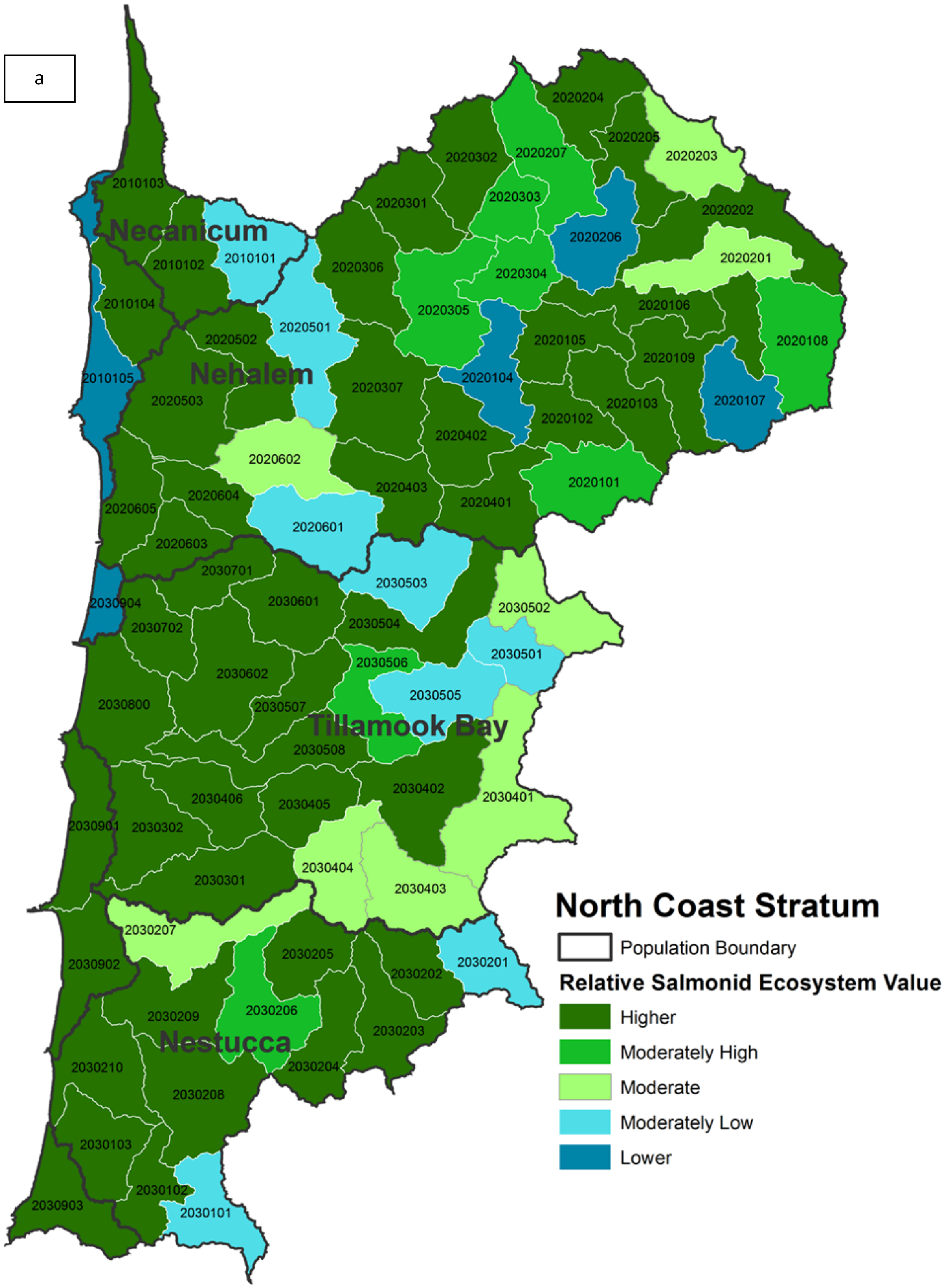
[54] Digital data provided upon request from ODFW as an MS-Excel worksheet and GIS-generated maps.
[55] http://water.usgs.gov/GIS/huc.html
[56] https://nrimp.dfw.state.or.us/nrimp/default.aspx?pn=fishdistdata; 2012 update
[57] http://www.fsl.orst.edu/clams/index.html
[58] http://www.fsl.orst.edu/clams/data_index.html
[59] http://www.netmaptools.org/

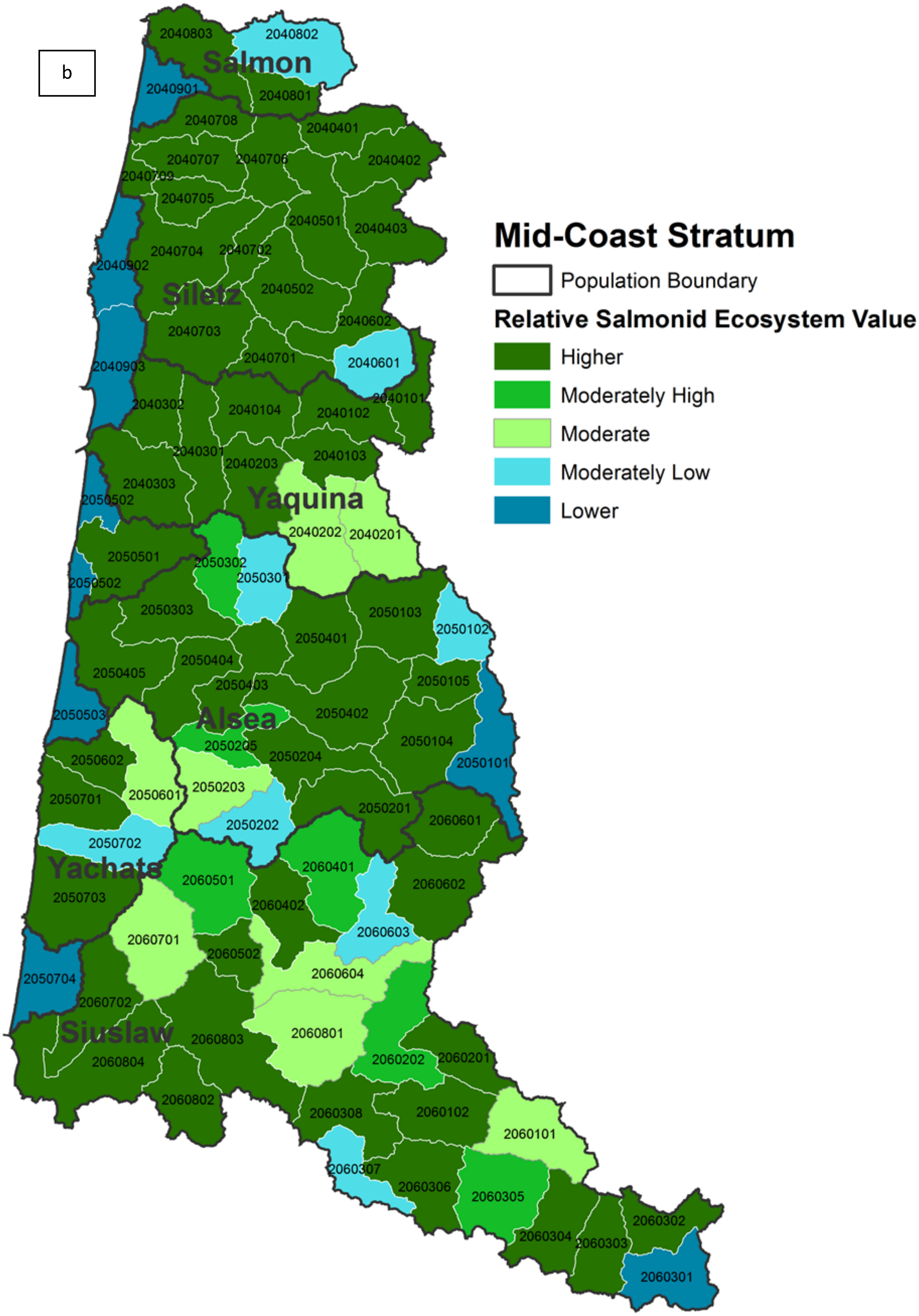
a HU-12 for a given species. Therefore a relative SEV score could be "trumped", or elevated to the highest SEV score (5) if the HU-12 scored in the highest category of Criterion B (IPKM/total IP kms > 70%) for any species. In the example below, the HU-12 received a final SEV score of "5" because it had a large amount of high IP for steelhead. In addition, to reflect the importance of estuarine habitat for some life stage of all SMU's, HU-12s that drained directly into or were part of an estuary received the highest SEV score. In the example below, the HU-12 does not drain directly into an estuary and does not get an estuary trump score, but still was scored as a "1" for its steelhead IP. Final SEV scores for HU-12s were mapped to allow visual comparisons (Figure 15, maps a through d). **Appendix IV – Salmonid Ecosystem Value (SEV) Habitat Scores** is a summary of the spreadsheet that was used to organize and score the HU-12s.

Table 22. Summary of the four steps used to score coastal HU-12s for SEV. See text in main body describing these steps. Arrows visually indicate continuation of columns. ChF= fall-run Chinook, StW = winter steelhead, ChS= spring Chinook, StS= summer steelhead.

	A: Magnitude of Salmonid Habitat				B: Modeled Intrinsic Potential				C: Salmonid Diversity			
I. Criterion Scores	kms	a: Coho	b: ChF	c: StW	IPKM[a]	a: Coho	b: ChF	c: StW		b: ChS	c: StS	d: Chum
0	0				0				Absent = 0	*x*		*x*
1	≤20				<0.4							
2	≤40	*x*			<0.5		*x*					
3	≤60		*x*	*x*	<0.6	*x*						
4	≤80				<0.7							
5	>80				≥0.7			*x*	Present		*x*	
		⬇	⬇	⬇		⬇	⬇	⬇		⬇	⬇	⬇
Subtotals		Aa	Ab	Ac		Ba	Bb	Bc		Cb	Cc	Cd
Coho (Aa+Ba)	*5*	*2*	--	--		*3*	--	--		--	--	--
Chinook (Ab+Bb+Cb)	*5*	--	*3*	--		--	*2*	--		*0*	--	--
Steelhead (Ac+Bc+Cc)	13	--	--	*3*		--	--	*5*		--	*5*	--
Chum (Cd)	0	--	--	--		--	--	--		--	--	*0*
II. Total (= SEV_c)	**23**											
	⬇											
III. Relative SEV scoring - based on rank percentiles of all HU-12s												
SEV_c = 0 (lower SEV)	1											
SEV_c ≤10	2											
SEV_c ≤20	3											
SEV_c ≤30	4											
SEV_c >30 (higher SEV)	5											
IV. Trumping relative SEV_c score						⬇	⬇	⬇				
High IP Trump	Yes, HU-12 gets highest SEV score (5)					*no*	*no*	*yes*				
Estuary Trump	No, HU-12 does not drain directly into an estuary; no trump score											
Chum Trump	No, HU-12 does not have chum distribution; no trump score											
Final SEV score (Map)	**5**											

[a] Reach IP scores are multiplied by the length of the reach to give an IP score-adjusted reach length, referred to as IP kilometers or IPKM, or Length Weighted Average Intrinsic Potential (= sum of IPKM / sum of kms).


a
Necanicum
Nehalem
Tillamook Bay
Nestucca
North Coast Stratum
Population Boundary
Relative Salmonid Ecosystem Value
Higher
Moderately High
Moderate
Moderately Low
Lower


b
Mid-Coast Stratum
Population Boundary
Relative Salmonid Ecosystem Value
Higher
Moderately High
Moderate
Moderately Low
Lower
Salmon
Siletz
Yaquina
Alsea
Yachats
Siuslaw
2040803
2040802
2040901
2040801
2040708
2040401
2040707
2040706
2040402
2040709
2040705
2040501
2040403
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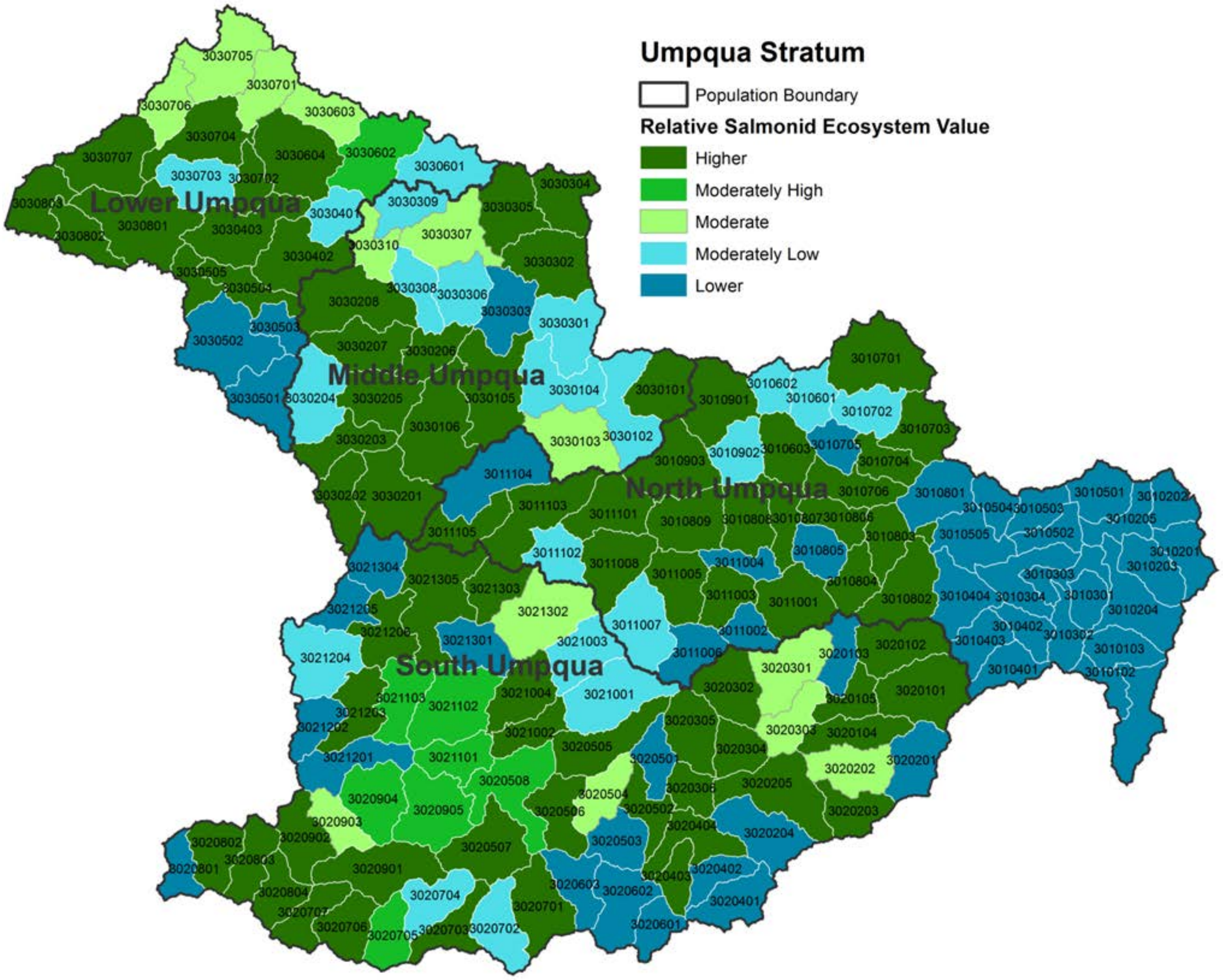
2060801
2060803
2060202
2060201
2060804
2060802
2060308
2060102
2060101
2060307
2060306
2060305
2060304
2060303
2060302
2060301

c


Umpqua Stratum
Population Boundary
Relative Salmonid Ecosystem Value
Higher
Moderately High
Moderate
Moderately Low
Lower
Lower Umpqua
Middle Umpqua
North Umpqua
South Umpqua

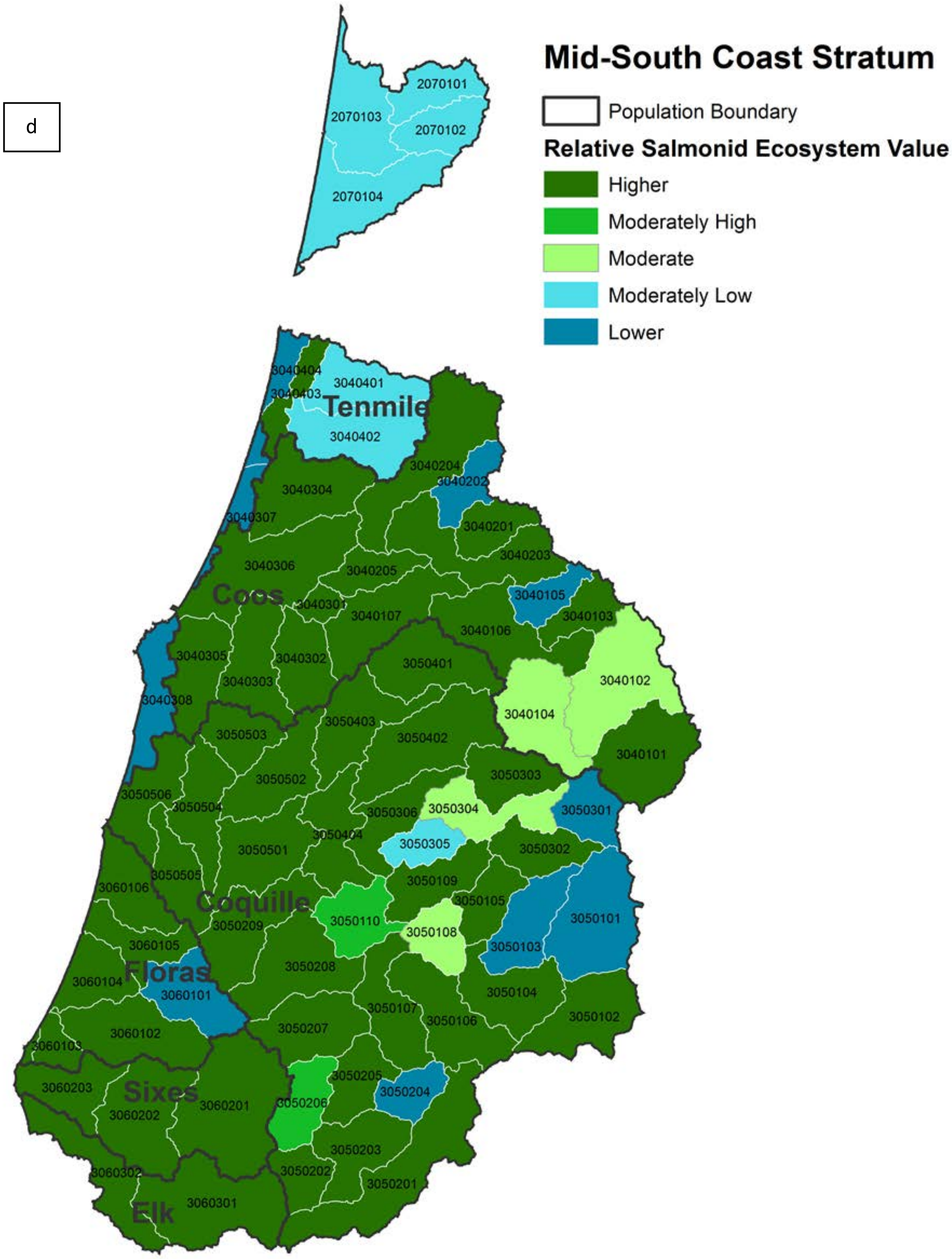


Figure 15. Maps a through d provide SEV results for each of four coastal Oregon salmonid strata; a= North Coast stratum; b= Mid Coast stratum; c= Umpqua stratum; d= Mid-South Stratum. Actual scores for each HU-12 are in *Appendix IV – Salmonid Ecosystem Value (SEV) Habitat Scores*.

Step 3: Using Watershed Assessments to Identify Restoration Actions

In the context of recovery planning Beechie et al. (2003) described two phases to assessing habitat. Typically, phase I assessments summarize existing data on land use patterns and/or habitat conditions at watershed and larger scales and use them to inform biological desired status criteria. According to Beechie et al. (2003), comparative and correlative analyses derived from these assessments can help set conservation goals. It is notable here that ODFW implements an Oregon Plan monitoring program that summarizes the status and trend of coastal coho physical habitat (wadeable streams) at the stratum and ESU scale (see Anlauf et al. 2011, Anlauf-Dunn and Jones 2012), relates these attributes to coho habitat capacity goals, and has been used in listing decisions for the Coastal Oregon ESU. For species in this conservation plan these types of assessments were not developed for establishing SMU-level conservation goals. However, in the case where broad scale assessment of habitat conditions is needed, this plan recommends approaches that can be consistently applied across the planning area, and where the methodologies can be adjusted to calibrate the relative risk of habitat degradation for each coastal salmonid "population area". Examples of these approaches include the CLAMS[60] and the National Fish Habitat Action Plan (NFHAP[61]; and supporting documentation [including Esselman et al. 2011, Wang et al. 2012]).

Phase II assessments are intended primarily to identify which ecosystem processes have been disrupted, how and where they have caused habitat loss or degradation, and how they are affecting salmonid biological performance through limiting factors. Given the complexity of differences in temporal and spatial habitat use by species and life stages in this conservation Plan, it is believed that assessing the conditions of ecosystem processes at the watershed scale is the appropriate framework to characterize habitat factors influencing the biological performance of coastal Oregon salmon and trout. An example of a template for an ecosystem process assessment is the watershed condition framework developed by the USFS (USFS 2011). While map-based assessments based on available digital data are generally too coarse to allow detailed analyses of habitat condition and its effects on fish populations (see references in Beechie et al. 2003, e.g*., Lunetta et al. 1997, Pess et al. 1999a, Feist et al. 2003*), the lack of comprehensive spatial assessments within a watershed (due in part to mixed ownership types) impedes not only the development of common habitat objectives for the watershed, but also affects the scaling, location, and presumed feasibility of a strategy or suite of actions. Therefore the CMP recommends that watershed councils and land management agencies that have or are developing watershed action plans incorporate ecosystem process assessment methodologies that are transferable across watersheds and land ownership types, and that they are designed to identify salmonid limiting factors and specific restoration and enhancement actions within the context of watershed processes.

Identifying Habitat Limiting Factors and Restoration Strategies through Process-Based Threat Pathways

For the CMP, ODFW outlined the hierarchical structure and some presumptive ecological pathways by which habitat threats are manifested into limiting factors for anadromous salmon and trout. This is a more mechanistic approach to assessing limiting factors than the SMU-level table of limiting factors provided in the Plan summary. The pathways are initiated through the principal governing processes that influence instream, riparian, and upslope functions (Theobold et al. 2010), which in turn interact through subordinate processes to form salmonid habitat. There are four threat pathways. Their relationships to the SMU-level categories of limiting factors in the plan summary are shown in Table 23. The threat pathways illustrate the ecosystem processes that are likely influenced by anthropogenic activities analysis, and can be used in the development of process-based habitat assessments for delineating limiting factors. This will result in habitat action plans and the implementation of strategies and actions that address the causes of limiting factors rather than the symptoms.

The threat pathways are organized within four governing processes and terminate at the limiting factors (Table 24a through d). Pathways are coded according to the principal governing process and level in the hierarchy. For example, in Table 24a, the code "1.2.1.1." represents a *Water Quality - Temperature* limiting factor resulting from the causal pathway of "Water Extraction". The codes used in the matrix table can be used as a tracking nomenclature between specific actions and the casual pathway and limiting factors being addressed by the action.

State of Oregon Programs Supporting Habitat Protection and Restoration

Table 25 summarizes the major programs sponsored by the State of Oregon that address aquatic habitat protection and restoration. Programs are cross-referenced to the causal pathway codes in Table 24a through d to show program relevance to

[60] http://www.fsl.orst.edu/clams/intro.html
[61] http://fishhabitat.org/resources

habitat limiting factors, and also cross referenced to the land use types to which the program pertains. The table does not include county level programs or federal programs, nor does it include partnerships. The ODFW Coastal Implementation Coordinator is an information source for these entities.

Table 23. The relationship between the threat pathway governing processes (Table 24a through d) and habitat limiting factors assessed in *Desired Status and Limiting Factors*. Note that multiple pathways may need to be addressed for a given limiting factor identified in the CMP.

		Threat Pathway			
Limiting Factors		1- Change in Flow Regime	2- Upland Processes / Sedimentation	3- Riparian Process / Lateral Connectivity	4- Intertidal Processes (estuaries)
Water Quality	Temperature	x	x	x	
	Toxins			x	x
	Turbidity (Sediments)	x	x		
	Other				x
Water Quant.	Low	x		x	
	Flashy	x	x	x	
Access	Inundation				
	Upstream	x	x		
	Downstream	x		x	
	False Attraction/ Injury				x
	Peripheral Connection	x		x	x
Physical Habitat Structure	Instream Structure/ Complexity		x	x	
	Substrate (Gravel)		x	x	

Table 24. Threat pathways ordered across a hierarchical structure of dominant ecosystem processes (sub-tables *a* through *d*), watershed functions or components affected by altered processes, and habitat attributes that can limit salmonid viability (habitat limiting factors: HLF's). The relative importance of a pathway (● high, ◎ moderate, ○ low) depends in part on location in the watershed (U=Upper, M=Mid, L=Lower).

Table 24a

<table>
<tr><th colspan="5">1 – Changes to Watershed Hydrology (Flow Regime) processes affecting water runoff, infiltration, and groundwater flow to the stream channel</th><th colspan="3" rowspan="2">Relative Importance in Watershed</th></tr>
<tr><th rowspan="2">Processes</th><th rowspan="2">Causal Level Pathway</th><th colspan="2">Altered Watershed Function or Loss of Watershed Component</th><th rowspan="2">Salmonid HLF's</th></tr>
<tr><th>Ecological Threat Level Pathway</th><th>Ecological Pathway Consequences (= factors leading to fish HLF's)</th><th>U</th><th>M</th><th>L</th></tr>
<tr><td rowspan="4">Altered Flow Regime (flood frequency / duration/ variability / intensity), affecting hydrodynamic balance, surface water storage processes, and energy management process</td><td>1.1. Land Management Structures: Water Storage/Control Structures and/or Rural Road Networks

(examples: culverts and other structures, unscreened water diversions)</td><td>1.1.1. Physical downstream flow fragmentation</td><td>1.1.1.1.
Direct: decreased
- habitat connectivity
Indirect: decreased access to
- total available habitat (habitat quantity)
- available habitat diversity</td><td>1.1.1.1. Habitat Access
- adults: impaired access/dispersal/delay to good holding or spawning habitat.
- juveniles: impaired access to diverse rearing habitat (small scale movements) and/or blockage or delay in migration reaches (directional downstream movements)</td><td>◎</td><td>●</td><td>●</td></tr>
<tr><td>1.2. Water Extraction

(examples: irrigation and municipal uses)</td><td rowspan="3">1.2.1. Reduced surface and groundwater flow and exchange,

1.3.1. Reduced peak flows within channel, unto floodplain, and through sediments

1.4.1. Decreased infiltration → increased surface runoff / flashiness, and decreased surface water storage</td><td rowspan="3">1.2.1.1.
Direct:
- decreased channel capacity and aquatic habitat quantity
-insufficient instream flows at critical periods
Indirect: decreased
- instream flows and fish carrying capacity
- flow volume and hyporheic buffering →increased stream temperature

1.3.1.1.
Direct: decreased
- frequency, duration, and magnitude of overbank flows and channel forming dynamics
- floodplain connectivity → decreased source materials for habitat formation
- LWD transport and storage
- bed load/sediment transport capacity

Indirect:
- riparian forest and change in stand composition
- extent of riparian zone development
- shade function,→ increased water temperature

1.4.1.1.
Direct: increased
- frequency of substrate scouring
- flow dynamics especially in winter, →greater scour and bank erosion, and/or otherwise degrade substrate quality.
- decreased hyporheic exchange →increased stream temperature
Indirect:
-disruption of redds and displacement of alevin/fry</td><td rowspan="3">1.2.1.1. & 1.3.1.1.
Habitat Quantity – unusable habitat (insufficient flows)

Water Quality -Temperature (above seasonal thresholds)

Physical Habitat Quality - (bed form dynamics simplified)
- Instream Sediment Quantity (coarse sediment degrading)
- Instream Sediment Quality (fine sediment aggrading)

1.4.1.1.
Physical Habitat Quality – (bed form dynamics simplified) and Instream Sediment Quantity (scouring)

Water Quality -Temperature (above seasonal thresholds)</td><td>○</td><td>●</td><td>●</td></tr>
<tr><td>1.3. Flood Control Structures (mostly) that significantly alter hydrograph</td><td>●</td><td>◎</td><td>◎</td></tr>
<tr><td>1.4. Simplified Hydraulic Exchange (revetments, levees) and Impervious Surfaces</td><td>○</td><td>●</td><td>●</td></tr>
</table>

Table 24b

<table>
<tr><th colspan="5">2 - Changes in Upland Processes affecting sediment sourcing into the stream channel</th><th colspan="3">Relative Importance in Watershed</th></tr>
<tr><th rowspan="2">Processes</th><th rowspan="2">Causal Level Pathway</th><th colspan="2">Altered Watershed Function or Loss of Watershed Component</th><th rowspan="2">Salmonid HLF's</th><th rowspan="2">U</th><th rowspan="2">M</th><th rowspan="2">L</th></tr>
<tr><th>Ecological Threat Level Pathway</th><th>Ecological Pathway Consequences (= factors leading to fish HLF's)</th></tr>
<tr><td rowspan="3">Altered Sediment Sourcing from landslides debris flows, etc. affecting sediment continuity (erosion, transport, deposition processes) and sediment structural processes</td><td>2.1. Rural Road Network

(examples: episodic failure, chronic input from inadequate buffer, etc.)</td><td>2.1.1. Increased fine sediment supply</td><td>2.1.1.1.
Direct: decreased
- hyporheic function

Indirect: decreased
- aeration of redds
- subsurface cooling function
- fish egg deposition / incubation function
- trophic function</td><td>2.1.1.1.
Physical Habitat Quality/Quantity
- Instream Sediment Quality (fine sediment aggrading)</td><td>●</td><td>◍</td><td>○</td></tr>
<tr><td>2.2. Agricultural and Forestry Activities

(examples: inadequate buffers, poor adherence to other BMPs, revetments, levees, dredge/fill)</td><td rowspan="2">2.2.1. & 2.3.1
Decreased coarse sediment supply and increased fine sediment supply</td><td rowspan="2">2.2.1.1. & 2.3.1.1.
Direct: decreased
- hyporheic function/cooling capacity
- hyporheic maintenance
- substrate maintenance

Indirect: decreased
- aeration of redds
- subsurface cooling function
- fish egg deposition / incubation function
- trophic function</td><td rowspan="2">2.2.1.1. & 2.3.1.1.
Physical Habitat Quality/Quantity - Instream Sediment Quantity (coarse sediment degrading) and Quality (fine sediment aggrading)</td><td>●</td><td>●</td><td>●</td></tr>
<tr><td>2.3. Urban/Rural Residential Activities and Structures

(examples: impervious surfaces, inadequate buffers, dredge/fill, ditching, poor adherence to other BMPs, etc.)</td><td>○</td><td>●</td><td>●</td></tr>
</table>

Table 24c

3 - Change in Riparian Process, Lateral Connectivity, and in-stream Morphology					Relative Importance in Watershed		
Processes	Causal Level Pathway	Altered Watershed Function or Loss of Watershed Component: Ecological Threat Level Pathway	Altered Watershed Function or Loss of Watershed Component: Ecological Pathway Consequences (= factors leading to fish HLF's)	Salmonid HLF's	U	M	L
Altered Association Between Riparian Zone and Stream Channel: affecting geomorphic dynamics, ii-stream habitat formation, and physiochemical processing	3.1. Altered Riparian Stand Composition	3.1.1. Decreased LWD supply to stream	3.1.1.1. Direct: decreased - physical habitat creation and maintenance - in channel capacity and aquatic habitat - extent of functional riparian zone - channel/bed form diversity and channel-forming processes Indirect: -Decreased instream fish carrying capacity	3.1.1.1. Physical Habitat Quality- summer (loss of habitat complexity and maintenance)	●	●	○
		3.1.2. Increased solar incidence to stream	3.1.2.1. Direct: decreased - shade function, →increased stream temperature	3.1.2.1. Water Quality-Temperature (above seasonal thresholds)	●	●	○
	3.2 Flow Control Structures (revetments, levees, etc.)	3.2.1. Decreased channel/flow complexity and surface water storage	3.2.1.1. Direct: decreased - material flow exchange between habitat types - fish access to seasonally inundated habitat Indirect: decreased - trophic function	3.2.1.1. Physical Habitat Quality- winter (loss of lateral flow and biotic exchange between habitat types)	○	●	●
	3.3 Altered Channel Morphology / Structure, and Legacy Effects	3.3.1. Artificial dredge/fill features	3.3.1.1. Direct: - decreased coarse sediment supply and increased fine sediment supply Indirect: decreased - channel form and channel-forming processes - channel capacity and aquatic habitat	3.3.1.1. & 3.3.2.1. Physical Habitat Quality/Quantity - Instream habitat simplification, bedrock reaches, hydrologic disconnection	○	●	●
		3.3.2. Decreased substrate structure from previous splash damming	Multiple ecological consequences		◍	●	●
		3.3.3. Artificial channels disjoined from natural physical/biological processes			○	●	●
	3.4. Simplified Hydraulic Exchange (revetments) and Impervious Surfaces	3.4.1. Reduced riparian buffering of toxins and fine sediments	3.4.1.1. Direct: more punctuated - temperature levels in aquatic system - toxin levels into aquatic system - fine sediments delivery into aquatic system	3.4.1.1. & 3.5.1.1 Water Quality – Temperature / Toxins / Pollutants / Fine Sediments	◍	●	●
	3.5. Water Treatment/ Storm Water Practices/ Control Structures	3.5.1. Increased sourcing of temperature/ toxins / nutrients	3.5.1.1. Direct: - more persistent and punctuated temperature /toxin / nutrient levels in aquatic system		○	◍	●

Table 24d

4 - Change in intertidal / estuarine physical and chemical processes					Relative Importance in Estuary		
Processes	Causal Level Pathway	Altered Estuarine Function or Loss of Estuarine Component: Ecological Threat Level Pathway	Altered Estuarine Function or Loss of Estuarine Component: Ecological Pathway Consequences (= factors leading to fish HLF's)	Salmonid HLF's	U	M	L
Altered Material Processing Dynamics	4.1 External FW Controls: Multiple causal pathways due to altered FW water quality pathways	4.1.1. Increased sourcing of temperature/ toxins / nutrients from FW	4.1.1.1. Direct: - more punctuated and persistent toxin levels in estuarine system	4.1.1.1. Estuarine Water Quality - Toxins / Pollutants	●	●	◍
	4.2 External FW Controls: Multiple causal pathways due to altered FW flow pathways	4.2.1. Dampened flow regime dynamics from FW	4.2.1.1. Direct: - simplified chemical mixing function/processing, altering nutrient cycling, and food web composition/dynamics - decreased habitat forming function	4.2.1.1. Physical Habitat Quality/Quantity (loss of energy flow and biotic exchange supporting estuarine food web)	○	●	◍
	4.3. Agricultural / Residential / Port Activities within estuary	4.3.1. Habitat simplification	4.3.1.1 Direct: - decreased quantity and quality of estuarine rearing habitat	4.3.1.1. Physical Habitat Quality/Quantity - loss of juvenile rearing habitat	●	●	●

Table 25. Description of programs implemented by the State of Oregon that support habitat management strategies in freshwaters and estuaries, and their applicability to the causal pathway categories and the codes in Table 23a-d. Land use categories applicable to a program and particular causal pathway category are: ALL= All land types; FF= Federal Forest; SF = State Forest; PF = Private Forest; AG = Agricultural/Rural; UR = Urban/Rural Residential; O = Other.

Program and Guidance	Description, Status, Jurisdiction	Causal Pathways leading to Habitat Limiting Factors														
		Flow Regime				Sediment Production			Riparian Processes					Estuary Processes		
		1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	3.4	3.5	4.1	4.2	4.3
ODA: Agricultural Water Quality Management Act (SB 1010) Ag Water Quality Mgmt. Act. OAR Chapter 603, Divisions 90 and 95. ORS 561.191.	This statute reinforces ODA's responsibility for and jurisdiction over agricultural practices and water pollution associated with activities on agricultural and rural lands. Regulatory actions address violations when they arise. Monitoring tools include DEQ ambient monitoring sites, local monitoring programs such as Rogue Valley Council of Government's Bear Creek monitoring and ODA Riparian Conditional Analysis for agricultural lands. Affected by rate of riparian vegetation development where needed. Development timeline will vary from 5-50 years depending on present site condition and site potential. All agricultural practices and water pollution associated with activities on agricultural and rural lands, excluding federal or tribal trust lands.					AG: Road Network & Ag Activities			AG: Stand Composition & Revetments			AG: Buffer Condition & Control Structures				
ODA: Confined Animal Feeding Operation (CAFO) ORS 468B0.50 and 468B.0125	Confined Animal Feeding Operation (CAFO) program protects water quality by preventing animal wastes from discharging into waters of the state. ODA's CAFO program provides a means for the state to meet the requirements of the federal Clean Water Act. Operators know what is expected of them and are visited by ODA inspectors on an annual basis to insure compliance. On-going All permitted and non-permitted Confined Animal Feeding Operations.											AG: Buffer Condition & Control Structures				

Program and Guidance	Description, Status, Jurisdiction	Causal Pathways leading to Habitat Limiting Factors														
		Flow Regime				Sediment Production			Riparian Processes					Estuary Processes		
		1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	3.4	3.5	4.1	4.2	4.3
ODA: Pesticides Oregon State Pesticide Control Act, ORS 634, and Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)	The ODA Pesticide Division regulates pesticide applicators, labeling, and regulates misuse. On-going All pesticide use throughout the state (commercial and private)												ALL: Control Structures			
ODA: Soil and Water Conservation Districts Organized under ORS Chapter 568 and governed by elected board of directors who serve without pay	SWCDs identify and address natural resource concerns within their respective boundaries and work w/ local, state, federal and private interests to deliver conservation services. On-going All lands within district boundaries		ALL: Water Extraction & Flow Regime			ALL: Road Network & Ag Activities			ALL: Stand Composition & Flow Control & Channel Structure			ALL: Buffer Condition & Control Structures				ALL: AG Activities
ODA: Weed Control Program ORS 561.685.	The Oregon State Weed Board (OSWB) has an appropriation to assist counties in special projects and to help support biological control work. The board and the ODA weed staff confer in setting statewide priorities for funding of projects. The board also develops and maintains the State Noxious Weed List. The primary mission of the OSWB is to guide statewide noxious weed control priorities and to award noxious weed control lottery funds. The OSWB provides direction to control efforts at the county and local levels. Priorities are developed, in part, through the state noxious weed control policy and classification system. The OSWB is also responsible for awarding noxious weed control grants to assist cooperators in noxious weed control efforts throughout the state. On-going Non-regulatory program – weed control statewide (Federal, State, Public and Private lands)								ALL: Stand Composition			ALL: Buffer Condition				

Program and Guidance	Description, Status, Jurisdiction	Causal Pathways leading to Habitat Limiting Factors														
		Flow Regime				Sediment Production			Riparian Processes					Estuary Processes		
		1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	3.4	3.5	4.1	4.2	4.3
ODEQ: Water Quality Standards, 303(d) listings, and TMDL's Federal Clean Water Act; ORS 468B.035 & 048; OAR 340-041-0001 to 340-041-0350; OAR 340-0410046 OAR 340-042	DEQ develops numeric and narrative water quality standards to protect for the most sensitive beneficial uses of the waters of the state – typically for protection of cold water fish and other aquatic life, and human health. As required under Section 303(d) of the Clean Water Act (CWA), these standards are to be reviewed every three years to insure that they are scientifically up-to-date. The CWA requires states to identify (list) waters that do not meet water quality standards on a biennial basis. This listing is often use as a basis for developing water-quality based programs to bring the waters back into compliance with the standards. Total Maximum Daily Loads (TMDLs) are required for waters on the 303(d) list and describe the amount of a pollutant a water body can receive and not violate water quality standards. Loads are allocated among point and nonpoint sources while maintaining a reserve for future growth and a margin of safety. Based on this work, permits for point sources may be modified with the source required to come into compliance with conditions in the permit before the end of the permit cycle (typically 5-years). Nonpoint sources are required to develop and implement Plans designed to meet allocations. DEQ requires Designated Management Agencies (DMA's) to develop Non-Point Source Implementation Plans for sub-basins that have TMDLs. Additionally, DEQ works in cooperation with other state, federal and local agencies to enhance their programs to address elements of non- point source pollution and administers grants and loans to implement on-the-ground projects. On-going All waters of the State		ALL: Flow Extraction & Regime			ALL: Rural Roads & Ag and Forest Activities & Stand Composition						ALL: Buffer Condition & Control Structures				
ODEQ: 401 Dredge & Fill Certifications and Hydroelectric Recertification Federal Clean Water Act; ORS 468B.035 & .047; OAR 340-048	Section 401 of the federal Clean Water Act requires that an applicant for a federal permit, to conduct an activity that may result in a discharge to waters of the State, must provide the permitting agency with a State water quality certification. A water quality certification is the mechanism by which the State evaluates whether an activity will meet water quality standards. Certifications may be denied, approved or approved with conditions, which if met, will ensure that water quality standards are met. On-going All waters of the State											ALL: Buffer Condition & Control Structures				
ODEQ: Point Source and Storm Water Permits Federal Clean Water Act; ORS 468B.035, 030 & 050; OAR 340-045.	DEQ issues point source water quality permits to protect surface and ground waters of the state. These permits regulate sewage and industrial wastewater discharges from industrial and municipal sources. Storm water permits are required for and regulate storm water discharges to surface waters from: Construction activities (that disturb greater than 1 acre); industrial activities (subject to federal permitting requirements determined by SIC codes listed in the federal regulations); and municipalities (covered under Phase 1 (populations over 100,000) and Phase 2 (populations over 50,000) permitting requirements). On-going All waters of the State											ALL: Buffer Condition & Control Structures				

Program and Guidance	Description, Status, Jurisdiction	Causal Pathways leading to Habitat Limiting Factors														
		Flow Regime				Sediment Production			Riparian Processes					Estuary Processes		
		1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	3.4	3.5	4.1	4.2	4.3
ODEQ: Environmental Clean Ups Various Federal Laws; ORS465; OAR 340-122	DEQ's Environmental Cleanup Program protects human health and the environment by identifying, investigating, and remediating sites contaminated with hazardous substances. The Cleanup Programs objective is to guide all sites to No-Further-Action (NFA) determinations as quickly and inexpensively as possible. DEQ has issued over 1,000 NFAs since 1994, some of which include institutional or engineering controls to manage site risks. On-going All waters of the State											ALL: Buffer Condition & Control Structures				
ODEQ: Water Quality Monitoring Federal Clean Water Act; ORS 468B.035; ORS 468.035 (1)(b)	States need comprehensive water quality monitoring and assessment information on environmental conditions and changes over time to help set levels of protection in water quality standards and to identify problem areas that are emerging or that need additional regulatory and non-regulatory actions to support water quality management decisions such as TMDLs, NPDES permits, enforcement, and non-point source management. DEQ's monitoring falls into three broad categories: status and trends; compliance monitoring for standards and permits; and effectiveness monitoring of water quality pollution management programs. On-going															
ODF: Fire Program ORS Chapter 527, 526	The Fire Program of the Oregon Department of Forestry provides effective protection from fire for forest resources including water and watersheds, fisheries, wildlife, soil productivity and soil stability. National Fire Plan activities target fuel reduction and stand management that contribute to stands that are more fire resilient and benefit all forest resources. The Fire Program also educates forest landowners and forest homeowners about the value off fire hazard and risk reduction measures and takes positive action to minimize threats. On-going All waters of the State					SF: Rural Roads & Forest Activities										

Program and Guidance	Description, Status, Jurisdiction	Causal Pathways leading to Habitat Limiting Factors																	
		Flow Regime				Sediment Production			Riparian Processes					Estuary Processes		
		1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	3.4	3.5	4.1	4.2	4.3
ODF: Oregon Forest Practices Act (FPA) ORS Chapter 527, OAR Chapter 629	The FPA guides forest practices on private forest lands to promote economically sustainable harvest of forest trees and as the leading use on such land. FPA guidelines address the management need of other resources (soil, air, water, fish/wildlife) with the following: Road construction and maintenance must allow the migration of adult and juvenile fish during conditions when fish movement in that stream normally occurs. The FPA requires fish passage to be maintained For roads constructed after 1994, and for all other roads the FPA encourages this standard. For roads constructed prior to 1994, other statutes apply that are outside the jurisdiction of the Department of Forestry. The water protection rules protect, maintain and, where appropriate, improve the functions and values of streams, lakes, wetlands, and riparian management areas. These functions and values include water quality, hydrologic functions, the growing and harvesting of trees, and fish and wildlife resources. Temperature is primarily addressed in the water protection rules that include general vegetation retention prescriptions for streams, lakes and wetlands. With regards to habitat complexity and off-channel habitat availability, the FPA regulates slash treatment, reforestation, chemical applications, road construction, harvesting, and hauling. Statutes and administrative rules vary for each practice. For fine sediment, the FPA regulates slash treatment, road construction, harvesting, and hauling. Rules vary for each practice. Each set of rules is designed to prevent or minimize sediment or debris delivery to waters of the state and to meet clean water standards. These rules take a precautionary, passive approach by protecting the existing condition. They allow restoration activities only with site specific, written plans. ODF foresters work with landowners and operators to assist, educate, and enforce the rules. A statewide monitoring program assesses compliance with the rules and rule effectiveness at achieving objectives. Program is active & ongoing. Recent changes include wet weather hauling rules, road drainage, and measures around certain streams. Monitoring of small and medium fish bearing streams is under way.	PF: Rural Road Network				PF: Rural Road Network & Forest Activity			PF: Stand Composition		PF: Legacy Effects	PF: Buffer Conditions				
ODF: State Forest Program ORS Chapter 527, 521, OAR 629-640-0100 & -0200 through -0440, Northwest Oregon State Forests Management Plan, Forest Roads Manual, ODFW rules/statutes, OWEB guidance on fish passage	The Program implements actions related to roads and harvest activities to minimize fish passage issues and sediment delivery: Roads are built and maintained according to the standards of the Forest Roads Manual. Stream crossings are surveyed at the watershed scale to identify locations of potential effects to fish passage. (This is usually conducted through the watershed analysis process.). Based on these surveys, actions are taken to improve fish passage, reduce hydrologic connectivity, potential for road failure, and other potential sediment impacts. The buffers specified by the FMP are designed to prevent disturbance in the near stream area that might otherwise result in sediment delivery to streams The State Forest Program applies standards that include wider riparian buffers than called for under the FPA. The State Forest Program applies standards that are designed to increase the development of riparian large wood to restore aquatic habitats. Where appropriate, the Forest Management Plan (FMP) promotes the use of alternative vegetation treatments to accelerate the development of large wood. Active restoration is also applied to improve habitat complexity. Restoration projects include wood placement and re-routing of roads away from streams. Priority areas for restoration are generally identified through the watershed analysis process. Finally, ODF conducts monitoring to ensure that actions are applied properly and to evaluate the effectiveness of these actions. Finally, monitoring is conducted. ODF evaluates the effectiveness of its riparian strategies through its adaptive management program. Ongoing	SF: Rural Road Network				PF: Rural Road Network & Forest Activity			SF: Stand Composition		SF: Legacy Effects	SF: Buffer Conditions				

Program and Guidance	Description, Status, Jurisdiction	Causal Pathways leading to Habitat Limiting Factors																
		Flow Regime				Sediment Production			Riparian Processes					Estuary Processes		
		1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	3.4	3.5	4.1	4.2	4.3
ODFW: Habitat Mitigation Policy, Scientific Take, Fish Transport, In-Water Blasting, and In-Water Work Timing OAR 635-007-0600, 007-0900, 415,425	ODFW comments on land and water use activities under the guidance of the Habitat Mitigation Policy. It also regulates where fish may be removed (take) and stocked (transport) within Oregon's habitat. The agency also regulates in-water blasting and provides in-water work timing guidelines which guide when activities may be conducted in waters of the state, in coordination with ODSL. On-going	ALL: Advisory and Permitting Nexus																
ODFW: Oregon Conservation Strategy USFWS and Association of Fish and Wildlife Agencies guided the development and review process for the Strategy. For guidance on the implementation, see the Oregon Conservation Strategy document: http://www.dfw.state.or.us/conservationstrategy	The Oregon Conservation Strategy provides a non-regulatory, statewide approach to species and habitat conservation. It synthesizes existing plans, scientific data, and local knowledge into a broad vision and conceptual framework for long-term conservation of Oregon's native fish, wildlife and habitats. Conservation of instream and upland habitats will promote watershed health. The Oregon Conservation Strategy is meant to apply to all lands, rivers, streams, and estuaries in Oregon.	ALL: Planning and Implementation Nexus																
ODFW: Fish Passage Program Laws regarding fish passage may be found in ORS 509.580 through 910 and in OAR 635, Division 412.	The owner or operator of an artificial obstruction located in waters in which native migratory fish are currently or were historically present must address fish passage requirements by gaining approval from ODFW prior to certain trigger events. Trigger events include installation, major replacement, a fundamental change in permit status (e.g., new water right, renewed hydroelectric license), or abandonment of the artificial obstruction. In addition, ODFW is working toward identification of the highest priority passage sites, at which passage can be addressed. On-going Artificial obstructions located in Oregon waters in which native migratory fish are currently or were historically present.	ALL: Water Control Structures																
ODFW: Fish Screening and Passage Grant Program Laws regarding passage, screening, and cost share can be found in ORS 315.138, 496.085, 496.141, 496.303, 497.124, 498.301 through 346, 509.580 through 910, 537.141, 540.525, and in OAR 635, Division 412.	Oregon water users may be eligible for an ODFW cost-share incentive program and state tax credit designed to promote the installation of ODFW approved fish screening or fish passage devices. Fish screens prevent fish from entering water diversions. Fishways provide fish passage to allow migration. ODFW works with owners who apply for funding, as well as actively seeks projects at which to provide fish screening and passage. On-going Oregon water users including independent agriculture users, private domestic users, municipal water suppliers, irrigation districts and commercial industries.	ALL: Funding																

Program and Guidance	Description, Status, Jurisdiction	Causal Pathways leading to Habitat Limiting Factors														
		Flow Regime				Sediment Production			Riparian Processes					Estuary Processes		
		1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	3.4	3.5	4.1	4.2	4.3
ODFW: Lands Resources Program Info. for Landowner Incentive Program (LIP), Access and Habitat Program, Bird Stamp Program, and Riparian Lands Tax Incentive Program) can be found at http://www.dfw.state.or.us/wildlife/grants/index.asp	The Wildlife Division Habitat Resources Program helps guide land-use activities in Oregon that affect fish and wildlife habitats. The Program offers tax incentives, grants and technical assistance to private and public landowners, businesses and governments to help conserve fish and wildlife habitats, and to ensure environmental protection standards are met. Program goals promote healthy riparian and wetland corridors – decreasing bank erosion and filtering run-off. On-going All owners of private and public land in Oregon interested in conserving fish and wildlife habitats.	ALL: Technical Assistance and Restoration Funding														
ODFW: Restoration and Enhancement Program OAR's 635-009-0200 through -0240; Stat. Auth.: ORS 512	ODFW oversees a comprehensive program to assist in enhancing natural fish production, improve hatchery programs, and provide additional public access to fishing waters. To achieve these goals, the R & E Program provides funding that directly benefits fish by addressing items such as fish passage, habitat restoration, public education, research and monitoring. On-going All streams, rivers, lakes, and estuaries in Oregon.	ALL: Restoration Funding														
ODFW: Salmon Trout Enhancement Program OAR's 635-009-0090 through -0150; Stat. Auth.: ORS 496	The Salmon and Trout Enhancement Program (STEP) recognizes that volunteers play an important role in the restoration of salmon, steelhead and trout. STEP (1) educates the public about Oregon's salmon and trout resources and the habitats they depend on, (2) inventories and monitors fish populations and their habitat, (3) enhances, restores and protects habitat for native stocks of salmon, steelhead, and trout. Ongoing	ALL: Volunteer Support														
ODLCD: Statewide Comprehensive Land Use Planning ORS 197, ORS 195, ORS 215, ORS 227	Oregon's statewide comprehensive land use program requires cities and counties to plan for and manage land use in compliance with 19 statewide planning goals. Goal 5 requires local protection programs for significant freshwater wetlands, Goal 16 prohibits development in 98% of the remaining estuarine wetlands, and Goal 17 requires protection for major marshes along Oregon's coastal shore lands. Less directly, Goals 6 and 7 may address wetland management for water quality and flood management purposes. Local land use plans and ordinances must identify and protect natural resources and identify and plan for hazard areas. The statewide land use program provides a framework for local governments to adopt land use plans and ordinances and approve development that are salmon-friendly. Implementation is on-going. Plans and ordinances are updated according to local needs and as a result of legislation.	UR: Roads/Culverts	UR: Flow Extraction & Regime		UR: Impervious surfaces			UR: Impervious Surfaces		UR: Revetments		UR: Buffer Condition & Control Structures				UR: Development

Program and Guidance	Description, Status, Jurisdiction	Causal Pathways leading to Habitat Limiting Factors														
		Flow Regime				Sediment Production			Riparian Processes					Estuary Processes		
		1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	3.4	3.5	4.1	4.2	4.3
ODSL: Removal-Fill Program ORS Chapter 196.795 - 990 and ORS Chapter 390.835; OAR 141-085-0005 - 0165.	Oregon's Removal-Fill Law is administered by the Department of State Lands Wetlands and Waterways Conservation Division whose mission is to conserve and protect waters of the state (streams, wetlands, lakes, estuaries). The law requires people who plan to remove or fill material in waters to obtain a permit from DSL. By offering a streamlined General Authorization for projects with minimal impacts (i.e. bioengineering methods and planting instead of riprap), the permit process encourages applicants to design projects with minimized impacts to water quality. Coordination with other state agencies in administering the removal-fill program is required under the agency's State Agency Coordination Plan. All permits issued by DSL include conditions that require protection of water quality, including turbidity monitoring and sediment and erosion control. Proposed permanent impacts to in-stream, off-channel, and side-channel habitat are required to be offset with compensatory mitigation actions such as riparian planting or large wood placement. Ongoing Waterways to the ordinary high water mark and wetlands that meet the three wetland indicators described in the Corps of Engineers' 1987 Wetlands Manual						ALL: Dredge/fill Activity			ALL: Channel Alteration						ALL: Dredge/fill Activity
ODSL: Wetlands Program ORS Chapter 196.600 - 692; OAR 141-085-0240 - 0257 and 0610 - 0660	The Wetlands Program was established by statute in a 1989 comprehensive wetlands conservation bill. The Program is responsible for developing and maintaining the Statewide Wetland Inventory, providing wetland planning assistance, developing standards and tools, and providing public information and training. The Oregon Wetland Plan describes several activities that can increase restoration and protection of wetland resources. Ongoing										ALL: Buffer Condition & Control Structures					ALL: Buffer Condition
OWEB: CREP Program ORS 541.351 - 541.420 and OAR 695-001-0000 through 695-050-0050	The Conservation Reserve Enhancement Program (CREP) is a voluntary program for agricultural landowners. CREP is a state and federal partnership that allows landowners to receive incentive payments and conservation rental payments from the USDA Farm Services Agency for establishing long-term riparian buffers on eligible land. In addition to providing partial funding to direct landowner payments for conservation activities, OWEB has participated in providing funding for outreach, technical assistance and program coordination. The Oregon Departments of Agriculture, Forestry and Water Resources have also assisted in CREP implementation and coordination. Ongoing Agricultural lands					AG: Restoration Funding / Technical Assistance										
OWEB: Partnership Investments	The Partnership Investment Program is a means by which OWEB works closely with partners and utilizes a different process from other grant process to invest in longer-term activities intended to result in larger-scale ecological outcomes. Ideally, a Partnership Investment contributes to a historic change or surge of progress in the recovery of a species, the restoration of an ecosystem, or the launching of an initiative that addresses widespread issues. Examples include CREP, Special Investment Partnerships (SIPs) and Whole Watershed Restoration Initiative (WWRI). Ongoing	ALL: Restoration Funding														

Program and Guidance	Description, Status, Jurisdiction	Causal Pathways leading to Habitat Limiting Factors														
		Flow Regime				Sediment Production			Riparian Processes					Estuary Processes		
		1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	3.4	3.5	4.1	4.2	4.3
OWEB: Grant Program ORS 541.351 - 541.420 and OAR 695-001-0000 through 695-050-0050	OWEB's grant program supports voluntary efforts by Oregonians seeking to maintain and restore native fish and healthy watersheds. OWEB funds projects that restore, maintain, and enhance the state's watersheds, supports the capacity of local watershed-based citizen groups to carry out a variety of restoration projects, promotes citizen understanding of watershed needs and restoration ideas, provides technical skills to citizens working to restore urban and rural watersheds, and monitors the effectiveness of investments in watershed restoration. OWEB regular grants are awarded every 6 months for restoration and protection of ecological resources. Grant applications are reviewed by a regional multidisciplinary team to develop recommendations and prioritization of grant applications for OWEB consideration. The review teams evaluate whether the grant applications address limiting factors and the technical soundness of the proposals. Ongoing All lands	ALL: Restoration Funding														
OWRD: Fish and Fish Habitat Protection OAR 690-009, 033, 051, 310	Surface waters in many areas of the state are fully allocated during critical flow periods for fish. However, there are several aspects of the review process for new water right applications that are protective of fish and fish habitat. All new groundwater permits are evaluated to determine the potential to cause substantial interference with surface flows. Surface water availability is modeled monthly and includes existing in-stream water rights. Applications to appropriate surface waters are evaluated at the 80% exceedance level. Permits are subject to public interest review standards that include interagency consultation on potential impacts of further appropriation to fish and fish habitat. Permits, if approved, can be conditioned to address impacts identified through the public interest standard and interagency review process. Ongoing With few exceptions, all surface and ground waters of the state		ALL: Instream Flow													

Program and Guidance	Description, Status, Jurisdiction	Causal Pathways leading to Habitat Limiting Factors																
		Flow Regime				Sediment Production			Riparian Processes					Estuary Processes		
		1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	3.4	3.5	4.1	4.2	4.3
OWRD: (under the Oregon Plan for Salmon and Watersheds) Streamflow Restoration Priorities OAR 690-018, 077, 380	The Oregon Plan measures which the Water Resources Department is committed to implementing under the Oregon Plan for Salmon and Watersheds include a variety of actions targeted to priority watersheds and streams to incrementally aid in improving salmonid habitat throughout the state. Within the existing legal framework, the measures are intended to support recovery efforts by encouraging voluntary efforts by water users to preserve and enhance streamflows and by ensuring that the use of water is consistent with state water law and the terms and conditions of water rights. The Department developed updated measures in February 2003 (http://www.oregon.gov/owrd/pubs/docs/reports/opsw_wrd_plan.pdf) to focus on actions that have the greatest potential for success in high priority watersheds addressing three key desired outcomes: (1) maintenance and restoration of streamflows, (2) fish passage at all instream structures, and (3) protection against salmonid mortality. The WRD and ODFW jointly identified priority areas for streamflow restoration in basins throughout the state. These priority areas represent watersheds in which there is a combination of need and opportunity for flow restoration to support fish recovery efforts under the Oregon Plan for Salmon and Watersheds. WRD is focusing its efforts to aid in recovery of salmonids on these priority areas. A summary of the prioritization process and the criteria used in establishment of the priorities is available at the WRD website. OWRD staff work with water rights holders to restore streamflow through voluntary flow restoration measures. Voluntary measures include in-stream leases, in-stream transfers, allocations of water conserved through improved efficiencies, and changes to existing rights including consolidation or transfers of points of diversion. In certain circumstances, reclaimed water from certain municipal, industrial and confined animal feeding operations may provide an effective alternative to new diversions of surface water or ground water. Ongoing With few exceptions, all surface and ground waters of the state		ALL: Instream Flow														

Program and Guidance	Description, Status, Jurisdiction	Causal Pathways leading to Habitat Limiting Factors														
		Flow Regime				Sediment Production			Riparian Processes					Estuary Processes		
		1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	3.4	3.5	4.1	4.2	4.3
OWRD: Water Distribution and Regulation and Water Rights Programs OAR 690-250, 077, ORS 540.045 OAR 690-009, 033, 051, 310	Existing Water Rights: Oregon's water laws are based on the principle of prior appropriation. This means the first person to obtain a water right on a stream is the last to be shut off in times of low streamflows. Distribution and regulation of water use for the protection of senior water rights, including instream rights, is a priority for OWRD. If there is a surplus beyond the needs of the senior right holder, the water right holder with the next oldest priority date can take as much as necessary to satisfy needs under their right and so on down the line until there is no surplus. Watermasters respond to complaints from water users and determine in times of water shortage, which generally occur every year, who has the right to use water. Staff regularly monitors streamflow, particularly on those streams with established instream rights, and work to eliminate illegal use through compliance and enforcement of Oregon water law. New Water Rights: applications are subject to review through an interagency review and consultation process. Permits, if approved, may be conditioned to address impacts on listed species identified through the consultation process. Water Right Transfers: Water rights are appurtenant to the land and pass from owner to owner when the land is sold. A water right may only be used for the purposes authorized under the right at the location identified in the right. Most changes in the use of water rights may only be made after approval by the Water Resources Department for a Water Right Transfer. A transfer may approve changes in the place of use, point of diversion, or character of use of a water right. In reviewing applications to transfer water rights, the Department is responsible for ensuring that other water right holders will not be injured by the change. Instream Leases: Oregon's Instream Leasing program provides a voluntary means to aid the restoration and protection of streamflows. This arrangement provides benefits both to water right holders and to instream values by providing water users with options that protect their water rights while leasing water for instream benefits Ongoing With few exceptions, all surface and ground waters of the state		All: Instream Flow													

Program and Guidance	Description, Status, Jurisdiction	Causal Pathways leading to Habitat Limiting Factors																
		Flow Regime				Sediment Production			Riparian Processes					Estuary Processes		
		1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	3.4	3.5	4.1	4.2	4.3
OWRD: Water Supply and Conservation Planning OAR 690-086	OWRD staff work with water rights holders to address water supply through the development of Water Management and Conservation Plans. The planning program provides a process for municipal water suppliers to develop plans to meet future water needs. Many municipal water suppliers are required to prepare plans under water right permit conditions. In addition, with the revision of the permit extension rules in fall 2002, communities seeking long-term permit extensions will be required to prepare plans. These plans will be used to demonstrate the communities´ needs for increased diversions of water under the permits as their demands grow. A municipal plans provides a description of the water system, identifies the sources of water used by the community, and explains how the water supplier will manage and conserve supplies to meet future needs. Preparation of a plan is intended to represent a pro-active evaluation of the management and conservation measures that suppliers can undertake. The planning program requires municipal water suppliers to consider water that can be saved through conservation practices as a source of supply to meet growing demands if the saved water is less expensive that developing new supplies. As such, a plan represents an integrated resource management approach to securing a community´s long-term water supply. Water Management and Conservation Plan programs are in place and ongoing. With few exceptions, all surface and ground waters of the state		ALL: Instream Flow														
OWRD: Water Use Measurement Strategy OAR 690-085, ORS 537.099 and the Water Resource Commission's Strategy for Statewide Water Measurement	Federal and state agencies, cities, counties, schools, irrigation districts and other special districts are required to report water use on an annual basis. Since 1990, many new permits have required water meters to be installed and annual reports to be submitted to the state. In addition, the Water Resource Commission considered water use measurement in 2000 and adopted a strategy for improving water measurement statewide. The strategy includes a program to inventory and complete field assessments of significant points of diversion and to look for opportunities to increase measurement at those diversions by ensuring compliance and promoting voluntary measurement via cost-share programs. Significant diversions are characterized as those required to measure through a water right condition, or those diversions without a measurement condition that are greater than 5 cfs, or greater than 10% of the lowest monthly 50% exceedance flow as defined in the water availability model, and greater than 0.25 cfs. Ongoing with partial implementation With few exceptions, all surface and ground waters of the state		ALL: Instream Flow														

Impacts of Climate Change and Human Population and Economic Growth

Effects of climate change and increases in human population and growth on the Oregon Coast will likely impact coastal salmonid SMUs. Although it is difficult to project the specific impacts of these emerging threats on coastal salmon and trout, the CMP summarizes what are considered the most likely changes to occur, and how they might affect particular salmonid life stages. Meeting the biological goals of the CMP will require improvement on the status quo for primary habitat limiting factors and preventing other potential impacts from becoming limiting factors. There are many recent efforts to project the effects of climate change on fish and wildlife in the Pacific Northwest using global emission scenarios and regional and global climate change models. Although the potential ecological responses and management approaches are complex and not precisely predictable, the projected regional trajectories of increased winter flooding, decreased summer and fall streamflows, and elevated temperatures in streams, rivers, and the estuary are likely to compound already degraded habitat conditions for salmon and trout. These types of changes will likely make it more difficult to meet the biological goals for coastal Oregon salmonid SMUs.

Although the SMUs have presumably persisted through past climatic extremes, this was prior to the recent overlay of human-induced limiting factors, and it is unclear how populations will respond to the future effects of human-induced climate change. For example, the effects of degraded and lost habitat quality and complexity in the estuary and the SMU tributaries—which already impact salmonid populations—could be amplified through climate change. With the anticipated negative changes in altered hydrology and higher seasonal water temperatures, there will likely be further losses of backwater, sloughs, and other off-channel areas that provide cool water refugia and resting habitat important to salmonid survival. Degraded riparian habitat conditions may further exacerbate altered hydrology and water temperatures by reducing stream shading, bank stabilization, aquatic food production, and nutrient and chemical mediation. While the impacts of global climate change are less clear in the ocean environment, some modeling suggests that warmer temperatures are likely to increase ocean stratification, which in the past has coincided with relatively poor foraging conditions for several species of fishes. Ocean acidification and sea-level rise will also likely affect salmonid productivity.

Given that annual, cyclic, and shifting trends in broad environmental conditions are known to exert extremely strong influence on salmonid survival, precautionary upward adjustments to all populations' abundance goals were made[62]. It is also extremely important for freshwater and estuarine habitat strategies and general actions identified in this plan be implemented because a) localized effects of climate change and human population growth will manifest themselves through the limiting factors identified in this plan (e.g., water quality/temperature, water quantity, physical habitat quality), and b) these, along with actions in the other Management Categories, are within Oregon's management control.

Assessing the Effects of Future Climate Change and Human Population Growth on Salmonid Biological Performance

There is a rapidly expanding literature of the projected changes in regional climatic and weather patterns due to global climate change, and what the effects these could have on aquatic ecosystems and fishes. Interested readers are referred to Reiman and Isaaks (2010), Beechie et al. (2012), and associated work[63,64] for some of the latest projections for the Pacific Northwest. As stated by Reiman and Isaaks (2010) *"… long-term warming trends and increasing variability will result in more frequent events (e.g., droughts, intense precipitation, and periods of unusually warm weather) that were considered extreme during the twentieth century, and the magnitude of these events may also exceed recent historical levels.*" The rain-dominated hydrology of coastal Oregon streams and rivers are not projected to experience the same magnitude of change in temperatures and flows as other portions of the Pacific Northwest (Beechie et al. 2012). However, it is sufficient to note that coastal Oregon salmonid populations will likely be exposed to lower summer base flows, higher summer-fall water temperatures, and greater stochasticity in hydrology due to changes in precipitation and runoff patterns. Although it is not clear how global climate change will affect salmon and trout in the ocean environment[65], some modeling efforts suggest that warmer air temperatures

[62] As climate change and population growth effects increase, the rate of habitat actions may need to increase in order to meet abundance goals and prevent serious declines.
[63] http://occri.net/publications
[64] http://cses.washington.edu/db/pdf/wacciach6salmon649.pdf
[65] ODFW has seen a shift in the distribution of hatchery fall-run Chinook from Elk River. They are being caught in a higher proportion in the northern fisheries (AK and BC) than in previous recent history.

are likely to increase ocean stratification, which in the past has coincided with relatively poor ocean habitat for most Pacific Northwest salmon, herring, anchovies, and smelt populations (CIG 2004). Achieving habitat goals in this context will likely require increased intensity, persistence, and continued implementation of habitat restoration actions, as well as identifying additional new actions as RME and adaptive management proceed.

Several documents list general strategies and actions for mitigating the effects of climate change (Nelitz et al. 2007; Reiman and Isaaks 2010; others) and Beechie et al. (2012) summarize the potential effectiveness of classes of actions to ameliorate changes to temperate and flow regimes. It is generally assumed that watersheds with unaltered governing processes and good habitat will be more resilient (but not immune) to directional ecosystem change, compared to those that are already subject to cumulative effects and have altered processes. For example, in altered watersheds, factors that already lead to impaired water temperature and altered stream flow will have an exacerbating role under projected climate conditions and human population growth. In addition, based on inherent differences in geomorphic and fluvial properties across watersheds, some will experience greater change than others.

Strategies that are implemented to help coastal Oregon salmon and trout persist under climate change should be identified within the decision support process described by Beechie et al. (2012), with the details of specific actions guided by watershed assessments. However, due to the difficulties in down-scaling regional climate projections to watershed scales and the range of potential biotic responses across salmonid life stages, it is not always clear where, when, and which strategies from Beechie et al. (2012) to implement in any given watershed. Therefore, it should be assumed that evaluating action effectiveness should be based on a tactical framework for reducing uncertainties, within which strategies are modified based on results of research and monitoring.

Climate change threats (or hazards) may be defined in terms of absolute values or departures from the mean of variables such as rainfall, temperature, or water level, perhaps combined with factors such as speed of onset, duration and spatial extent (Brooks 2003). Climate change threats can be categorized as 3 exposure types relative to what capacity a system has to adapt to that threat: 1) Discrete recurrent hazards: droughts, episodic rainfall/scouring, 2) Continuous hazards: increases in mean temperatures or precipitation (decadal trends), 3) Discrete singular hazards: abrupt change in ocean regimes To help identify potential strategies to reduce these exposures this plan assumes that climate change will affect salmonid habitat through changes to existing watershed processes and the threat pathways in Table 24a through d. The pathways specify how the principle climatic drivers of warmer air temperatures and unusual precipitation patterns could change ecosystem processes in the near term. Risk scenarios project how these changes will likely be routed through the threats pathways, and how they could be manifested through varying degrees of exposure into limiting factors for specific salmonid life stages (Table 26)[66]. It should be noted that in Table 26 there is an inter-play between air temperatures and flow regimes, but the principal effect is the driving role of air temperature on seasonal water availability and how this affects salmonid life stages. Not included in these scenarios are other threat pathways that have longer term effects. For example, extended drought conditions could change fire regimes and change riparian processes through altered stand composition. This long-term vegetation change would not only influence shade function in the riparian zone, but also the habitat forming function of large wood (see pathways 3.1.1 and 3.2.1 in Table 24c). In addition, the scenarios do not fully capture potential negative feedback loops, for example, the human response of increased irrigation demand under a regime of higher air temperatures, reduced soil moisture, and greater evapotranspiration. The conceptual framework summarized in Table 26 can be further developed to assist watershed planners and fishery managers in conducting climate change risk assessments. Biophysical vulnerability is not only a function of threat exposure, but also the underlying sensitivity of a population or watershed. For example, if some populations in the planning domain are already affected by habitat stressors that will be expected to increase under projected climates climate changes, those populations should be considered relatively more sensitive to further change. Therefore a future need is to characterize (map) the relative differences in habitat conditions and population attributes (spatial structure, diversity) to inform a decision support matrix that can screen which salmonid population areas will be more resilient to climate change, and which watersheds that might not support certain life stages and species or life history strategies in the future.

[66] The pathways concept was adapted from the one diagramed in Nelitz et al. 2007.

Table 26. Scenarios of climate-induced risks to salmonids under climate change projections.

Potential Threat Pathways of Climate Change and Biological Attribute Affected	Life Stage Exposures to Threats								
	Adults-Upstream migration and Pre-spawn Mortality	Adults-Spawning Habitat	Egg mortality	Fry mortality	Parr mortality, summer rearing	Parr mortality, overwinter rearing	Smolt mortality, FW	Smolt mortality, Estuary	Adult physiological fitness- ocean
Scenario 1: - Higher summer air temperatures lead to greater water demand to offset greater evapo-transpiration, further reducing flows and increasing summer and early fall water temperatures - Increased fall air temperatures lead to low fall flows, reduced water depth, increased water temperature, change in habitat availability/distribution, and greater habitat fragmentation. 1. <u>Diversity:</u> change in run timing 2. <u>Productivity</u>: change in adult reproductive success due to: - greater incidence of disease - thermal stress and mortality - bio-energetic stress - intra-specific competition for reduces spawning area - increase in predation 3: <u>Spatial Structure</u>: change in access to good habitat	Continuous Exposure								
Scenario 2: - Warmer fall/winter/spring air temperatures increase intensity of storms, leading to greater channel scour, inundation of inappropriate habitat, and displacement of fry and parr to inappropriate habitat - Unusual air temperatures will lead to unusual spring flows and warmer spring water temperatures. 1. <u>Productivity</u>: change in early life survival - redd destruction, fry displacement, stranding - O_2 stress and thermal mortality - change in prey density, change in competition - change in survival due to change in body size/condition at winter onset - change in predator efficiency, including new invasions of warm-water predators 2. <u>Diversity</u>: - change in growth rates, sex ratios, hatch timing (earlier emergence?)			Discreet Exposure			Discreet Exposure			
Scenario 3: - Increase in summer air temperatures leads to late summer/early fall flow declines, and more severe and frequent drought events. <u>Productivity</u>: change in summer parr survival due to lower habitat quantity and quality - change in growth rates - O_2 stress and thermal mortality - change in prey density, change in competition, change in predator efficiency, including new invasions of warm-water predators					Discreet Exposure				

Potential Threat Pathways of Climate Change and Biological Attribute Affected	Life Stage Exposures to Threats								
	Adults-Upstream migration and Pre-spawn Mortality	Adults-Spawning Habitat	Egg mortality	Fry mortality	Parr mortality, summer rearing	Parr mortality, overwinter rearing	Smolt mortality, FW	Smolt mortality, Estuary	Adult physiological fitness- ocean
Scenario 4: - Flow declines will increase water temperatures and decrease dissolved oxygen <u>Productivity:</u> - increased predation and competition - O_2 stress, change in physiological function and delayed mortality Diversity: - change in growth rates - change in migration timing and age of outmigration							Continuous Exposure		
Scenario 5: Increased estuary temperatures and associations with increased salinity, change in estuarine mixing, and change in pH. 1. > in predation and competition 2. temperature stress 3. salinity stress 4. change in food availability 5. change in incidence of disease 6. change in plume dynamics								Continuous Exposure	
Scenario 6: Abrupt changes in ocean regime leading to increased ocean temperatures and associations with increased salinity, change in currents, and change in pH. 1. change in age of sexual maturation 2. change in size at maturation 3. change in egg viability 4. change in growth rates 5. change in migration routes and timing									Abrupt

Implementation

The overriding structure for implementation of this plan provides oversight of action implementation, commitment to implement the plan, evaluation of action effectiveness, and a process to adapt strategies or actions over time to ensure achievement of the desired status.

<u>Oversight</u>
The groundwork for overseeing plan implementation has already started. ODFW will utilize its Coastal Implementation Coordinator position to monitor and facilitate the implementation of the CMP. The Implementation Coordinator currently oversees the implementation of the Oregon Coast Coho Conservation Plan (OCCCP) and many of the actions in this plan are also identified in the OCCCP. In addition, many of the individuals, organizations, and agencies the Implementation Coordinator has been working with to rebuild coastal coho will be involved in implementing actions called for in the CMP.

<u>Commitment</u>
ODFW will be responsible for implementing the CMP. The agency is committed to implement those actions over which it has direct authority as long as staffing or funding does not prohibit their implementation. For those actions related to hatcheries, harvest and predators that involve current, ongoing programs, ODFW has either already implemented or will implement those actions as quickly as is practical. For those actions that require adjustments to existing programs or creation of new programs, funding will need to be secured to allow implementation. ODFW also commits to work cooperatively with the various coastal STEP groups to help them implement the fish rearing, acclimation and trapping actions called for in this plan.

ODFW is committed to working cooperatively to implement actions related to habitat protection and enhancement. ODFW will continue its involvement in the Oregon Plan for Salmon and Watersheds by working cooperatively with OWEB, watershed councils, SWCDs, landowners, STEP volunteers and the public to help identify, fund and implement voluntary habitat protection and enhancement projects. The agency will also work cooperatively with other agencies and landowners to promote the protection of important habitats.

<u>Research, Monitoring, and Evaluation</u>
To address some of the uncertainties identified in the Current Status assessment, to measure the metrics identified for tracking Desired Status and Limiting Factors (in order to be able to assess the health of the fish species), and to evaluate the effectiveness of actions, ODFW has identified a comprehensive monitoring program (see **Appendix V – Monitoring Approach**). This program consists of on-going monitoring, shifts in current monitoring efforts to get better data across multiple species, and new initiatives. New initiatives, mostly intended to assess the effectiveness of new programs, fill larger data gaps, better understand management mechanisms, and address critical uncertainties, are dependent on additional funding (see Table 27). Sources of new funding have not been identified. On-going and shifted work depends on maintaining existing funding levels. ODFW also recognizes the need for initiatives with respect to new monitoring methods, more efficient protocols, and more data analyses to identify program efficiencies that will allow on-going and new monitoring to continue in the face of increased data needs for management and increased funding uncertainty. In addition, critical uncertainties and research needs are also identified in **Appendix V – Monitoring Approach**, with associated costs in Table 27. These include research conducted at or through the Oregon Hatchery Research Center (OHRC) that results in reduced hatchery fish risk and improved fisheries. The mandatory reporting of harvest will improve the ability to evaluate impacts of harvest without significant new costs.

<u>Reporting, Re-Assessment, and Adaptive Management</u>
Monitoring information related to the metrics identified in the CMP will be reported annually through the completion of *Hatchery Program Summaries* and *Wild Fish Monitoring Summaries* to determine if any concerning trends or signals are developing in relation to both the critical abundance level and desired status. These data will be summarized and made available to the public along with updates on action implementation. If review of the annually collected information appears to show that progress is not being made towards desired status goals, including optimizing harvest opportunities, or some populations are declining towards their critical

abundance levels, ODFW will consider if additional, or alternative, actions need to be implemented to change the trajectory. Data will also be used to adjust the sliding scales for harvest or to modify actions called for in the plan as necessary. ODFW will also incorporate results from OHRC and other research into adaptive management considerations.

Every 12 years (approximately two salmon/steelhead generations) the status of populations and SMUs will be re-assessed, with a possible adjustment of actions in the CMP if needed to achieve Plan objectives. If the status or goals of the SMUs and strategies to achieve desired status need to be substantively changed or modified as a result of this broader re-assessment, a public process will be undertaken, with OFWC approval necessary for such changes.

Modifications to the CMP are required if any Oregon Coastal salmon, steelhead, or trout addressed in the CMP become listed under the federal ESA or if a status assessment determines an SMU has become non-viable.

<u>Cost</u>

Many, but not all, of the actions contained in the CMP will not require additional funding and can be carried out by ODFW with existing staff levels and funding. However, some of the actions will require additional funding. These include increased hatchery production at some hatcheries, infrastructure to acclimate and capture fish, staff to coordinate new programs, monitoring to evaluate actions and wild fish at a finer scale, and new research. Table 27 shows the estimated costs for actions which require new funding.

<u>Outlook</u>

The CMP is intended to provide relative management certainty for hatchery programs and harvest options until re-assessment occurs in 12 years. It is also intended to be a living document that evolves as more is learned about the fish and the effectiveness of the strategies outlined in the plan for improving the health of the SMUs and the fishery opportunities they provide. Because there is uncertainty related to both the status of the fish and the actions necessary to improve their status, it is important to observe how the actions work and how the fish respond to the actions. Based on those observations, ODFW and others will be able to better address the needs of the fish and ensure Desired Status is achieved, with the first big “check-in” period at re-assessment in 12 years.

The desired status for each SMU is ambitious and will require improvements in habitat, as well as management of the other risks fish face. It will require cooperation and dedication from all parties interested in coastal salmon, steelhead and trout to reach these goals. Fortunately, there is a long track record of citizens along the coast working together to restore fish and their habitats. If the current enthusiasm for working under the Oregon Plan can be maintained and even increased, these ambitious goals can be achieved and Oregonians for many generations can benefit from all that these healthy salmon, steelhead, and trout populations can provide.

Table 27. Costs associated with the implementation of CMP actions which may require new funding. Any actions contained in the CMP that are not included in this table are assumed to fit within current ODFW funding and staffing levels. Costs are general estimates only; detailed budgets will be developed as specific funding is sought for each action. Funding Category values indicate the following: "1" means the cost is required to implement management actions and "2" means the cost is not necessarily required for action implementation but would provide more robust, efficient, and informed implementation.

Action	Funding Category	Start-Up/One-Time		Annual	
		Description	Cost ($)	Description	Cost ($)
Hatchery Programs					
Increase ChS production (mostly at Trask Hatchery)	1	refurbish rearing pond	30,000	feed, marking	108,000
Trap Necanicum StW	2	weir and infrastructure	25,000	personnel, services/supplies	14,000
Improve Salmon R weir, trap, passage	1	re-construction/repair (additional amount needed)	200,000	n / a	0
Trap Elk R ChF (Anvil and Rock Crks)	1	weirs and infrastructure	50,000	personnel, services/supplies	28,000
Elk R Hatchery ladder outlet	1	re-construct	50,000	n / a	0
Mark all hatchery fish	2	marking trailer	1,100,000	personnel, services/supplies	28,000
Harvest					
Mandatory tag return and guide logbooks	2	n / a	0	coordinator/data entry, services/supplies	103,000
Wild StW fisheries (*see Research, Monitoring, and Evaluation costs*)	---	---	---	---	---
Predation					
Pinniped predation coordination	2	n / a	0	coordinator, services/supplies	106,000
Pinniped and cormorant research (*see Research, Monitoring, and Evaluation costs*)	---	---	---	---	---
Habitat					
increased funding for assessment, restoration, and protection of habitat is strongly supported, but specific projects and costs are not identified in the CMP					
Research, Monitoring, and Evaluation					
Research wild population impacts from pinnipeds (Coos Bay)	2	personnel, equipment, services/supplies	200,000	n / a	0
Survey and research impacts of cormorants	2	personnel, equipment, services/supplies	176,000	personnel, equipment, services/supplies	0
Monitor harvest of wild StW (creel in 2 Management Areas)	2	n / a	0	personnel, services/supplies	39,000
Monitor all species' spawner abundance at a 30% annual precision rate for populations	2	n / a	0	personnel, services/supplies	1,362,000
Programmatically conduct research and development studies for new and efficient monitoring techniques and systems	2	n / a	0	personnel, equipment, services/supplies, capital outlay	563,000
Programmatically conduct mechanistic research into critical uncertainties and management questions	2	n / a	0	personnel, equipment, services/supplies, tags	977,000
Monitor mainstem salmon spawners	1	n / a	0	personnel, services/supplies	119,000
Coordinate, compile, and maintain monitoring and management data	2	n / a	0	personnel	103,000
Maintain or expand Coded Wire Tag program for hatchery fish assessments	2	n / a	0	personnel, equipment, services/supplies	261,000
Identify chum spawning, restoration, and preservation sites	1	n / a	0	personnel, services/supplies	93,000

Action	Funding Category	Start-Up/One-Time		Annual	
		Description	Cost ($)	Description	Cost ($)
Identify chum population genetic structure	1	personnel, services/supplies, sample processing	86,000	n / a	0
TOTAL (Category 1)			**$416,000**		**$348,000**

Additional Actions (*costs to be determined [TBD] and funding source identified with implementation partners or volunteers*)					
Release hatchery ChS in Little Nestucca	1	acclimation site	TBD	personnel, services/supplies	TBD
Release hatchery ChS in Yaquina Bay	1	acclimation site	TBD	personnel, services/supplies	TBD
Monitor benefit and effects of Yaquina ChS hatchery fish	1	n / a	0	personnel, services/supplies	TBD
Release hatchery ChS in Coos Bay	1	acclimation site	TBD	personnel, services/supplies	TBD
Monitor benefit and effects of Coos ChS hatchery fish	1	n / a	0	personnel, services/supplies	TBD
Increase S Umpqua StW hatchery production	1	new rearing capacity	TBD	personnel, services/supplies	TBD
Additional support for new Oregon Hatchery Research Center studies	1	personnel, services/supplies	TBD	personnel, services/supplies	TBD

Appendices

Appendix I – Additional Background Information

<u>Methods Used to Determine SMU Spawner Abundances, Hatchery Releases, and Harvest</u>
To help understand how the spawner abundances of coho, Chinook, steelhead, and chum SMUs have changed over the last 60 years, ODFW estimate the 10-year average abundances for each decade starting with the 1950's (the earliest any significant data are available to inform such estimates). The decadal estimates presented in the main body of the CMP were made using many assumptions about the data and what it represented, and should be considered a very rough estimate of general trend. Detail on the assumptions and calculations that went into these decadal estimates are described below. In addition, ODFW developed comparisons of average harvest and returning hatchery adults in the 1990's and 2000's. Hatchery releases by species were also summarized from ODFW Fish Propagation records and only include hatchery fish released by ODFW programs (private aquaculture releases were not included).

Coho

Wild Abundance – Annual wild spawner estimates for coho were estimated by ODFW's OASIS program and are based on population estimates made since 1990 and were back-calculated to 1950 based on the relationship of the 1990-to-present estimates and standard surveys conducted in each population area since 1950.

Hatchery Abundance – The abundance of hatchery coho adults in the 1990's and 2000's was based on returns to coastal hatcheries and the ocean exploitation rates reported in the Pacific Fisheries Management Council post-season report (PFMC 2011).

Harvest Estimates – Estimates of ocean and in-river harvest rates on wild and hatchery coho were reported in the PFMC post-season report (PFMC 2011). The in-river estimates for total coho harvest were based on Combined Angling Tags (harvest cards).

Fall-Run Chinook

Wild Abundance - To estimate wild fall-run Chinook abundances throughout the SMU, a combination of annual population abundance estimates made for most populations and index surveys conducted over most of the years between 1950 and 2011 were used to create population estimates for each year from 1950 through 2011. The SMU estimates shown in Figure 2 and Figure 6 reflect the estimated abundances in 14 of the 18 fall-run Chinook populations comprising the SMU (the Necanicum, Yachats, Lower Umpqua and Middle Umpqua populations were not estimated because of inadequate data to develop estimates for these populations, or to infer what proportion of the SMU abundance is represented by these four populations).

The fall-run Chinook spawner abundance estimates for the years 1986 to 2011 were developed for 14 populations as part of the status assessment process (see **Spawner Abundance** section of Appendix II). The annual estimates of spawners during each of these years was used to assess the abundance and productivity of these populations, and were also used to calculate the 10-year average spawner estimates for the 1980's, 1990's and 2000's.

The relationship between annual index survey peak adult counts and the population spawner abundance estimates from 1986 through 2011 were used to estimate the SMU spawner abundances for years 1950 through 1985. Eight of the 14 populations with index surveys had one or more surveys that were conducted for the vast majority of years between 1950 and 2011. For each of these eight populations, the survey with the fewest number of years of missing data was chosen to generate a regression between the peak adult count in each year from 1986 through 2011 and the estimated spawners for each of those years (from the dataset created for the A&P assessment). The relationship (regression) between the index survey annual peak count and the annual population estimate of spawners was then used to convert the peak counts from 1950 through 1985 into annual spawner estimates.

To estimate a total number of spawners for all 14 populations of fall-run Chinook from 1950 through 1985, the average proportion that each of the eight populations represented of the total (from 1986 through 2011) was used to expand out to a total for each year from 1950 through 1985. The 10-year averages of fall-run Chinook abundances shown in Figure 2 represent an estimate for 14 of the 18 populations that comprise the SMU. The actual SMU abundances are assumed to be higher when all populations are considered. There is very little information available for the four populations not included in the totals shown to understand what proportion of SMU abundance is missing. Two of the four populations (Necanicum and Yachats) are relatively small and would be expected to have abundances that are less than the average population abundance. The Lower and Middle Umpqua populations were considered to be of an average size.

Hatchery Abundance – Hatchery fall-run Chinook abundance in the 1990's and 2000's (Figure 6) was estimated from in-river harvest estimates (Figure 8). Estimates of the proportion of hatchery fish in the in-river fishery from statistical creel surveys was used for some populations. Other population hatchery proportion estimates were based on the presence of, size of, or distance from a fall-run Chinook hatchery program and professional opinion on the contribution in the fishery. The number of hatchery fish estimated to have been harvested in the in-river fishery was applied to the in-river exploitation rate estimated for wild fall-run Chinook in the A&P assessment to calculate a pre-harvest abundance of hatchery fish.

Harvest Estimates – Estimates of wild and hatchery fall-run Chinook in-river harvest were generated from harvest card returns that were adjusted to account for non-compliance (cards not returned) and reporting bias (Figure 8). Estimates of ocean harvest impacts were taken from reports issued by the Pacific Salmon Treaty Chinook Technical Committee (Figure 7). These estimates are based on recoveries of coded-wire tags placed in hatchery fish and recovered in ocean fisheries. It was assumed that hatchery and wild harvest impacts from in-river and ocean fisheries were of the same proportions.

Spring Chinook

Wild Abundance – The 10-year average abundance estimates of wild North Umpqua spring Chinook spawners were taken from the data set developed for the A&P assessment that utilized the Winchester Dam passage counts since the 1940's. No attempts were made to translate the available data on South Umpqua wild spring Chinook into annual spawner estimates.

Hatchery Abundance – The estimates of hatchery spring Chinook pre-harvest abundance for the 1990's and 2000's were generated by estimating the annual amount of in-river harvest of hatchery fish that occurred below Winchester Dam and adding that amount to the Winchester Dam passage estimate. This "river entry" abundance estimate was then adjusted by the estimated ocean exploitation rate to come up with a pre-harvest estimate.

Harvest Estimates - The ocean exploitation rate for North Umpqua spring Chinook is not known, but was estimated to be 67% of the ocean exploitation rate for Salmon River fall-run Chinook (the Oregon PST exploitation rate indicator stock). The reduction in the fall-run Chinook rate was based on the fact that spring Chinook adults leave the ocean and enter the river in the spring before ocean fisheries begin. As a result, each age class of spring Chinook is exposed to one fewer ocean fishing seasons than the same age class of fall-run Chinook. Because little is known of the age composition of North Umpqua spring Chinook, the assumption that ocean exploitation is 67% of that for fall-run Chinook is somewhat arbitrary.

Winter Steelhead

Wild Abundance - Annual wild spawner abundance information for winter steelhead is limited in this SMU. SMU-wide annual estimates of winter steelhead spawner abundance based on redd estimates have only been made since 2003. These estimates are based on generalized random tessellation stratified (GRTS) design redd surveys conducted by ODFW throughout the SMU (except for the North Umpqua[67]). Winter steelhead passage estimates above Winchester Dam on the North Umpqua have been made since the 1940's. A redd survey has been conducted annually in one section of the Salmonberry River (a significant winter steelhead producing tributary in the Nehalem population) since 1973. The North Umpqua and Salmonberry River data sets were both used to estimate annual wild spawners and recruits for the abundance and productivity criteria used to assess current status in this plan (see **Appendix II – Current Status Methods and Results**). No other long-term data on wild winter steelhead spawner abundances is available in any other population areas in the SMU. As a result, these three data sets were analyzed to determine how SMU-wide spawner abundances could be estimated back to 1950.

The winter steelhead spawner estimates for 2003 through 2011 that were calculated from the longer-term data sets for Winchester Dam and the Salmonberry River (for the current status assessment) were compared to the SMU-wide estimates of spawners (minus the North Umpqua) produced by ODFW's OASIS program for these same years. The Salmonberry River spawner estimates had a much better correlation with the OASIS estimates than did the North Umpqua estimates. For this reason, the correlation between the Salmonberry River estimates and the OASIS estimates was used to estimate the SMU-wide annual spawner abundance (minus the North Umpqua) from 1973 through 2002. The derived estimates from 1973 through 1979 were used for the 1970's 10-year average for the SMU (minus the North Umpqua). The North Umpqua 10-year averages of spawners for the 1970's through the 2000's were added to the SMU 10-year average estimates to better reflect the SMU-wide spawner abundances.

Annual SMU wild spawner abundances could not be estimated for the 1950's and '60's because the Salmonberry River data set did not extend into the past beyond 1973. To estimate these 10-year averages, the North Umpqua winter steelhead estimates were used to infer what the SMU-wide abundances may have been. It was assumed that any changes in abundance seen in the North Umpqua between decades was due to changes in marine survival of winter steelhead, and that those marine survival changes would have been the same throughout the SMU and could be used to estimate changes in SMU abundance during those decades. The North Umpqua 10-year average spawner abundance estimates for the 1980's (1980 through 1989) were considered a reference period to which the 10-year estimates from the 1950's and '60's were compared. The difference in 10-year average spawner abundances in the North Umpqua from the 1950's and 60's compared to the 1980's was applied to the SMU-wide spawner abundance estimate for the 1980's to come up with estimates for the 1950's and 60's.

Hatchery Abundance – The estimates of hatchery winter steelhead abundances in the 1990's and 2000's were generated by using SMU-wide estimates of adult hatchery winter steelhead that were developed for the 1980's utilizing a method described by Kenaston (1989). This method used hatchery proportions from scales collected by anglers in each stream and divided the reported in-river catch (from harvest cards) by those proportions. The average assumed harvest rate in each stream was estimated based on the intensity of the fishery and was used to calculate the number of hatchery fish that would have entered each stream. This method was followed for the years 1980 through 1989 to estimate the number of hatchery fish entering the streams each year in the 1980's.

The pre-harvest abundance estimates for the 1980's was adjusted by the proportionate number of hatchery winter steelhead released in the 1980's as compared to the 1990's and 2000's to account for more or less hatchery fish being released in those decades – and a resultant increase or decrease in the number of potential hatchery adults. In addition, the North Umpqua 10-year average spawner abundance estimates for the 1980's (1980 through 1989) were considered a reference period to which the 10-year estimates from the 1990's and 2000's were compared. The difference in 10-year average spawner abundances in the North Umpqua from the 1990's and 2000's compared to the 1980's was applied to the SMU-wide hatchery winter steelhead pre-harvest estimate for the 1980's (based on the same assumptions that were used

[67] The Winchester Dam estimates of passage are believed to be more accurate than the GRTS-based redd survey estimates, so redd surveys are not conducted in the North Umpqua.

to estimate SMU wild abundances), along with the adjustment for different levels of hatchery winter steelhead released in the 1990's and 2000's, to come up with pre-harvest adult hatchery winter steelhead estimates for the 1990's and 2000's.

Harvest Estimates – The estimates of in-river harvest rates for winter steelhead along the coast from Kenaston (1989) averaged 20% for the 1980's. In the 1990's the winter steelhead fisheries along the coast were gradually shifted from allowing wild harvest to allowing hatchery-only harvest. Because this change happened for different rivers in different years it was difficult to estimate a 10-year averaged harvest rate for wild winter steelhead. Professional opinion was used to assume that for the entire 1990's the wild harvest rate went from averaging 20% in 1990 to averaging 5% in 1999, and would have averaged approximately 10% for the decade. The average harvest rate for the 2000's was estimated to be 5% SMU-wide. This is half of the estimated harvest rate reported by ODFW in the Lower Columbia River Conservation and Recovery Plan for Oregon Populations of Salmon and Steelhead (2010). The rate was assumed to be half of the 10% level due to coastal populations not having the impact of Columbia River fisheries and having many populations with no fisheries targeting hatchery winter steelhead.

It was assumed that impacts from fisheries in the ocean were very small and were estimated at 1%.

Summer Steelhead

There are only two populations of summer steelhead in this SMU – the Siletz and North Umpqua populations. There is limited information on the annual spawner abundances of the Siletz summer steelhead population prior to 1993 when ODFW began trapping all steelhead year-round at Siletz Falls. A four-year research study estimated passage at Siletz Falls from 1969 through 1972 (the only other years prior to 1993 when estimates were made) to average just over 600 wild summer steelhead. In comparison the estimated passage of wild summer steelhead over Winchester Dam on the North Umpqua during this same four years was 3,800 – over six times greater. Because the spawner abundance of Siletz summer steelhead prior to 1993 is mostly unknown, and the fact that it appears to always have been much smaller than the North Umpqua population, it was decided to show only the 10-year average spawner abundances for the North Umpqua summer steelhead population. The spawner estimates come from the spawner-recruit data developed for this plan to assess current status (see **Appendix II – Current Status Methods and Results**).

Chum

There are only five index surveys that have been consistently conducted for chum salmon since the 1950's – four in the Tillamook population area and one in the Nestucca population area. Since little is known about the complete distribution of chum in these areas or chum carcass residence time, it was not possible to convert the peak adult counts from these surveys into spawner abundance estimates. To provide some idea of chum abundance trends over the past six decades, the peak adult counts from the five chum index surveys were summed and averaged for each decade.

<u>NADOTs: Other Locations with Salmon and Trout</u>

In addition to the identified population areas which were assessed for viability, other locations in the Coastal planning area produce salmon and trout. These areas are collectively referred to as "non-assessed direct ocean tributaries" (NADOTs). Although these areas were not assessed, they contain an important resource and will be managed consistent with the actions identified in the CMP, as identified in those sections. Table A-I: 1 lists the species present in each NADOT and Figure A-I: 1 identifies where the NADOTs are located.

Table A-I: 1. List of coastal direct ocean tributaries which were not assessed in the CMP but contain salmon and trout. These areas are collectively referred to as "non-assessed direct ocean tributaries" (NADOTs). "●" indicates consistent presence. "□" indicates periodic presence. "?" indicates presence is unknown.

Stratum	Not-Assessed Direct Ocean Tributaries	Stream KM	Coho	Chinook	Spring Chinook	Chum	Winter Steelhead	Summer Steelhead	Cutthroat
N Coast	Ecola Cr	52	●	□		□	●		●
	Arch Cape Cr	9	●				●		●
	Short Sand Cr	15	●				●		●
	Spring Cr	8	□				●		●
	Watseco Cr	6	□				●		●
	Netarts	54	●			●	●		●
	Rover Cr	4	□				●		●
	Sand Cr	50	●	□		●	●		●
	Neskowin Cr	52	●	●		□	●		●
Mid Coast	Devils Lake	31	●				●		●
	Schoolhouse Cr	4	□						●
	Fogarty Cr	11	●				□		●
	Depoe Bay Cr	12	●				□		●
	Rocky Cr	16							●
	Spencer Cr	14	●				●		●
	Wade Cr	7	□						●
	Coal Cr	6	□						●
	Moolack Cr	6	●				□		●
	Big Cr (Yaquina)	15	●						●
	Thiel Cr	11	●						●
	Beaver Cr	84	●	□			●		●
	Big Cr (Alsea)	22	●	□			●		●
	Vingie Cr	7	●				□		●
	Berry Cr	8	●						●
	Sutton Cr	34	●	□			●		●
	Siltcoos	180	●	□			●		●
	Tahkenitch	90	●	□			●		●
Mid South	Big Cr (Cape Arago)	17	●				□		●
	Threemile Cr	9	?				?		●
	Fivemile Cr (N. of Bando	4	?				?		●
	Twomile Cr (N. of Bando	7	?				?		●
	Johnson Cr (ocean)	10	□				?		●
	China Cr (S. of Bandon)	6							●

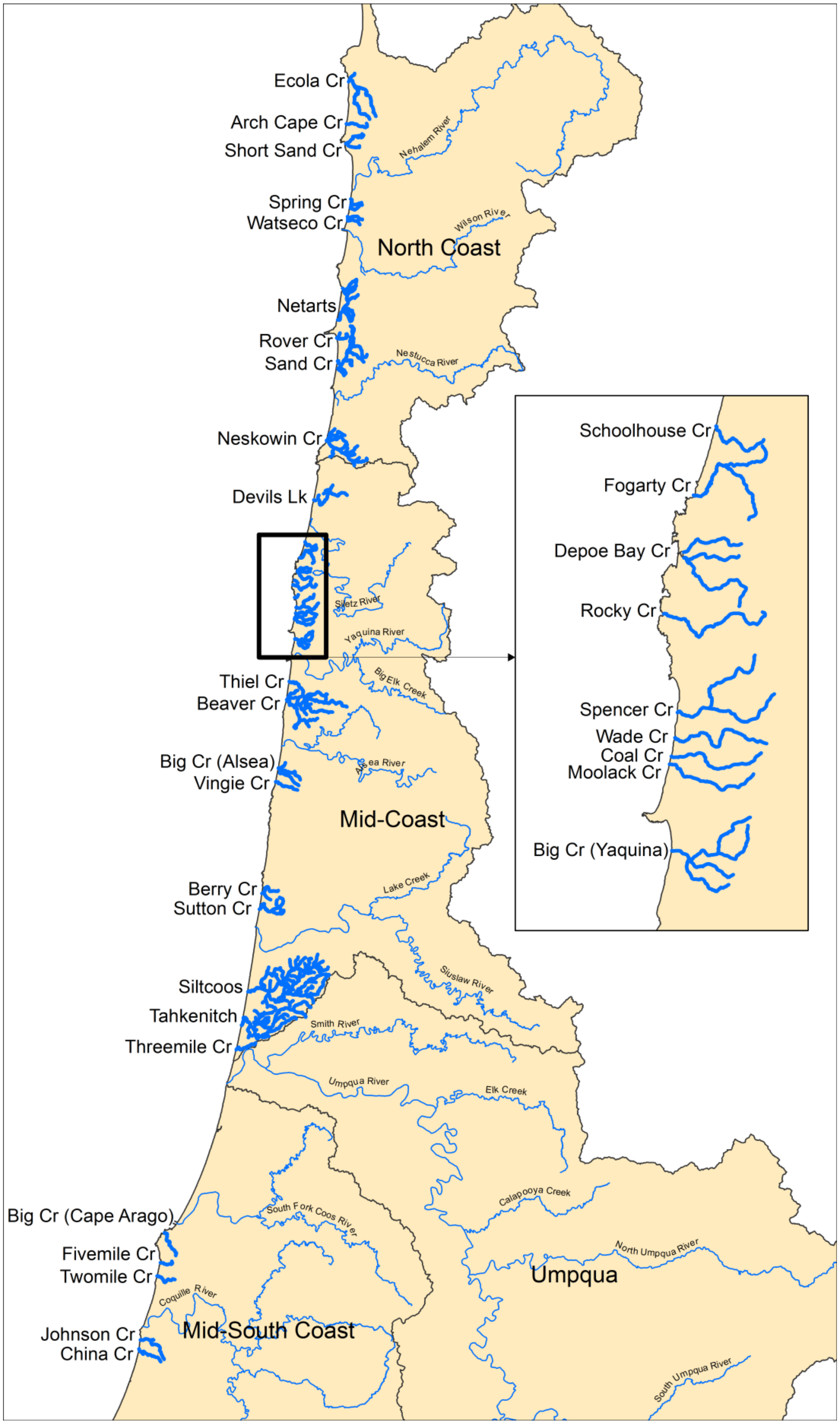


Figure A-I: 1. Map of coastal direct ocean tributaries which were not assessed in the CMP but contain salmon and trout. These areas are collectively referred to as "non-assessed direct ocean tributaries" (NADOTs).

Appendix II – Current Status Methods and Results

Appendix II (Current Status): Abundance and Productivity

Spawner Abundance

It is difficult to completely census wild animals at useful spatial and temporal scales. Instead, imperfect observations of abundance are typically made over a subset of places and times, and then inference is needed to transform these observations into estimates of total abundance at the desired spatial and temporal scale. The inferential methods used to transform specific observations into more meaningful estimates of total abundance critically depend on observation protocols and the availability of ancillary information. Since observation protocols and the availability of ancillary information vary across SMUs, populations within SMUs, and ODFW's history, there is no single method to estimate spawner abundance across all SMUs and populations. Similarly, uncertainty in the estimates of spawner abundance is not constant across SMUs or even populations within an SMU. The following sections describe the different methods used to estimate spawner abundance in each SMU. These estimates were then used to assess the current abundance and productivity parameter of each population.

Fall-Run Chinook

Data

Four different sources of information were used to generate annual estimates of the total abundance of spawning fall-run Chinook at the population scale. These sources of information are:

1. Standard index survey sites
2. Sites surveyed in the Coho sampling protocol
3. Mainstem surveys of Nehalem, Siletz, and Siuslaw rivers
4. Mark-recapture studies in the Nehalem, Siletz, Siuslaw, Coos, Coquille

The first three types of surveys mentioned above result in counts of observable living and dead fish that are made at approximately weekly intervals during the spawning run. The maximum count at a site during the run, known as a "peak count," is a commonly used summary of abundance at the site on the given year.

Some standard index surveys have been conducted since the 1950's, but many standard index surveys were begun in 1986. Thus, the period of time over which fall-run Chinook abundance and productivity are assessed is 1986 through 2011. Peak counts from standard index surveys within the same population can be averaged together to obtain an index of total population size through time. However, such an index is unstable in the sense that equal spawner abundances on two different years could result in different index values if fish use space differently on different years. Furthermore, some standard index sites were not surveyed on particular years because of logistical difficulties. Taking the average of the peak counts in the remaining sites will introduce substantial bias if the site that was not surveyed tends to have high or low peak counts. A more robust assessment of how spawning fall-run Chinook use space is needed in order to overcome these obstacles. Information from the second and third type of survey listed above do not have the temporal depth of the first, but since these surveys are conducted in different kinds of habitat, these survey data can be used to understand how spawning Chinook use space.

Peak counts from the first three sources of information listed above were used to build a statistical model of how peak counts vary in space and time. The fitted model can then be used to make year-specific inferences about peak counts at all locations within a population that were not surveyed. Summing these peak count densities across all locations within the fall-run Chinook spawning frame on a given year yields a population-level estimate peak count.

The population-level estimate of peak count is not identical to total spawner abundance because the former does not account for false-negative observation error (i.e. the probability of detecting a given fish is less than 1, so observed counts are a subset of the total), and because the peak count is a fraction of the total number of fish to visit a site during the entire run. To correct for both of these biases and arrive at an estimate of the total spawner abundance on a given year for each population, the output of the peak count model (a population-level summation of estimated peak counts) is correlated to independent, mark-recapture estimates of abundance (the 4^{th} source of abundance information listed above).

Peak Count Model (PCM)

The Peak Count Model (PCM) intends to capture spatial and temporal variation contained in empirical observations of peak counts recorded at (i) standard index survey sites, (ii) sites surveyed in the Coho sampling protocol, and (iii) mainstem surveys. Since the PCM will be used to infer/predict peak counts at locations throughout an entire population area, it is necessary to use spatial covariates ("predictor variables") that are available in geographic information system (GIS) layers with coverage across all population areas. A GIS layer on channel geomorphology meets this spatial coverage requirement. Furthermore, channel geomorphology is not likely to substantially change over the period during which site surveys were conducted. The geomorphology GIS layer used here has also been used in other analyses of salmon abundance (Burnett et al. 2007, Busch et al. 2011).

For each stream segment within each population's spawning frame, three geomorphic attributes are computed from a 10 meter digital elevation model (DEM):

1. mean annual flow ("MAF")
2. gradient
3. channel width

Note that mean annual flow (MAF) is a static geomorphic variable, and does not reflect temporal variability in stream flow. MAF is computed by multiplying the channel confinement by a function of historical rainfall. All three variables listed above vary over space but are invariant over time. To capture temporal variation in habitat use, a forth variable on dynamic steam flow was also used. Steam flow was measured with United States Geological Survey (USGS) flow gauges. The specific gauges used are given in Table A-II: 1 and the correlation among gauges is given in Figure A-II: 1. There are six missing values at the Siuslaw stream gauge during the period of interest, but these values could be imputed using an extremely good relationship with gauges in the Alsea and Umpqua (multiple regression $R^2 = 0.99$; $P<0.0001$).

Table A-II: 1. Seven stream flow gauges were used to model variation in peak counts observed in fourteen populations. The difference in the periods over which flow measurements were averaged reflects the later spawn timing of more southern Chinook.

Gauge in	Gauge ID	Averaged over	Applied to population in
Wilson	14301500	Nov	Nehalem, Tillamook
Nestucca	14303200	Nov	Nestucca
Siletz	14305500	Nov	Siletz, Yaquina
Alsea	14306340	Nov	Alsea
Siuslaw	14307620	Nov	Siuslaw
Coquille	14325000	Nov	Coos, Coquille
Chetco	14400000	Nov&Dec	Floras, Sixes, Lower Rogue, Winchuck, Chetco

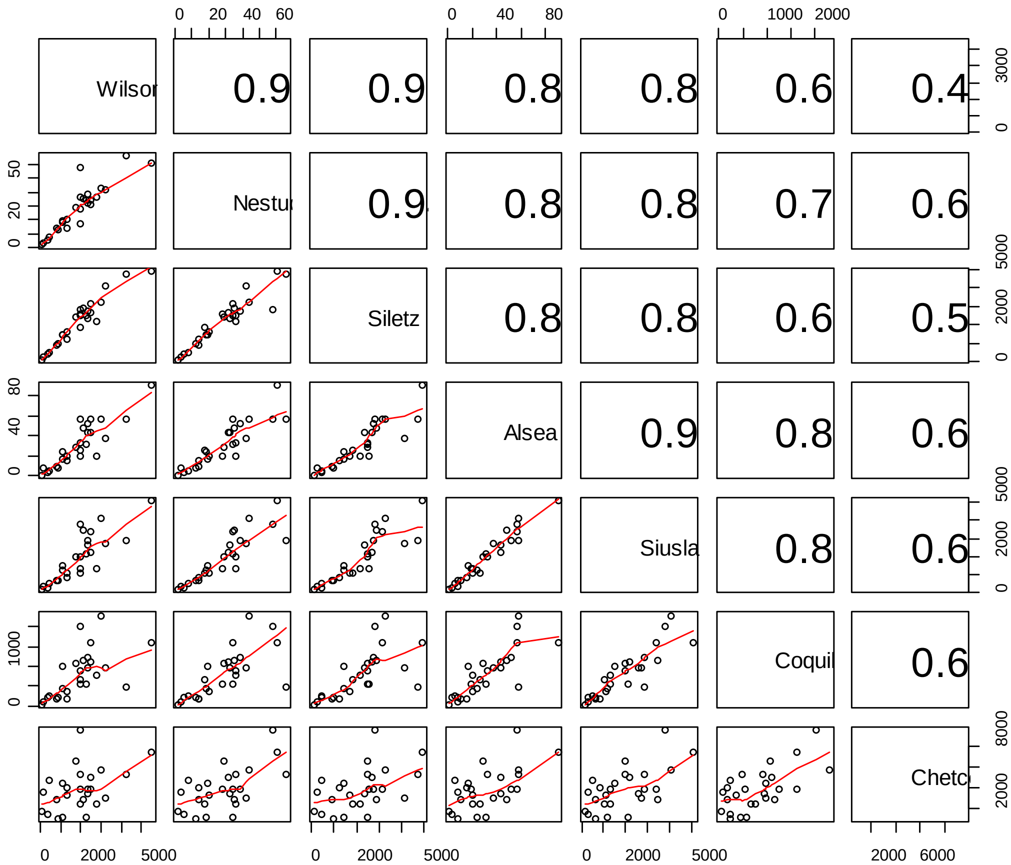


Figure A-II: 1. Correlation matrix of stream flow (CFS) measured with seven different USGS gauges. Note that six flow values in the Siuslaw were imputed from flow gauges in the Alsea (a different gauge than the one plotted here) and the Umpqua.

The peak count (*C*) at site *i* in population *p* on year *t* is considered a Poisson random variable:

$$C_{i,t,p} \sim Poisson(\lambda_{i,t,p})$$

The natural logarithm of the Poisson rate parameter (λ) can be described with several different models that represent competing hypotheses about the "best" representation of spatio-temporal variation in the peak counts. Five different models were fitted to the data. The five models have different numbers and combinations of potential explanatory variables. A summary of the explanatory variables included in the five models is given in Table A-II: 2.

Table A-II: 2. Five candidate Peak Count Models. Blackened cell entries indicate that the term in the leftmost column was not included in the model. The bottom row gives deviance information criterion (DIC) values for all five models.

Model Terms	Model #1	Model #2	Model #3	Model #4	Model #5
Offset					
Intercept					
$Rand_{t,p}$					
MAF					
MAF^2				■	■
Gradient					
$Gradient^2$			■	■	■
Width					
$Width^2$				■	■
Flow					
Flow*MAF		■	■		
Flow*Gradient					
Flow*Width	■		■		■
$Rand_{t,p}$*MAF		■	■	■	■
$Rand_{t,p}$*Gradient				■	■
$Rand_{t,p}$*Width	■		■	■	■
DIC=	92441	91542	93939	106328	106328

The DIC indicates that Model #2 is better than all the alternative models (see below for more on DIC). Model #2 can be written:

$$\log(\lambda_{i,t,p}) = \log(Length_{i,t,p}) + \beta_1 + Rand_{t,p} + \ldots$$
$$\beta_2 * MAF_{i,p} + \beta_3 * MAF_{i,p}^2 + \beta_4 * Gradient_{i,p} + \ldots$$
$$\beta_5 * Gradient_{t,p}^2 + \beta_6 * Width_{t,p} + \beta_7 * Width_{t,p}^2 + \ldots$$
$$\beta_8 * Flow_{t,p} + \beta_9 * Flow_{t,p} * Width_{i,p} + \beta_{10} * Flow_{t,p} * Gradient_{i,p} + \ldots$$
$$\beta_{11} * Rand_{t,p} * Width_{i,p} + \beta_{12} * Rand_{t,p} * Gradient_{i,p}$$

Several features of the best PCM deserve explanation. The first term, log($Length_{i,t,p}$), is commonly referred to as an "offset." The offset accommodates the fact that peak count surveys are not conducted over equal stream lengths (some sites are longer than others, and some sites have variable lengths through time). Clearly, as the length of stream that is surveyed increases, the total observed count should generally increase as well. The offset therefore permits modeling of the raw data (a Poisson random variable) as opposed to a potentially ill-suited transformation intended to satisfy simple parametric assumptions (O'Hara and Kotze 2010). The offset functions like an intercept, but it is not a parameter estimated from the data (the coefficient is fixed to 1), and therefore does not affect degrees of freedom available for estimating model parameters.

The second term, β_1, acts as a global intercept. This intercept is "global" in the sense that it takes on a single value that applies to all sites and times (note that there are no subscripts associated with β_1). The third term is commonly referred to as a "random effect." Specifically, it is a "random intercept" that allows structured deviation from the global intercept. The random effect is a normally distributed deviate that varies throughout time and is unique to each population. Thus, if peak counts within a population tend to be above average on year t, then the random effect takes on a relative large value. This is important for several reasons. First, since primary interest is focused on the effects of the geomorphic covariates, the coefficients on those variables ($\beta_2, \beta_3, \ldots, \beta_7$) would be unduly affected by overall changes in spawner run abundance. The random effect gives this kind of variation a place to go so that the betas can be more clearly interpreted.

The PCM is a Generalized Linear Mixed Effects Model (GLMM) with random intercepts. A Bayesian perspective on parameter estimation was adopted to fit the model. The WinBUGS code used to specify the full PCM is given below:

```
model {
for (i in 1:2436){
  X[i,1]~dpois(lambda[X[i,3],X[i,2],X[i,4]])
  log(lambda[X[i,3],X[i,2],X[i,4]])<-log(L[X[i,3],X[i,2],X[i,4]]) +
     a1[X[i,2],X[i,4]] +
     b[1] +
     b[2]*MAF[X[i,3],X[i,4]] +
     b[3]*MAF[X[i,3],X[i,4]]*MAF[X[i,3],X[i,4]] +
     b[4]*G[X[i,3],X[i,4]] +
     b[5]*G[X[i,3],X[i,4]]*G[X[i,3],X[i,4]] +
     b[6]*W[X[i,3],X[i,4]] +
     b[7]*W[X[i,3],X[i,4]]*W[X[i,3],X[i,4]]+
     b[8]*Flow[X[i,2],X[i,4]] +
     b[9]*Flow[X[i,2],X[i,4]]*W[X[i,3],X[i,4]] +
     b[10]*Flow[X[i,2],X[i,4]]*G[X[i,3],X[i,4]] +
     b[11]*a1[X[i,2],X[i,4]]*W[X[i,3],X[i,4]] +
     b[12]*a1[X[i,2],X[i,4]]*G[X[i,3],X[i,4]]
   }
#priors
b[1]~dnorm(3,taub[1])
taub[1]<-pow(sigb[1],-2)
sigb[1]~dunif(0,6)

for (i in 2:12){
b[i]~dnorm(0,taub[i])
taub[i]<-pow(sigb[i],-2)
sigb[i]~dunif(0,6)
}
for (p in 1:14){
for (t in 1:26){
a1[t,p]~dnorm(0,taua1)
  }
}
taua1<-pow(siga1,-2)
siga1~dunif(0,6)
}
```

Prior to analysis, all covariates were standardized by subtracting the mean from each observation and dividing by the standard deviation.

Deviance information criterion (DIC) is the Bayesian analog of the well-known (Burnham and Anderson 2002) Akaike information criterion (AIC). Both metrics represent a tradeoff between the fit of a model to data with the principle of parsimony. This is a fundamental concept of scientific inquiry. The creators of DIC suggest that the same rules of thumb used to assess meaningful differences between AIC scores can also be applied to DIC (Spiegelhalter et al. 2002). Thus, models with a DIC score that is 10 or more points than the model with the lowest DIC score do not constitute worthwhile alternative models.

Fitting models with Markov chain Monte Carlo methods (McMC) require more care than other “canned” techniques. For all candidate PCMs, three Markov chains were ran with a 1000 iteration “burn-in” and a “thinning” rate of 1:57. For the best PCM (Model #2), a total of 18,000 samples were collected (this process lasted 20 hours on a 2.9 GHz dual-core machine). A time series plot posterior parameter estimate was inspected for signs of model convergence and McMC mixing. Also, the

Gelman-Rubin convergence diagnostic was computed for all model nodes. Both indicate excellent performance of the McMC simulation.

Posterior probability densities for 12 parameters of the best PCM (Model #2) are given in Figure A-II: 2. Point estimates and 95% highest probability density intervals are given in Table A-II: 3. The point estimates are not easily interpreted because they exist on a log scale and apply to standardized covariates. Figure A-II: 3 through Figure A-II: 5 provide back-transformed point estimates (predictions) of the PCM across the observed range of geomorphic attributes.

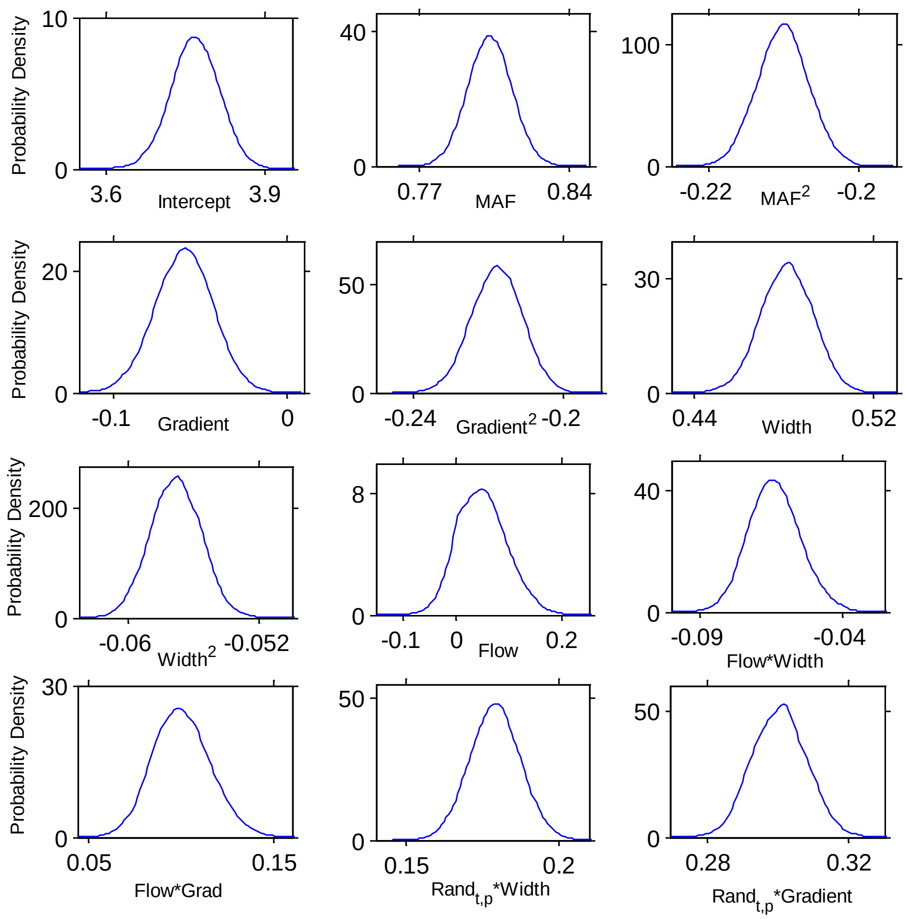


Figure A-II: 2. Posterior probability estimates for twelve parameters of the best peak count model (PCM). Note that only Flow has a density that overlaps zero.

Table A-II: 3. Point estimates and 95% belief intervals for terms in the best Peak Count Model (PCM).

Terms in Best PCM	Estimate	L 95%	U 95%
Intercept	3.768	3.673	3.852
MAF	0.803	0.783	0.823
MAF^2	-0.210	-0.217	-0.203
Gradient	-0.059	-0.093	-0.027
$Gradient^2$	-0.218	-0.231	-0.205
Width	0.481	0.458	0.503
$Width^2$	-0.057	-0.060	-0.054
Flow	0.049	-0.036	0.145
Flow*Width	-0.064	-0.081	-0.046
Flow*Gradient	0.100	0.071	0.132
$Rand_{t,p}$*Width	0.179	0.162	0.195
$Rand_{t,p}$*Gradient	0.300	0.286	0.315
Std Dev of $Rand_{t,p}$	0.880	0.814	0.950

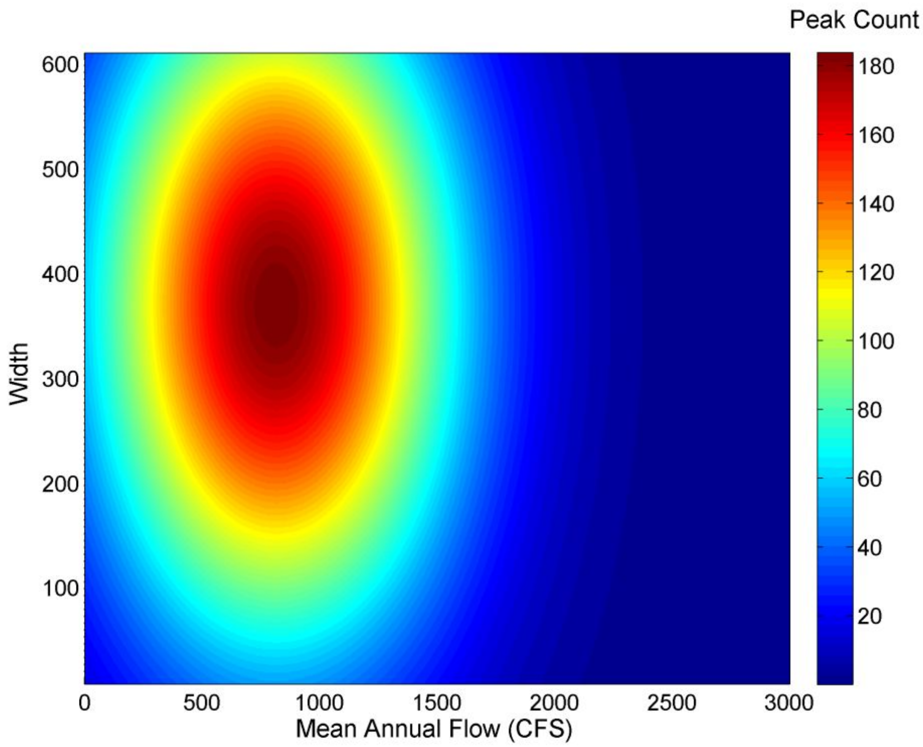


Figure A-II: 3. Predicted peak count (colors) over two geomorphic attributes.

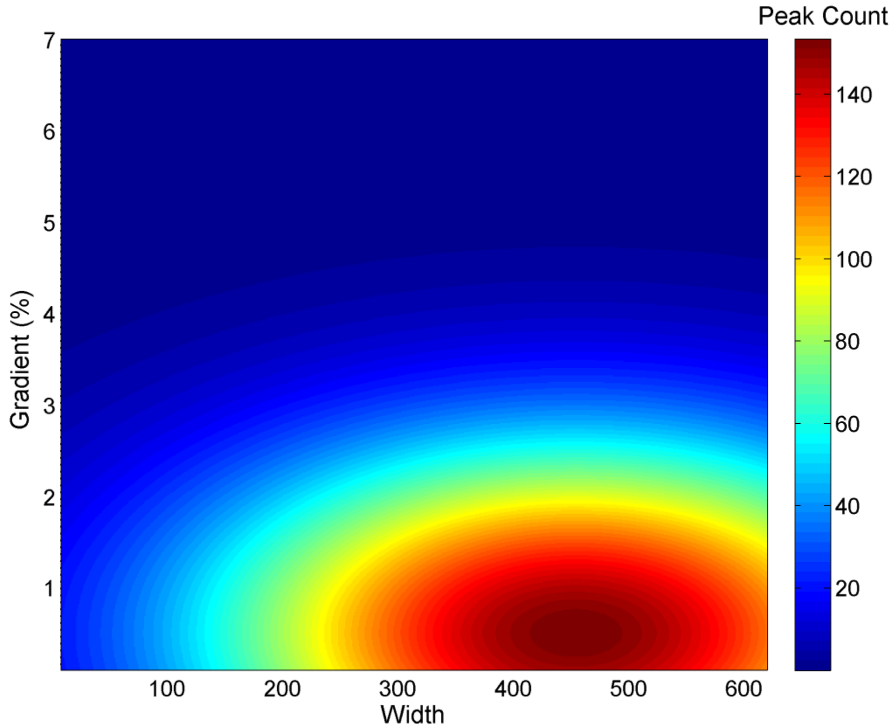


Figure A-II: 4. Predicted peak count (colors) over two geomorphic attributes.

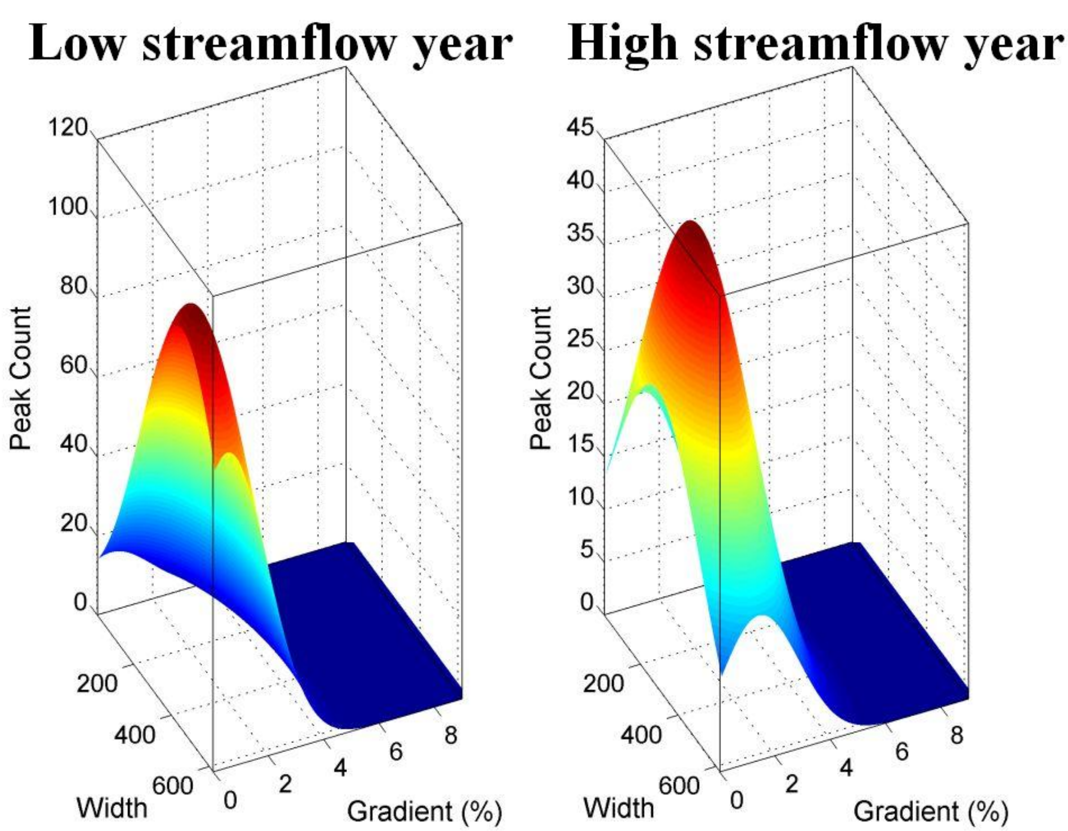


Figure A-II: 5. Predicted peak count (colors) over two geomorphic attributes for a low stream flow year (left) and a high stream flow year (right). Note difference in scale on the z-axis.

The coefficient of determination ("R-squared") for the best Peak Count Model (PCM) is

$$R^2 = 1 - \frac{\sum_{i=1}^{2436} \left(\hat{C}_i - C_i\right)^2}{\sum_{i=1}^{2436} \left(C_i - \overline{C}\right)^2} = 0.56$$

where *C* is the observed peak count at site *i*, $\hat{C}$ is the PCM's estimate of peak count at site *i*, and $\overline{C}$ is the mean of all observed peak counts. The coefficient of determination means that 56% of the observed variability in peak counts is captured with the PCM. The correlation between observed peak counts and peak counts predicted with the PCM is 0.75 (see Figure A-II: 6).

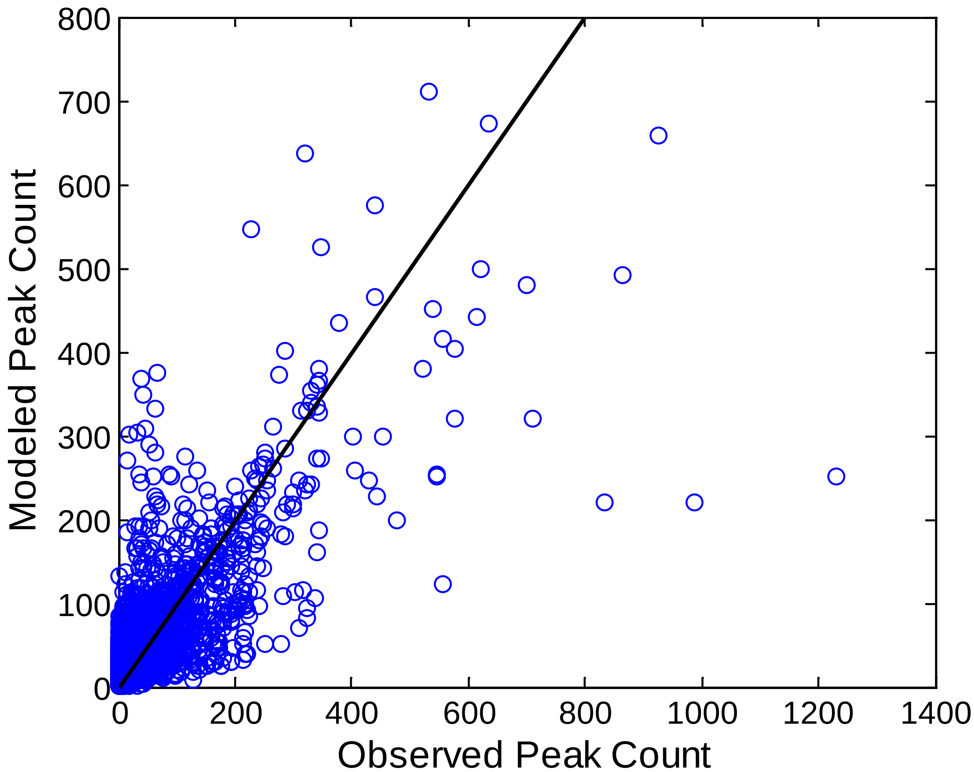


Figure A-II: 6. Relationship between observed peak counts (x-axis) and the peak counts predicted from Peak Count Model (y-axis). Black line is equivalence. The correlation coefficient is 0.75.

Relationship between Peak Count Model (PCM) and mark-recapture estimates

"Mark-recapture" describes a broad class of techniques to estimate unobservable population parameters. In their simplest form, which is used here, the total abundance of animals is estimated by comparing two ratios:

$$\frac{n_1}{N} = \frac{m_2}{n_2},$$

where n_1 is the number of animals marked in the first sampling event, N is the (unknown) total abundance of animals, m_2 is the number of animals marked in the first sampling event that are recaptured in the second sampling event, and n_2 is the number of individuals inspected for marks during the second sampling event. Rearrangement yields the well-known Lincoln-Petersen estimator of total abundance:

$$\hat{N} = \frac{n_1 n_2}{m_2},$$

which can be adjusted to remove bias associated with small sample size:

$$\hat{N} = \frac{(n_1+1)(n_2+1)}{m_2+1} - 1 .$$

The variance of abundance estimate is known to be:

$$\hat{v}(\hat{N}) = \frac{(n_1+1)(n_2+1)(n_1-m_2)(n_2-m_2)}{(m_2+1)^2(m_2+2)}$$

(Seber, 1970). A summary of mark-recapture estimates and the associated uncertainty is provided in Table A-II: 4. The parameterized PCM was used to estimate peak counts at every site within the Nehalem, Siletz, Siuslaw, Coos (S. Fork), and Coquille on the years that mark recapture studies were conducted. All the site-level estimated peak counts within a population and year were summed, yielding a population-wide annual estimate (see Table A-II: 4 and Figure A-II: 7).

Table A-II: 4. Mark-recapture (MR) estimates of fall-run Chinook spawner abundance and associated standard error (SE) conducted on different years within five populations. Output from Peak Count Model (PCM) is also provided.

Population	Year	MR estimate	SE of MR	PCM output
Nehalem	2000	10678	2569	4893
Nehalem	2001	12431	1313	8733
Nehalem	2002	19956	1042	26090
Nehalem	2003	21283	3995	17164
Nehalem	2009	5786	945	4180
Nehalem	2010	7097	1062	5050
Nehalem	2011	11143	1537	5701
Nestucca	2010	2843	1108	1627
Nestucca	2011	4424	917	2459
Siletz	2005	14355	5188	6315
Siletz	2006	15891	2564	4014
Siletz	2007	2700	419	533
Siletz	2008	1218	228	956
Siletz	2009	2201	268	1874
Siletz	2010	10985	3488	2017
Siletz	2011	4985	382	3273
Siuslaw	2001	9723	1732	31645

Siuslaw	2002	22506	1538	22126
Siuslaw	2003	28801	2179	24688
Siuslaw	2004	29119	2543	22217
Siuslaw	2005	13771	1270	14191
Siuslaw	2006	13380	1247	18831
SFCoos	1998	2383	466	973
SFCoos	1999	3078	262	1987
SFCoos	2000	3172	171	1524
SFCoos	2009	4430	369	3790
SFCoos	2010	6766	390	7639
SFCoos	2011	9404	263	8339
Coquille	2001	12512	1573	11397
Coquille	2002	13675	941	15696
Coquille	2003	18876	1450	25348
Coquille	2004	11514	1168	12054

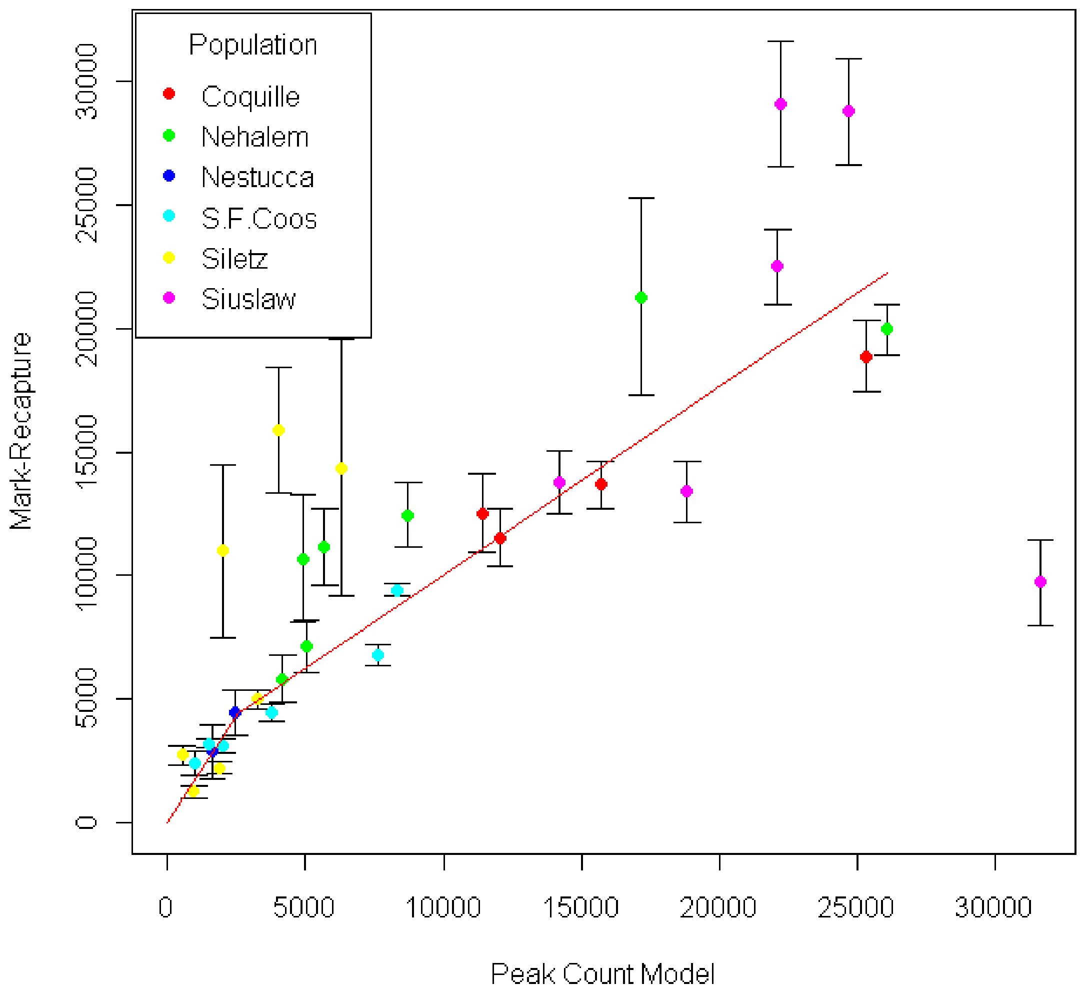


Figure A-II: 7. Relationship between mark-recapture estimates of abundance and the Peak Count Model output for five populations. Error bars are standard errors. Red line is result of segmented regression analysis.

The data in Table A-II: 4 and Figure A-II: 7 were analyzed with ANCOVA (analysis of covariance). The following R (http://www.r-project.org/) commands were used to analyze the data in Table A-II: 4:

```
Mod1<-lm(MR~Pop*PCM,weight=1/SE^2)
Mod2<-lm(MR~Pop+PCM,weight=1/SE^2)
anova(Mod1,Mod2)
```

Note that "Pop" is a nominal-scale variable, whereas PCM is continuous. The ANCOVA model is fitted with weights that were set to the inverse of the squared standard error. This allows more precise mark-recapture estimates to exert greater influence on the relationship than less precise mark-recapture estimates. The third line of code above reveals that there is little evidence for unique, population-specific slopes between mark-recapture estimates and the output of the PCM (P-value = 0.28 and 0.27 with and without the outlier datum in the Siuslaw, respectively). Thus, rather than separately estimating conversion factors for each population, data can be pooled across populations to generate a single conversion factor that applies to all populations.

If a positive intercept is entertained, then population size estimates would never fall below this value, even if zero fish are observed. This is biologically unrealistic. Thus, a datum at (0,0) with a tiny SE (0.001) was added to the data. A segmented regression model was then fitted to data that did not include the outlier from the Siuslaw using:

```
lin.mod<-lm(MR~PCM,weight=1/SE^2)
seg.mod<-segmented(lin.mod,~PCM,15000)
slope(seg.mod)
```

which yields:

	Est.	St.Err.	t value	CI(95%).l	CI(95%).u
slope1	1.6960	0.16590	10.23	1.3710	2.0220
slope2	0.7609	0.07331	10.38	0.6172	0.9046

```
breakpoint estimate = 2594
```

This model is plotted into Figure A-II: 7.

Alternative Reconstruction of Chinook Spawner Abundance

As indicated in Table A-II: 4, many of the mark-recapture estimates of abundance have been conducted recently. Prior to the availability of so many mark-recapture estimates, a different method was used to "expand" observations from standard index sites into population-wide totals. The specific spawner abundances that resulted from this general approach were also used by Chilcote et al. 2011. The method is based on adjustments of peak counts observed at standard index sites by various factors to produce an estimate of total spawner abundance, $\hat{S}$:

$$\hat{S} = \frac{PC / mi * TAM * AUC * Bias}{DP}$$

Where PC is the peak count observed at a standard index survey site of length *mi* miles, TAM is the total accessible miles of the basin, AUC is an "area under the curve" conversion from peak counts to totals (=2), *Bias* is a conversion reflecting the belief that standard index surveys are located in better-than-average habitat (=0.715), and *DP* is spawner detection probability (=0.761). The difference between this alternative method of estimating spawner abundance and the peak count model (PCM) method are characterized in Figure A-II: 8.

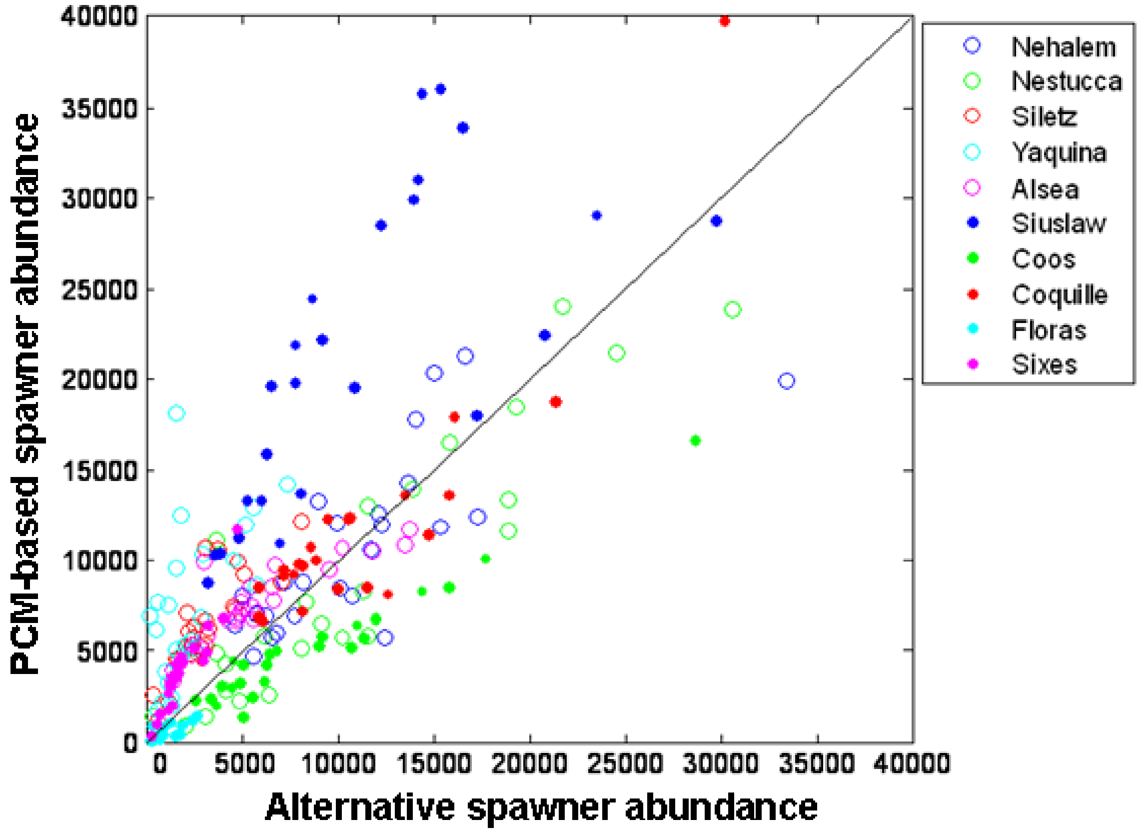


Figure A-II: 8. Relationship between two methods of reconstructing historical abundances of Chinook.

Salmon, Elk, and South Umpqua Spawner Reconstructions

Salmon River hatchery fall-run Chinook are considered an exploitation rate indicator stock by the Pacific Salmon Commission. The Elk River hatchery fall-run Chinook are under consideration for a similar designation. Consequently, many mark-recapture studies have been conducted in these populations in an effort to calibrate specific standard index surveys to total abundance (Riggers et al. 2012).[68]

Spawner abundances of fall-run Chinook in the South Umpqua are reconstructed from aerial surveys of redds that are calibrated to mark-recapture estimates. These abundances are reported by the Pacific Salmon Commission (http://www.psc.org/pubs/TCCHINOOK12-3.pdf; p. 139).

For consistency with all other fall-run Chinook assessments, the time period of 1986-2011 was used to assess current status of Salmon, Elk, and South Umpqua fall-run Chinook.

Spring Chinook

The abundance of North Umpqua spring Chinook spawners is estimated as the census counts at Winchester Dam less fish taken in the fishery. The time period of the assessment begins in 1972 because exploitation rates prior to this time are unknown. Note that Winchester Dam counts are also used to reconstruct North Umpqua steelhead abundances, yet a shorter time series is used for North Umpqua spring Chinook than North Umpqua steelhead. These time periods are not the same because: 1) Spring Chinook harvest rates are much higher than steelhead harvest rates, so assumption errors about spring Chinook historical harvest rates will have a much greater effect on analytical results than assumption errors about steelhead harvest, and 2) inferring spring Chinook harvest rates over the duration of the Winchester Dam count period (beginning in 1947) is

[68] Also, Elk River fall-run Chinook abundance estimates are based on carcass counts, as opposed to standard peak count index surveys.

more difficult than for steelhead because uncertainty in the magnitude of change in ocean harvest over this period affects the former but not the latter.

The abundance of spring Chinook in the South Umpqua is computed from resting-hole counts. Studies conducted in 1993 suggest that these resting pool counts represent 50% of the total population, but in 2009 the pools represented 95% of the population (Laura Jackson, personal communication). For this assessment, pool counts prior to and including 1993 were assumed to represent 50% of the total population. Between 1994-1999, the pool counts were assumed to represents 65% of the total population size, 2000-2005 were assumed to represent 80%, and 2006 to the present are assumed to represent 95%. The time period of the assessment begins in 1972 because exploitation rates prior to this time are unknown.

Chum

Peak counts of Chum exist at index sites. The year in which data collection began is provided in Table A-II: 5. Since Chum can mature at up to 6 years of age, there are insufficient points to perform a spawner-recruit analysis (see section below on spawner-recruit analysis) for the Necanicum. Although the Siletz time series begins early enough for a spawner-recruit analysis, there are many years of missing observations, which makes it impossible to estimate recruits. A continuous time series for Siletz Chum begins in 2003, which is not sufficient for spawner-recruit analysis.

Table A-II: 5. Summary of peak count data available for Chum salmon.

Population	Data Start	No. Sites
Necanicum	2000	2
Nehalem	1990	4
Tillamook	1989	8
Netarts	1993	1
Nestucca	1989	1
Siletz	1993	1
Yaquina	1991	4

Dividing the peak counts by the number of miles of the survey site length yields a peak density. These densities can be averaged across survey sites within a population area on a given year to yield the average annual peak densities. The relationship between these Chum densities and the rest of the population is not known. Thus, there is no reasonable method by which these observations made at these select survey sites can be used to represent total spawner abundances. Still a spawner-recruit analysis on peak densities is possible, but results must be interpreted in terms of peak densities, not total population size.

Winter Steelhead

Redds are counted annually in a 4.8 mile section of the Salmonberry within the Nehalem. These are then expanded to the entire Salmonberry assuming 2.5 redds/spawner. The time frame of analysis for this population area is 1973 to the present. There are no redd observations prior to 1973.

North Umpqua winter steelhead are censused at Winchester Dam. The time frame of analysis for this population is 1946 to the present.[69] Data do not exist prior to 1946.

Summer Steelhead

Siletz River summer Steelhead are censed at Siletz Falls as they are passed upstream. Uncertainty in the proportion of hatchery fish is much greater prior to 1993. Thus, the time frame of analysis of these counts begins in 1993.

[69] Winchester Dam actual counts were adjusted for 3 factors: 1) change in enumeration methods in 1992, 2) hatchery strays from the South Fork program beginning in 1971, and 3) hatchery summer steelhead during the winter period.

The abundance of North Umpqua summer Steelhead spawners is estimated as the census counts at Winchester Dam less fish taken in the fishery. The time period of the assessment begins in 1947.

Cutthroat Trout
Spawner abundance data do not exist.

Abundance Percentiles
Spawner abundance percentiles were used to establish many of the population abundance goals in Table A-III: 2. The abundance of spawning salmon and trout over time is often lognormally distributed (Figure A-II: 9). This asymmetry of abundances implies that the mean of the observations will be greater than the expected abundance. Using percentiles of an empirically parameterized lognormal distribution, as in Figure A-II: 9, makes it possible to characterize the relative frequencies of different abundances.

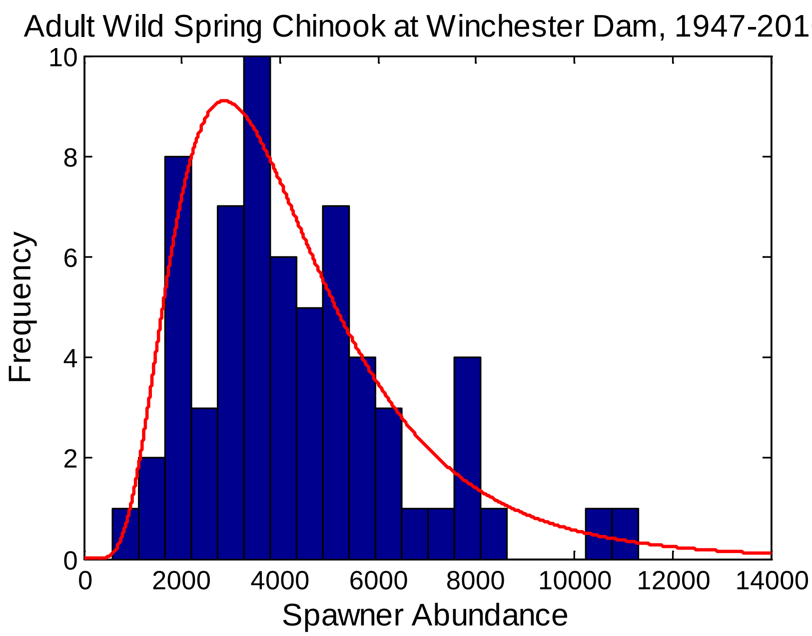


Figure A-II: 9. An example of the distribution of observations of abundance (blue) and the associated, parameterized lognormal distribution (red).

The probability density function of a lognormal distribution with mean, μ, and standard deviation, σ, is:

$$f(x \mid \mu, \sigma) = \frac{1}{\sigma\sqrt{2\pi}} e^{\frac{-(\ln x - \mu)^2}{2\sigma^2}}$$

Taking the partial derivatives of the associated likelihood function, setting them to zero, and solving for the parameters yields the maximum likelihood estimators:

$$\hat{\mu} = \frac{\sum_{i=1}^{n} \ln x_i}{n}, \hat{\sigma}^2 = \frac{\sum_{i=1}^{n} \left(\ln x_i - \hat{\mu}\right)^2}{n}$$

With these parameter estimates, the inverse cumulative probability of the lognormal distribution can be used to find the abundances associated with different "percentiles":

$$p = F(x \mid \hat{\mu}, \hat{\sigma}) = \frac{1}{\hat{\sigma}\sqrt{2\pi}} \int_0^x \frac{e^{\frac{-(\ln t - \hat{\mu})^2}{2\sigma^2}}}{t} dt$$

The abundances associated with the "percentiles" at [0.01, 0.05, 0.15, 0.5, 0.6, 0.75] are given as red horizontal lines in Figure A-II: 10.

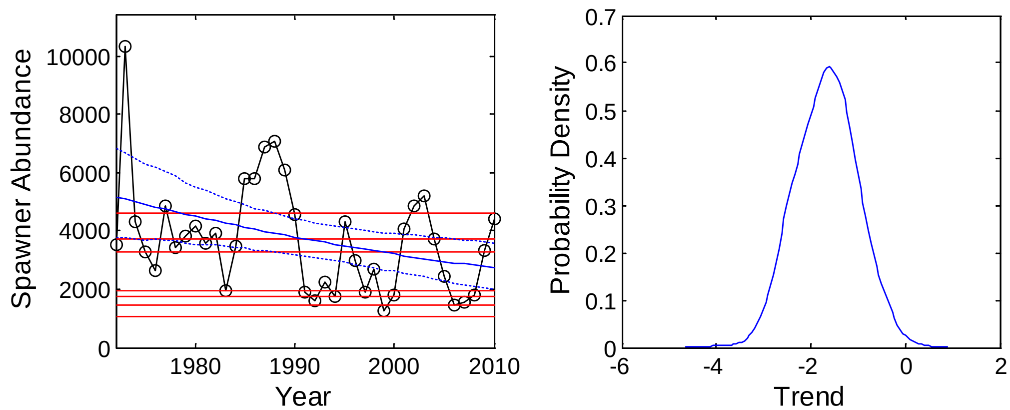


Figure A-II: 10. Time series of spawner abundances of North Umpqua spring Chinook (open circles) with lognormal percentiles at [0.01 0.05 0.15 0.5 0.6 0.75] (red), and estimates of trend and uncertainty in trend (blue).

<u>Current Status of Abundance and Productivity</u>

Abundance and productivity are key indicators of population health and are two of four metrics commonly used to assess the conservation status of Pacific salmonid populations (McElhany et al. 2000). Here, abundance and productivity are assessed in conjunction with one another for two reasons. First, both of these parameters are estimated from spawner-recruit time series data (see section below on spawner-recruit analysis). Second, abundance and productivity are related to one another with respect to a population's risk of extinction. A hypothetical relationship between abundance, productivity, and the probability of extinction is given in Figure A-II: 11. The figure illustrates that the effect of abundance on the probability of extinction critically depends on the population's productivity. Conversely, the effect of productivity on the probability of extinction critically depends on the population's abundance. Thus, abundance and productivity are jointly assessed through analysis of extinction risk (see section below on population viability analysis).

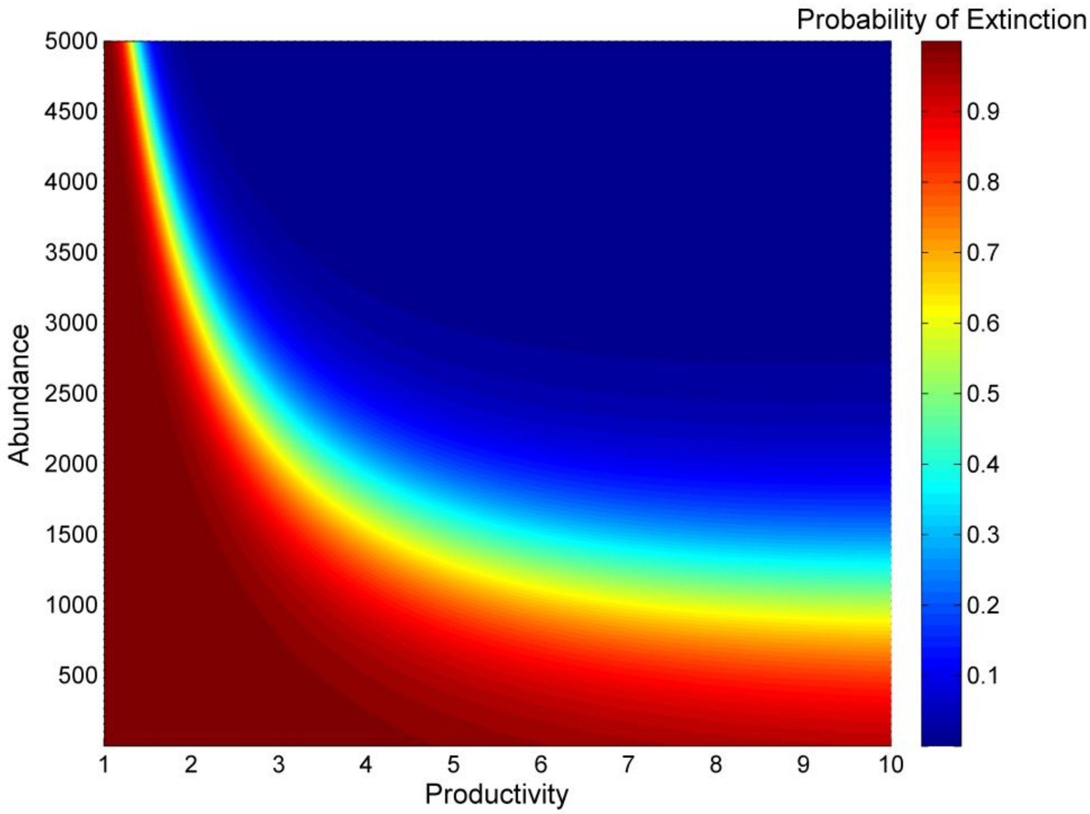


Figure A-II: 11. Hypothetical example of the 3-way relationship between abundance, productivity, and the probability of extinction.

Spawner-Recruit Analysis

Spawner-recruit analysis is a well-known technique among fisheries scientists (Ricker 1954, Hilborn and Walters 2003, Haddon 2011). The purpose of a spawner-recruit analysis is to quantify the relationship between the abundance of spawning fish in a given stock (or population) and the abundance of their progeny that is expected to "recruit" into (i.e., survive until) a predefined age or size class. If recruits are defined as fish that are old enough or large enough to be caught in a fishery, then spawner-recruit analysis can be used to identify optimal harvest rates that result in the maximum sustained yield (MSY). However, attempting to maintain a population at MSY can be problematic (Walters and Martell 2004, Finley 2011), and will therefore not be attempted here. Instead, spawner-recruit analysis is used to:

1. estimate population productivity,
2. estimate spawner population carrying capacity,
3. estimate uncertainty and covariance in (i) and (ii), and
4. derive an analytical model of density-dependent population regulation (with parameter uncertainty and covariance) useful for population viability analysis (see next section).

Recruits are defined herein as "mature run equivalents," which is the number of progeny produced from a population of spawners on a given year (where spawners include hatchery fish if present) that either survived to spawn or would have survived to spawn if they had not been intercepted in a fishery. To better understand this concept, first consider a scenario that ignores harvest. If no fish were harvested, then Table A-II: 6 presents an example of how to compute the abundance of recruits that are associated with spawner abundance in 2001. The spawner abundance in 2001 is simply a summation of the abundances for all fish that are older than two years (yellow). Two year old fish are sometimes neglected from such counts because they are usually precocious males that contribute little to the reproductive output of the spawners. The abundance of the recruits that resulted from that spawn year is a diagonal summation (pink). This is:

$$R_t = \varphi_{1,t+1} S_{t+1} + \varphi_{2,t+2} S_{t+2} + \varphi_{3,t+3} S_{t+3} + \varphi_{4,t+4} S_{t+4} + \varphi_{5,t+5} S_{t+5} + \varphi_{6,t+6} S_{t+6}$$

which can be written more compactly as:

$$R_t = \sum_{a=1}^{6} \varphi_{a,t+a} S_{t+a} ,$$

where *S* is the abundance of spawners and $\varphi_{a,t+a}$ is the proportion of spawners on year *t+a* that are age *a.*

Table A-II: 6. Example of age-structured spawner-recruit assessment that ignores harvest mortality.

Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Spawners	Recruits[a]
2001	0	68	115	299	238	68	720	953
2002	0	159	267	465	386	55	1173	
2003	0	74	230	330	341	52	953	
2004	0	95	218	472	262	116	1068	
2005	0	70	110	298	359	87	854	
2006	0	112	145	428	260	63	896	
2007	0	148	116	363	250	103	832	

[a] Assuming no mortality from fisheries, recruits are the sum of the pink cells.

Inland and ocean harvest estimates are used to estimate mature-run-equivalent recruits. These computations begin by dividing spawner abundances by one minus the inland harvest rate. This yields an estimate of the abundance of fish that returned to the mouth of the river. The abundance of fish that returned to the mouth of the river must then be expanded by ocean harvest rates to yield an estimate of mature-run-equivalent recruits. This is more complicated, however, because the harvest rates are estimated from coded wire tags (originating from either Salmon River or Elk River) and must acknowledge that some of the fish killed in the fishery (landed, by-catch, catch-and-release mortality) would have died naturally anyway before they reached the spawning grounds.

There is a widely accepted methodology to estimate oceanic harvest impact on fall-run Chinook that builds-in natural mortality rates. The model, COHSHAK (cohort analysis with shakers), is used by the Pacific Salmon Commission (http://www.psc.org/) to evaluate fisheries promulgated under the Pacific Salmon Treaty. COSHAK implements a backwards cohort analysis (also known as "virtual population analysis"). COSHAK receives information on natural ocean mortality rates, as well as recoveries of coded wire tags. The output of this model can be used to estimate "cohort expansion factors (CEFs)." The CEFs are a 2D matrix of values, with dimensions corresponding to run year and spawner age. The cohort expansion factors are multiplied to each year's abundance of returns-at-age in order to inflate the number of fish arriving at the mouth of the river into mature-run-equivalent recruits:

$$R_{t,a} = CEF_{t,a} * \frac{S_{t,a}}{1-h_t} .$$

To account for the fact that some populations are exposed to more ocean harvest than others, it was necessary to use a range of CEFs to compute mature-run-equivalent recruits. Coded wire tags from Salmon River were used to compute a matrix of CEFs that was used in recruitment computations for all fall-run Chinook populations between and including the Nehalem and

Siuslaw. Coded wire tags from both Salmon River and Elk River were used to compute a matrix of hybrid CEFs that were applied to all fall-run Chinook populations between and including Umpqua and Floras. Coded wire tags from the Elk River were used to compute a matrix of CEFs that were applied to Sixes and Elk fall-run Chinook.

Alternative Reconstruction of Chinook Recruit Abundance

The cohort expansion factors (CEFs) are a year-by-age matrix of numbers used to “expand” spawners-at-age into recruits-at-age. An alternative approach involves not a matrix of numbers, but a vector of brood-year ocean exploitation rates. Much like the CEFs, the brood-year ocean exploitation rates are derived from output of the Pacific Salmon Commission’s COSHAK model of coded wire tag recoveries (PSC 2012).

Model Fitting

After using the techniques above to estimate recruits, it is possible to associate each year’s spawner abundance with the abundance of their recruit progeny. A plot of these data should reveal information about the effect of spawner abundance on the abundance of their adult progeny. This relationship can be modeled with several different nonlinear recruitment functions. Several parameterizations of the Beverton-Holt recruitment function were considered in order to potentially improve parameter orthogonality/identifiability:

$$R_t = \frac{\alpha S_t}{1 + \frac{\alpha}{\gamma} S_t} e^{\varepsilon} = \frac{\gamma S_t}{\delta + S_t} e^{\varepsilon} = \frac{S_t}{\frac{1}{\alpha} + \frac{S_t}{\gamma}} e^{\varepsilon}$$

but these models frequently failed to converge. The Ricker recruitment function:

$$R_t = \alpha S_t e^{-\beta S_t} e^{\varepsilon}$$

was also fitted to the spawner-recruit data. Unlike the Beverton-Holt function, the Ricker function could be fitted to all spawner-recruit datasets. Where both functions could be fitted, a better fit was usually obtained with the Ricker function ($\Delta AIC > 2$). Thus, the Ricker function was used for all subsequent analyses.

The parameter α is the slope of the recruitment function at the origin (Figure A-II: 12), and is known as “intrinsic productivity.” The intrinsic productivity of a stock or population represents the number of recruits per spawner when the population is small enough that negative density-dependent effects are absent. Thus, intrinsic productivity is a population growth rate metric. The other parameter, β, gives the rate of curvature of the function as spawner abundance increases. This is typically a very small number that does not have an intuitive biological interpretation. A more biologically meaningful metric is the point where the recruitment curve crosses the 1:1 line on the spawner-recruit plot (Figure A-II: 12). This point is known as *Neq* because it is the number of recruits that are expected when the population is at equilibrium. This point can be found by rearranging the Ricker function for the condition where R=S:

$$N_{eq} = \frac{\log(\alpha)}{\beta} .$$

The Ricker function was fitted using Bayesian techniques in WinBUGS. The resulting McMC samples of the Ricker parameters (α, β), which include parameter covariance, are used to evaluate uncertainty in the Ricker function. The grey lines in Figure A-II: 12 illustrate the uncertainty in Ricker recruitment function. Uncertainty in *Neq*, which includes uncertainty in α, β and their covariance, is easy to estimate in WinBUGS by simply defining it in the WinBUGS model as a stochastic node.

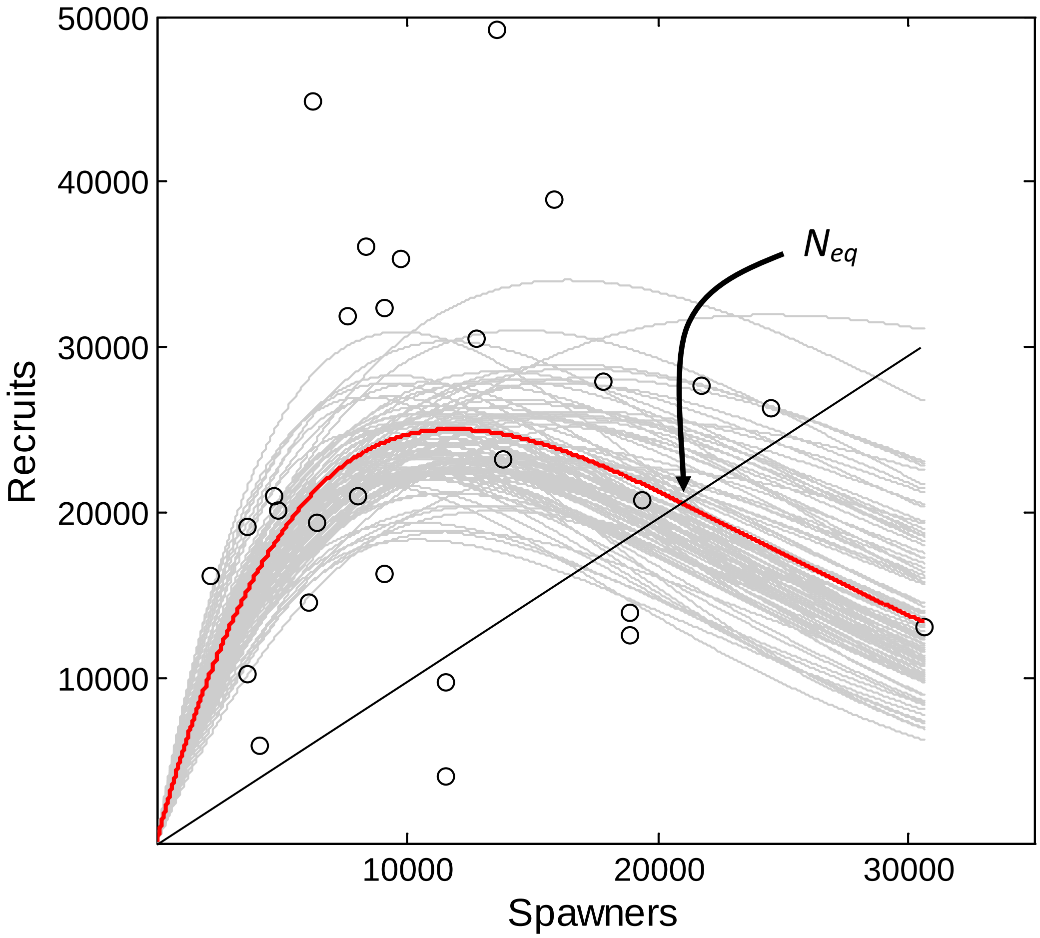


Figure A-II: 12. A Ricker function fitted to spawner-recruit data. Red line is constructed with parameter point estimates. The grey lines are constructed from uncertainty samples of the parameters. The black line shows equivalence between spawners and recruits.

Population Viability Analysis

Population viability analysis (PVA) is a cornerstone of conservation biology (Beissinger 2002, Morris and Doak 2002). Here, a PVA is a computer model that uses information from the spawner-recruit analysis (see previous section) to project/simulate population abundances into the future. 100,000 repetitions of a 100-year simulation of annual spawners and the recruits they produce are conducted, and the fraction of these that result in an extinction event yields the probability of extinction. Since the spawner-recruit data use data from the last several decades, the extinction probability estimated from the PVA is used as one component to assess the "current status" of the population. It is important to note that the word "extinction" refers to a population (i.e., "local extinction", or "extirpation"), not a species.

It is also important to note that the PVA models developed here were created for the existing data. An opposite modeling philosophy begins with a more detailed life-cycle model and then uses professional opinion to infer necessary values that are not estimable from existing data. The existing data are primarily peak counts at stream segments. These data can be used for spawner-recruit analysis, but they cannot be used to estimate the values needed in elaborate life-cycle models. Thus, the PVA models developed here are relatively simple because anything else would require inference with unquantifiable uncertainty. Not only is this a sound modeling approach, but more elaborate life-cycle models would not necessarily result in more accurate PVAs. The most important form of variability in a PVA occurs at the across-generation scale, not within a generation. A life-cycle model would be useful for evaluating future scenarios or prioritizing restoration, but it would not necessarily ensure better assessment of across-generation variation than the spawner-recruit models used here.

The recruitment function that is fitted to each population is the model of intergenerational population dynamics that is used within the PVA to simulate spawner abundances through time. However, in the spawner-recruit analysis, "recruits" are defined as mature-run-equivalents. The very same inland and ocean harvest estimates that are used to estimate mature-run-equivalent recruits from spawner abundances are also used by the PVA to convert mature-run-equivalent recruits back into spawners. Indeed, the analytical steps used to estimate recruits for the spawner-recruit analysis are reversed inside the PVA. Thus, the PVA:

1. takes a given spawner abundance on year t,
2. uses the recruitment function to estimate recruits,
3. uses the age-structured cohort expansion factor (CEF) to deflate the result of step 2 down to the inland return on year t+2, t+3, t+4, …m t+7 years later (because Chinook and steelhead mature between 2, 3, 4,… 7 year olds), and
4. takes the sum across age classes of inland return on year t+1and deflates it by an inland harvest rate to generate spawner abundance on year t+1.

A critically important aspect of all PVAs is the incorporation of stochasticity ("randomness"). Indeed, if stochasticity is neglected, then the steps outlined above would quickly result in static population and extinction risk would be zero. Stochasticity enters the PVA in several ways. First, the spawner-recruit data are ambiguous with respect to the parameters of the recruitment function (Figure A-II: 12). Thus, uncertainty in the estimates of recruitment parameters α and β are simulated within the PVA by repeating simulations with different values of α and β. Different values of α and β are selected in proportion to the probabilities of different values and their covariance. This is accomplished by fitting the Ricker spawner-recruit model with Markov chain Monte Carlo (McMC) methods in a Bayesian context. Samples of the Markov chain are saved, and the PVA randomly selects parameter values out of this pool.

The spawner-recruit data are not fully explained by the Ricker recruitment function, even though parameter uncertainty is acknowledged. In Figure A-II: 12, this can be seen as the vertical distances between spawner-recruit "points" and the line(s) representing the recruitment function(s). These "residual" deviations must also be simulated in the PVA. These residuals are lognormally distributed (note that the errors, ε, are exponentiated in the recruitment functions described above) and contain temporal autocorrelation. After the PVA receives a set of values for α and β, the variance of the errors is computed as well as the lag-1 autocorrelation of the errors. A 100-year time series of residual errors is then simulated using:

$$\varepsilon_t = \rho\varepsilon_{t-1} + \sqrt{\sigma^2}\sqrt{1-\rho^2}z_t \,,$$

where ρ is the lag-1 autocorrelation of the errors, σ^2 is the variance of the errors, and z_t is a standard normal random deviate (Morris and Doak 2002, p. 139).

The cohort expansion factors (CEFs) and inland harvest rates also induce stochasticity in spawner abundances. This is included in the PVA by randomly drawing CEFs and inland harvest rates for each simulated year from the time series of numbers used to estimate recruits.

Extinction in the PVA model occurs when spawner abundance for three consecutive years falls below a "quasi-extinction threshold" (QET). A separate process called "reproductive failure threshold" (RFT) is used to zero-out recruitment at critically low spawner abundances. Both of these thresholds are implemented because processes like inbreeding depression, genetic drift, mate finding, and increases per-capita juvenile mortality will drive the population into extinction at critically low abundances. These negative density-dependent processes are very infrequently observed in nature, so they cannot be explicitly modeled. Collectively, both QET and RFT represent the boundary of an "extinction vortex" from which real populations are irrecoverable (Gilpin and Soulé 1984, Courchamp et al. 2008, Jamieson and Allendorf 2012). The specific values of the threshold depend on the historical size of the populations, which was determined *a priori* by ODFW staff[70]. These values mirror those used in the *Lower Columbia River Conservation and Recovery Plan for Oregon Populations of Salmon and Steelhead* (ODFW, 2010):

- For "small" populations, RFT=QET=50
- For "medium" populations, RFT=QET=150
- For "large" populations, RFT=QET=250

Regardless of the result of the PVA model, if *Neq* is lower than 500 then the population is considered to have at least a moderate risk of extinction. Here, this threshold is called minimum equilibrium threshold (MET). This is done to reflect a situation where a population does not have enough quantitative genetic variation to maintain evolutionary/adaptive potential to persist in future, novel conditions.

The PVA model uses past abundances to infer extinction risk. Thus, the interpretation of the result is couched in the assumption that the conditions that were present when the data were collected will persist for 100 years. The model is not intended to capture effects of global warming, human population growth, or other anticipated future change. Of course, the future will not be like the past. Future food webs are uncertain, as is the adaptive potential of these fish. The purpose of the PVA is not to forecast the future; rather, the PVA is an assessment of current status.

Broadly speaking, the PVA needs to replicate observed patterns of variation in spawner abundance. A crude but effective method to determine if the PVA adequately captures observed population dynamics is to simply plot a randomly selected 100 year time series of simulated abundances and then superimpose the empirically observed/reconstructed abundances (Figure A-II: 13). This visual test indicates that the PVA performs well. It simulates abundances that are greater and less than the observed/reconstructed abundances, the volatility of these deviations seems to match the volatility of the observed/reconstructed abundances, and the average simulated abundance approximates the average of the observed/reconstructed abundances.

[70] Size classification of populations is for historical levels and is given in Table A-II: 11. Classification was initially determined based on the SMU-specific number of stream kilometers for a population, but was modified on a case-by-case basis to account for likely historical differences in productivity and habitat between basins for each population in comparison to others across the entire SMU.

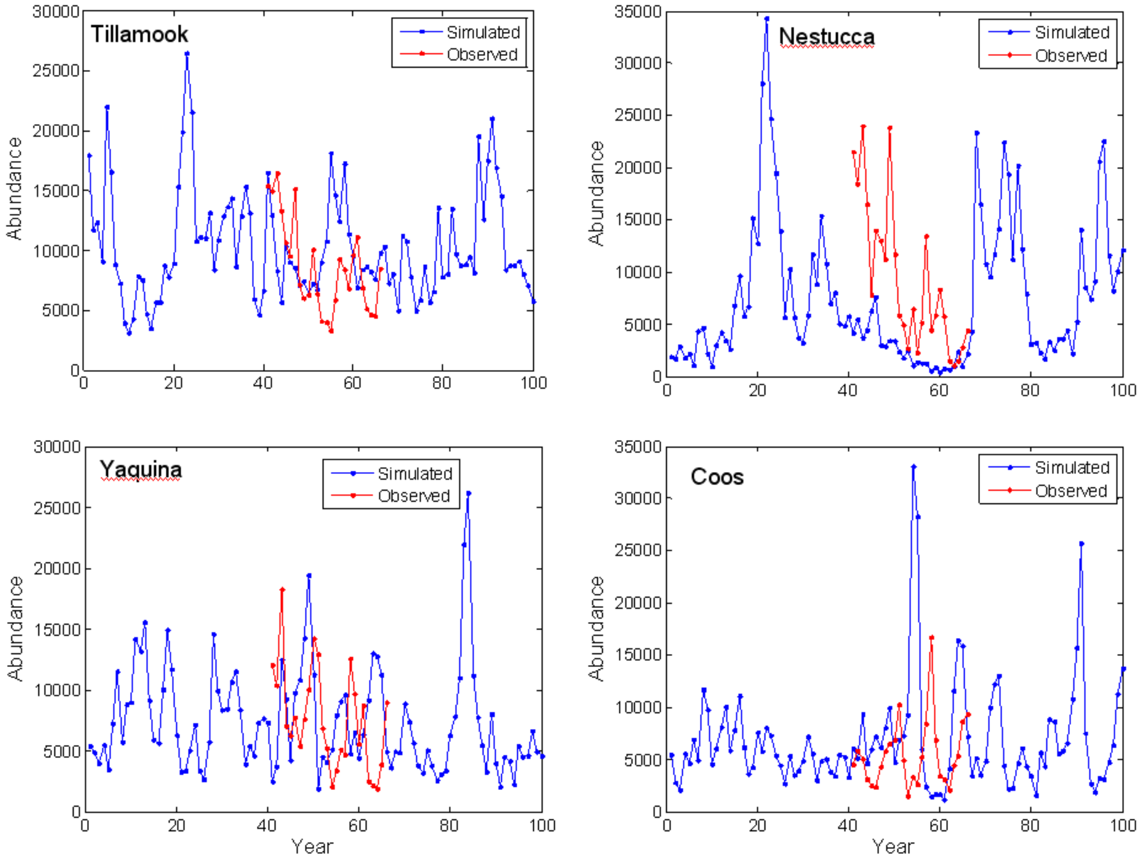


Figure A-II: 13. Examples of simulated abundances using the PVA (blue) and empirically observed/reconstructed abundances (red) for four populations of Chinook.

PVA Model Results

The mean extinction risk (ER) from the PVA model determined the abundance and productivity (A&P) viability risk score as follows:

A&P Score	Results
1	ER<1% and *Neq* >MET
2	ER<5%[71] and *Neq* >MET
3	ER<25%
4	ER<60%
5	ER≥60%

As noted in two subsections above, there are alternative methods to reconstruct abundances of Chinook spawners and recruits. Given two techniques to reconstruct spawners and two techniques to reconstruct recruits, there are four potential versions of spawner-recruit data. Here, only two of these are entertained. The first version uses the PCM (described previously) to reconstruct historical spawner abundances and Cohort Expansion Factors to reconstruct recruits. The second version uses expansions of standard index surveys to reconstruct spawner abundances and brood-year ocean exploitation rates to reconstruct recruits. Both of these approaches represent alternative representations of reality; they are different models and were both used in the PVA model to estimate extinction risk. For populations that could be represented with both of these models for reconstructing spawners and recruits, the results from the two PVAs were averaged.

[71] The Extinction Risk threshold between viable and non-viable populations is a 5 percent chance of extinction over a 100-year period (McElhany et al. 2006).

Viability Curves

Figure A-II: 11 presents a hypothetical relationship between productivity, abundance, and extinction probability. It is possible to use data to generate a similar figure for each population. To do this, productivity and *Neq* are systematically varied over a broad range of potential values. For all combinations of productivity and *Neq*, the PVA generates an extinction risk using empirical estimates of (i) the magnitude of recruitment residuals from a parameterized recruitment function, (ii) the lag-1 autocorrelation of recruitment residuals, and (iii) oceanic and inland harvest. A 2D interpolator can project extinction risk to all values within the range of productivities and *Neq*s that were explored in order to create a continuous image out of the discrete data points. Superimposing empirical estimates of uncertainty in productivity and *Neq* yields a visual guide to the cause of the extinction risk estimate (see section on desired status).

North Umpqua Winter Steelhead Harvest Tolerance

The mechanics of the PVA are well suited to address the effects of hypothetical harvest regimes on population extinction risk. The computations within the PVA that convert recruits into spawners can be manipulated to reflect any desired level of harvest. For North Umpqua winter steelhead (the winter steelhead population with the least uncertainty in abundance estimates), inland harvest rates between 20% and 60% were simulated in a PVA model and the resulting extinction risk was recorded. This exercise revealed that the probability of extinction does not exceed 0.05 until harvest rate reaches 52% (see Figure 14). However, it is important to note that the probability of extinction dramatically increases with very slight increases in harvest rate beyond 52%.

Chum

As noted in the section on Spawner Abundance above, it was not possible to reliably use observed peak densities to infer total spawner abundance. Still, a spawner-recruit model can be fit, and a PVA using this information is possible. The challenge in this case is adequately defining the quasi-extinction threshold (QET), reproductive failure threshold (RFT), and the minimum equilibrium threshold (MET). Here, a crude approximation is made by noting that QET and RFT are, on average 2% of *Neq* for fall-run Chinook. Using 2% of the peak densities of Chum as QET and RFT assumes that Chum densities can be expanded to a similar extent as Chinook densities. This assumption probably under-estimates QET and RFT, which will cause the PVA model to produce incorrectly low extinction probabilities. The accuracy of Chum PVA will increase with improved understanding of the relationship between densities at particular survey sites and basin-wide population abundance. This can be accomplished with numerous spatially randomized surveys or mark-recapture.

Appendix II (Current Status): Trend

The abundance of spawning fish within a population can change dramatically from one year to the next. This inherent inter-annual variability in spawner abundance can make it difficult to determine whether the difference between the starting and ending abundances over a period of time are attributable to randomness alone, or if there is also an underlying gradual change (i.e., “trend”) in abundance. Here, the weight of evidence that there has been a general trend in spawner abundances during approximately the last two and a half decades is assessed.

The time period over which trend is assessed is critical for proper interpretation of the result (Dietloff et al. 2010). For example, trend analysis of a population that is stable over the long-term but cyclic over shorter time periods can produce results that critically depend on the particular time period considered. In the top panel of Figure A-II: 14, there is no trend over the 60 year period of record, but there are decadal cycles in abundance. If the record had begun in 2000, then a negative (downward) trend would have been found if data were analyzed in 2010. The opposite result would be found if the record began in 1990 and was analyzed in 2000. The lower panel of Figure A-II: 14 is the same as the upper panel, except it contains a negative trend over the entire 60-year time period. It is possible to find positive trends within subsections of these data even though the overall trend is negative. The inherent sensitivity of a trend analysis to a particular window of time underscores the need for careful interpretation of the result. This further suggests that trend analysis has limited ability to characterize future abundances.

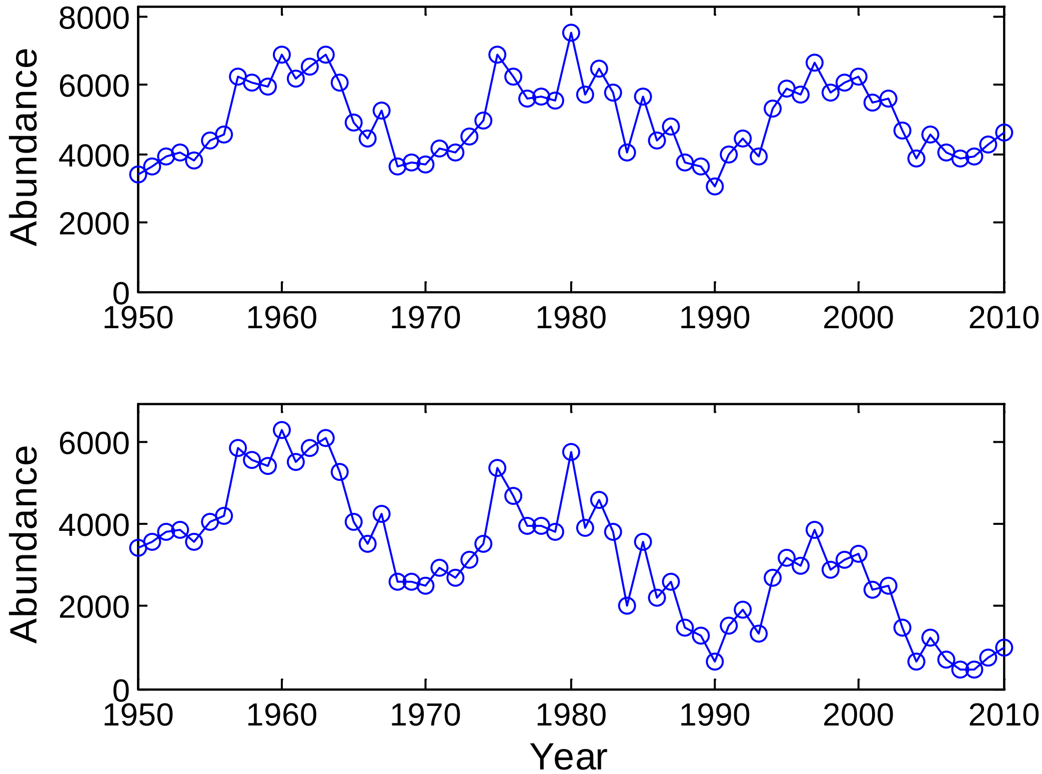


Figure A-II: 14. Hypothetical abundances illustrating that the result of a trend analysis can sensitively depend on the time frame used.

The time period for the trend analyses herein was selected to match the time period for each population's spawner-recruit analysis (see above). Each population's spawner-recruit analysis supplies information that is used in the corresponding population viability analysis (PVA). The PVAs do not assume a trend, so the results of the trend analysis are intended to complement the PVA result. For example, if the PVA suggest that a population has a high risk of extinction but the trend analysis reveals that abundance has been increasing, then belief about the population's current status should be intermediate to these two assessments.

The abundance of spawners at time t, S_t, is considered the result of Poisson random variable:

$$S_t \sim Poisson(\lambda_t).$$

Unlike the normal distribution, which has a mean and a variance, the Poisson distribution's variance and mean are equal, so it is characterized by a single parameter, λ. Poisson random variables often arise in the context of counts, which must be nonnegative and integer valued. Indeed, the Poisson distribution is frequently applied to counts of animals. The theory of generalized linear models (Nelder and Wedderburn 1972) indicates that a log-link should be used to model variability in λ. Hence,

$$P(S_t \mid \lambda) = \frac{\lambda^{S_t} e^{-\lambda}}{S_t!}$$

$$\lambda = e^{\alpha + \beta(t - t') + \frac{\sigma^2}{2}}$$

where $P(S_t \mid \lambda)$ is the likelihood of the observation of abundance S_t *given* some value for λ. α is an intercept and β is a slope for the effect of year, t. The term t´ is set to the median of the years in order to "center regressors," which improves convergence to stable parameter estimates. σ is the standard deviation of normally distributed error variance, which is divided by 2 because the error variance is exponentiated. A typical analysis would seek values of λ, α, and β that maximizes the product likelihood for all observations of spawner abundance. This is known as a "maximum likelihood" estimate.

Here, the concept of a maximum likelihood estimate is combined with neutral prior beliefs about parameter values in a Bayesian context (see next section). This model is fitted using WinBUGS software. A useful feature of Bayesian modeling with WinBUGS is the ability to estimate uncertainty in functions of parameters without having to analytically work-out computations involving covariances or Jacobians. Thus, trend can be defined as the geometric mean rate of inter-annual change, and all that is necessary to obtain estimates of uncertainty in this new parameter is to simply tell WinBUGS how the mathematical expectation is computed:

$$\hat{S}_t = e^{\alpha+\beta(t-t')+\frac{\sigma^2}{2}}$$

$$trend = 100\left(\left(\frac{\hat{S}_{t=\max}}{\hat{S}_{t=1}}\right)^{\frac{1}{\max-1}} - 1\right)$$

The utility of this feature cannot be overstated. Furthermore, after supplying noninformative, uniform priors to this Bayesian analysis, the resulting posterior distribution of trend has the intuitive interpretation of degrees of belief in different ranges of trend. The alternative, non-Bayesian, approach to this problem does not conceive of parameters as random variables, and therefore cannot omit discussion of probabilities of *different* magnitudes of trend (See section below on Bayesian Analysis).

Figure A-II: 15 illustrates how to interpret a posterior probability distribution and presents a practical dilemma. In the top left panel, 50% of the distribution is to the left of zero, which means there is equal support for a positive and negative trend. The same distribution is shown in the lower left panel, but here it is shown that 9% of the distribution is at a negative 2% trend *or worse*. A negative trend of 2% *or worse* is moderately severe (see Figure A-II: 16). Thus, even though the probability associated with this trend is low (9%), the probability of occurrence should be weighed by the magnitude of the effect. A minuscule chance of a major calamity may be as concerning as a near guarantee of a minor inconvenience.

The right hand column of Figure A-II: 15 shows a different distribution. In the upper right it can be seen that 73% of the distribution is to the left of zero. Thus, compared to the blue distribution, there is a greater probability of decline. However, because there is less uncertainty in the trend estimate (note that the red distribution is narrower than the blue distribution), there is only a 3% chance that the magnitude of decline is 2% *or worse* (lower right). Thus, the red distribution has a greater overall probability of *some* decline than the blue distribution (top row) but the red distribution has a lower probability of *severe* decline than the blue distribution (bottom row).

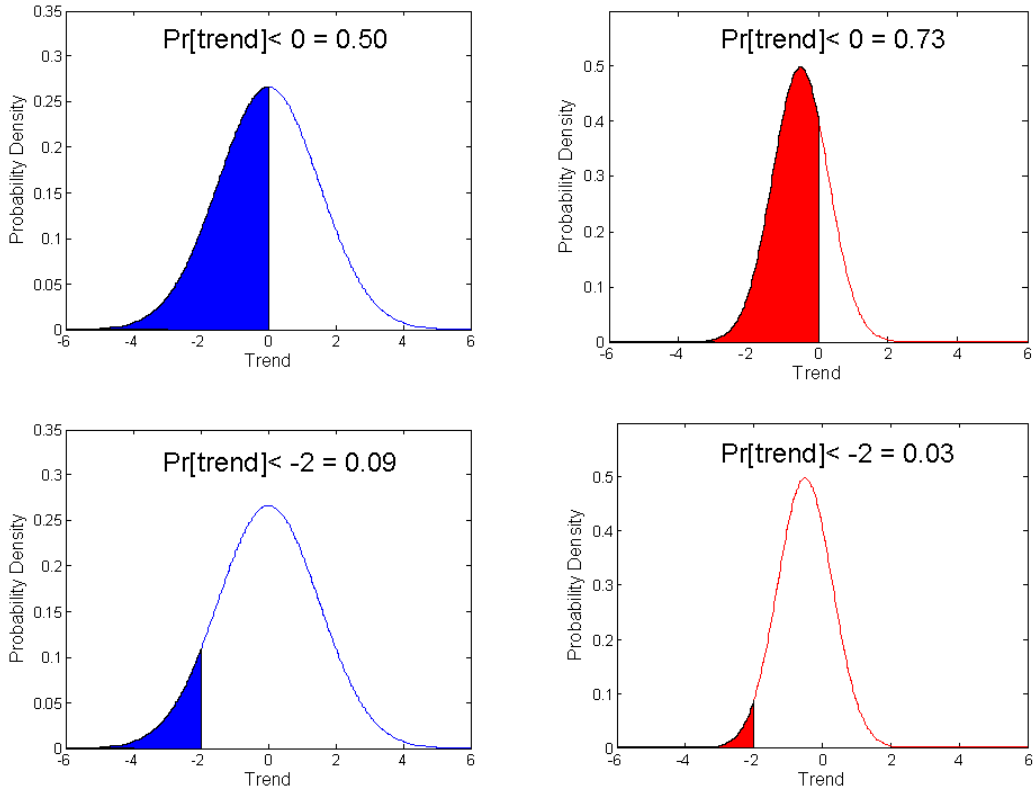


Figure A-II: 15. Two posterior distributions of trend are given in different columns and colors. The blue distribution has less probability mass to the left of zero than the red distribution (top row), but it has more probability mass to the left of -2 (bottom row).

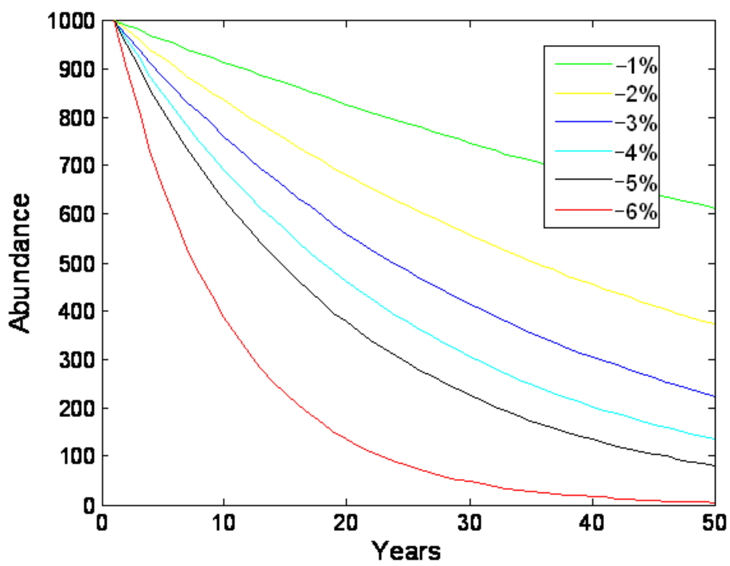


Figure A-II: 16. Trends that are defined as per-year geometric mean rate imply different percent reductions over time from an initial abundance.

The foregoing raises the question of how a posterior distribution of trend can be mapped into discrete risk categories. For each population, the probability of decline (% of posterior distribution to the left of zero) and the probability of at least a 2% decline are computed and plotted into Figure A-II: 17. The grey lines demarcate adjacent risk categories. The top of the grey lines occur at [(0.2, 0.2), (0.4, 0.4), (0.6, 0.6), (0.8, 0.8)] and extend downward at a 60º angle with the black line. Note that if the grey lines were perfectly vertical (making a 90º angle with the x-axis) then risk categories would be entirely independent of the values on the y-axis. By creating a slight angle, the categories are largely determined by the x-axis, but high values on the y-axis can elevate risk to the next higher category. The decision to delineate the risk categories in this manner was made prior to plotting points into the axes, and therefore was not influenced in any way by particular populations' trend estimates.

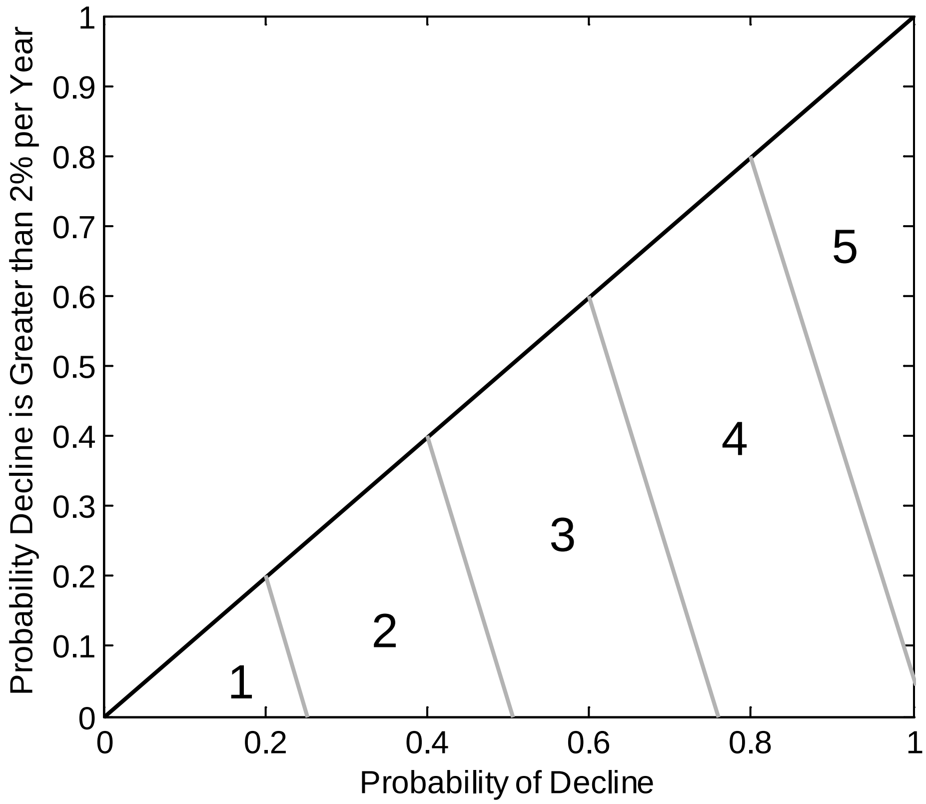


Figure A-II: 17. Discretization of posterior probability of trend into five categories, and the associated risk score. The region above the black line represents impossible values and can be ignored.

Appendix II (Current Status): Bayesian Analysis

A Bayesian perspective to data analysis is used to fit: (1) the Peak Count Model, (2) Spawner-recruit models, and (3) trend models. The Bayesian approach has some appealing features that are leveraged in these assessments. First, uncertainty in "derived parameters" of spawner-recruit models, like *Neq* and *Smsy* involves joint uncertainty of the original parameters (and their covariance). It is relatively simple to estimate uncertainty of derived parameters using Bayesian methods. Second, the output of a Bayesian analysis has an intuitive, probability-based interpretation of parameter uncertainty. In the trend analysis, this makes it possible to speak of different degrees of belief about various magnitudes of trend for a given population. Such an interpretation is not possible in the alternative, "frequentist" perspective to data analysis. The frequentist perspective treats the trend parameter as a fixed quantity (the population is either in decline or not, there is no such thing as probabilities of various values of trend), and uncertainty is expressed with confidence intervals that are constructed in a way that will correctly capture the "true" (point) estimate in 95% of hypothetical replications of the data-generating process.

Bayes rule is an uncontested mathematical statement about the relationship between marginal, joint, and conditional probabilities. Bayesian inference exploits this relationship to quantitatively revise existing beliefs in light of new information (data). Bayes rule states that, for two events A and B, the "joint probability" of the co-occurrence of A and B is:

$$P(A,B) = P(A \mid B)P(B) = P(B \mid A)P(A) \qquad (1)$$

where $P(A \mid B)$ is the "conditional probability" of A *given* that B occurred. $P(B)$ is the "marginal probability" of the occurrence of B, which is the probability of B taken over ("marginalized") all possible values of A.

Equation 1 can be rearranged to:

$$P(A \mid B) = \frac{P(B \mid A)P(A)}{P(B)}. \qquad (2)$$

The key to Bayesian inference is to conceive of events *A* and *B* as parameters (ϑ) and data (y), respectively:

$$P(\theta \mid y) = \frac{P(y \mid \theta)P(\theta)}{P(y)}. \qquad (3)$$

Now, $P(y \mid \vartheta)$ is the "likelihood" of the data given model parameters. $P(\vartheta)$ is the "prior" belief about the model parameters before inspection of the new data, y. The denominator of equation 3, $P(y)$, is the probability of the data (given some model). The denominator is conceptually difficult, and so it is useful to rewrite equation 3 more explicitly:

$$P(\theta \mid y) = \frac{P(y \mid \theta)P(\theta)}{\int P(y \mid \theta)P(\theta)d\theta} \qquad (4)$$

Since there are multiple parameters in the Peak Count Model(s), the denominator of equation 4 involves high dimensional integration over multiple probability density functions. Such integration is known to be analytically intractable, so numerical techniques involving a Markov chain Monte Carlo (McMC) algorithm must be used. However, it can be difficult to identify an efficient McMC algorithm on complex models like the Peak Count Model. Fortunately, WinBUGS (http://www.mrc-bsu.cam.ac.uk/bugs/winbugs/contents.shtml) is freely available software that implements efficient McMC sampling for a given model structure.

Appendix II (Current Status): Spatial Structure

Spatial structure is an important component of a viable salmonid population (McElhany et al., 2000). Spatial structure refers to the distribution of a species and the mechanisms or processes affecting its distribution. The spatial structure of a population is thought to affect the risks from localized catastrophes and determine re-colonization potential of vacant habitats both within and outside of the source population. A well distributed population utilizing a diversity of habitats can also ensure life-history diversity and population resilience to a changing environment (McElhany et al. 2000).

The mechanisms that translate spatial structure into population health are not well understood and difficult to measure. It is theorized that having members of a population spread throughout the boundaries of potential habitat lessens the chance that a catastrophic event (flood, landslide, wild fire, volcanic eruption) can eradicate an entire population, and thus increases the likelihood that the population will persist over time. The distribution of individuals in a population may also serve other functions that allow the population to persist. Because the specific qualities and mechanisms of spatial structure are difficult to quantify, criteria that seek to measure the actual distribution of individuals are usually developed to assess this aspect of population health (McElhany et al., 2000). The criteria developed here for spatial structure make the assumptions that; 1) the historical (pre-settlement) distribution of individuals ensured the most viable and persistent populations and should be considered optimum, and 2) historical distribution was likely to have resulted in individuals occupying all historically accessible habitats.

In order to assess the spatial structure of a population, data is needed that describes where fish are currently distributed and a way to compare that to the presumed historical distribution. Considering and comparing the distribution of fish under current and historical conditions is challenging, but can be evaluated if the extent of historically accessible habitat is assumed to represent historical distribution and accessibility is assumed to depend on the gradient of the streams and the location of natural barriers to upstream migration of adults. This approach, with its assumptions, was used in this plan to assess population spatial structure.

Two criteria were used in the status assessment to assess spatial structure; 1) the loss of access to historical habitat, and 2) the loss of non-linear distribution within a population area. Both of these criteria are based on criteria used by federal Technical Recovery Teams that assessed the status of listed salmon and steelhead in the Lower and Middle Columbia Evolutionarily Significant Units/Distinct Population Segments (WLC-TRT 2007, ICTRT 2007). Each criterion used in the assessment of spatial structure is described in more detail below.

<u>Loss of Access to Historical Habitat (Spatial Structure (SS) Criterion 1)</u>
A criterion was developed to assess the proportion of historical stream habitat that is no longer accessible (estuarine habitat was not included in this assessment). The historical distribution of each species was based on known natural barriers to fish migration and professional opinion on potential gradient barriers for individual species (ODFW's Natural Resources Information Management Program: https://nrimp.dfw.state.or.us/nrimp/default.aspx?p=259). The number of stream kilometers lost due to artificial barriers was calculated and compared to the total stream kilometers of historical distribution. The percentage of historical habitat lost was used to score the current status (Table A-II: 7).

Table A-II: 7. Scoring for the proportion of historical habitat lost due to artificial barriers by population size. Scoring and categories are the same as those used by the Willamette/Lower Columbia Technical Recovery Team (WLC-TRT 2007).

	Population Size		
Risk Score	Small	Medium	Large
1 – Very low	0-<5%	0-<10%	0-<15%
2 – Low	5-<15%	10-<20%	15-<25%
3 – Moderate	15-<25%	20-<40%	25-<50%
4 – High	25-<50%	40-<60%	50-<75%
5 – Very high	≥50%	≥60%	≥75%

This criterion looks at the loss of access to habitat and does not consider if fish are currently distributed throughout all or a portion of the accessible habitat. The current distribution of fish in accessible habitat is addressed in the second criterion.

<u>Loss of Non-Linear Distribution (Spatial Structure (SS) Criterion 2)</u>
Populations are protected from localized catastrophic events if the habitat they occupy is non-linearly distributed (habitats that are not connected upstream with other habitats). Populations with a broad and dendritic spatial structure occupying multiple sub-basins/forks are presumably at lower risk than those populations with a narrower distribution. Any loss of this non-linear distribution of habitat through creation of barriers or reductions in habitat quality would lessen the historical spatial structure and create a greater risk to a population.

To address distribution, Criterion 2, the occupancy of non-linear habitat, was assessed. Habitat that is non-linearly distributed was defined as any historical habitat that is in streams that are tributary to the mainstem portions of each basin and consist of at least three branches when viewed at a 1:24,000 scale. This type of stream was considered a major tributary for this exercise. The proportion of historically occupied major tributaries that are no longer occupied was used to assess the current loss of spatial structure for each population.

To assess the current non-linear distribution of cutthroat trout and steelhead in each population, the results from 10 years of random, spatially balanced surveys of juveniles were used. The data were generated by snorkel survey data from ODFW's Western Oregon Rearing Project (WORP) (http://nrimp.dfw.state.or.us/crl/default.aspx?pn=WORP). All sites sampled over the most recent ten years were plotted on a map of each population area. Sites were deemed to be occupied if one or more juvenile steelhead or cutthroat were observed over the ten years. A major tributary was considered to be occupied if at least one survey was conducted anywhere in that tributary and that survey site was found to be occupied.

The sampling frame from which sample sites were drawn is based on the assumed wadeable stream distribution of steelhead and does not include all habitats utilized by cutthroat and steelhead. While not all cutthroat or steelhead habitat was sampled, the majority was sampled and was deemed to provide a reasonable estimate of distribution.

For steelhead non-linear distribution, the presence of steelhead redds (i.e., spawning nests) was also used to determine if major tributaries were occupied. Spatially balanced, random spawning surveys conducted by ODFW's Oregon Adult Salmonid Inventory and Sampling project (OASIS) (http://oregonstate.edu/dept/ODFW/spawn/index.htm) over the most recent ten years were used in this analysis. An observation of a steelhead redd during any survey in any portion of a major tributary was considered proof of occupancy. Steelhead occupancy in a major tributary was determined if either juveniles or adults (through redds) were documented.

The distribution of surveys from the WORP and OASIS projects over the last ten years was insufficient to cover all of the major tributaries in each population. For steelhead, the inclusion of OASIS data did provide greater coverage than provided by WORP, but there were still major tributaries that were not sampled. The results of the analyses using WORP and OASIS data were shared with each of the District Biologists who manage populations in the steelhead and cutthroat SMUs. They were asked to review their files to see if they had documented cutthroat and/or steelhead in areas that either were not sampled by WORP and OASIS, or were found to be vacant by the WORP or OASIS surveys. The District Biologists identified those major tributaries for which they had documented the presence of cutthroat and/or steelhead during district activities over the last ten years, or for which it was their professional opinion that cutthroat and/or steelhead would be present if sampled.

Since juvenile summer steelhead cannot be distinguished from winter steelhead in the field, the scoring for this criterion was applied to both races of steelhead in the North Umpqua where they co-occur.

To assess the risk from loss of non-linear distribution, the proportion of historically occupied major tributaries that were believed to be no longer occupied by juveniles or adults was considered (WORP surveys, OASIS surveys, or District Biologists did not document occupancy). In addition, those population areas that were small (comprised of three or fewer 6th field hydrologic units) and could not contain as wide of a variety of habitats, and thus spatial structure, were deemed to be naturally at slightly greater risk than larger, more dendritic population areas. As a result, these small populations could not receive a very low risk score. Risk to a population from a reduced distribution was scored based on the categories in Table A-II: 8.

Table A-II: 8. Risk score categories for the proportion of non-linear distribution lost (historical major tributaries considered unoccupied) for small and larger population areas.

Risk Score	Small Populations (<3 HUC6)	Larger populations
1 – Very low	NA	No loss of distribution
2 – Low	No loss of distribution	<10% loss of distribution
3 – Moderate	<10% loss of distribution	>10% - <20% loss of distribution
4 – High	>10% - <20% loss of distribution	>20% - <40% loss of distribution
5 – Very high	>20% loss of distribution	>40% loss of distribution

For the Chinook and spring Chinook SMUs, WORP juvenile surveys are not conducted in larger streams where, or at a time when, the majority of juveniles are present, so it was not possible to look at current versus historical juvenile distribution. The adult surveys that have been regularly conducted to enumerate spawning Chinook are not random or spatially balanced, so professional opinion on where Chinook regularly spawn was used to look at the pattern of spawning locations as a way to assess the loss of non-linear distribution. District biologists were queried on where Chinook spawn on a regular basis to define current distribution and those locations were plotted on maps and the percent of historical major tributaries no longer occupied was scored as shown in Table A-II: 8.

The spatial distribution of spawning areas can be used to evaluate the risk to the population from a catastrophic event such as a debris torrent (ICTRT 2007). A population that has a dendritic distribution of spawners (spawners in several branches of a river system) has a lower risk of all of its incubating eggs being washed out by a debris torrent than a population with a linear distribution of spawning areas in a single mainstem channel. An additional rule for assessing spatial structure risk was applied to account for this greater inherent risk from catastrophic events. If the historical distribution of a population was linear (no distribution into tributaries), the score for loss of non-linear distribution could be no lower than 3 (risk score additions for loss of distribution are then applied to this base score). The scoring in Table A-II: 8 for a small population was then applied in these situations with a loss of greater than 10% receiving a risk score of 5. If the historical spawning distribution of a population included three or fewer 6th field hydrologic units, the population could receive a score no less than 2 and was scored for loss of distribution as a small population in Table A-II: 8.

In addition to the scoring in Table A-II: 8, the current distribution of major Chinook spawning areas (areas that consistently have high densities of spawners) was assessed. It was assumed that all major tributaries historically used for spawning were consistently major spawning areas and the current occasional use and lower spawner densities in some of these areas for spawning would be an indication of reduced spatial structure. A risk to the population was believed to occur if the proportion of areas no longer sustaining major spawning was significant. A rule was applied for Chinook that increased the risk score for loss of non-linear distribution by 0.5 if 50 percent or more of the historically used major tributaries were no longer considered major spawning areas.

Scores for each criterion described above were derived for each population. To assess overall spatial structure risk, the two scores for the spatial structure criteria were averaged.

Appendix II (Current Status): Diversity

A population's genetic diversity, as expressed through life-history characteristics, determines how flexible, or resilient, a population is to changing environmental conditions. Populations that have a diversity of life-history characteristics are more likely to be able to withstand extended periods of atypical environmental conditions (flood, drought, fire) than populations that have less variable characteristics (McElhany et al. 2000) - in essence, the greater a population's diversity, the greater the likelihood that the population will persist in the face of changing future environmental conditions.

To accurately assess diversity in salmon, steelhead and trout within the SMUs covered by this plan it is necessary to understand the historical suite of life-history characteristics expressed within each population. Such data do not exist for any of these populations except for major run timing variations in Chinook and steelhead. For this reason, it was necessary to develop diversity criteria based on limited information. Two criteria were developed to assess the diversity of populations in each SMU; 1) the lost use of diverse habitats, and 2) the loss or reduced variation of life-history traits. Both of these criteria were based on criteria used to assess diversity of Interior Columbia Basin salmon and steelhead (ICTRT 2007) and are described below.

<u>Lost Use of Diverse Habitats (Diversity Criterion 1)</u>
The use of a diversity of freshwater and estuarine habitats for spawning and rearing is believed to contribute to life-history diversity in fish by encouraging variable life-histories suitable to those habitats. The greater the variation in life-history traits, the more resilient a population can be to a changing environment.

Data to assess the diversity of habitats being used by each salmon, steelhead and trout population are limited and difficult to compare to historical conditions. This assessment of habitat diversity was approached by examining the underlying geology and geography within a population area, assuming that geology and geography would not be affected by anthropogenic activities over time. The Environmental Protection Agency (EPA) has developed a classification system to identify regional ecosystems, or ecoregions (Omernik 1995), that provides a way to classify historical habitat types. For this exercise, the EPA Level IV ecoregions in each population area were identified and the current utilization of the habitats in those ecoregions was compared to their historical use. Only ecoregions that historically were inhabited by more than 10% of the population were considered as historical ecoregions.

Data from juvenile and spawner surveys were queried and combined with professional opinion, to determine if populations currently inhabit each historical ecoregion. The data queried are the same data used to assess spatial structure, and the same rules for occupancy were applied (any observed or assumed use over a ten year period anywhere in the ecoregion). If occupancy could not be determined in a Level IV ecoregion, it was considered to be uninhabited and the population was scored based on the rules outlined in Table A-II: 9.

Table A-II: 9. Scoring for loss of occupied EPA Level IV ecoregions. Note that Scoring depends on the number of historically occupied ecoregions.

# of lost ecoregions	Populations w/ 1 ecoregion	Populations w/ 2 ecoregions	Populations w/ 3 ecoregions	Populations w/ 4 ecoregions	Populations w/ 5+ ecoregions
0	2	2	1	1	1
1	NA	4	3	2	2
2	NA	NA	4	4	3
3	NA	NA	NA	5	4
4	NA	NA	NA	NA	5

<u>Lost or Reduced Variation of Life-History Traits (Diversity Criterion 2)</u>
The diversity contained within a population is best expressed by the life-history traits adopted by individuals within that population (McElhany et al. 2000). Traits such as migration timing, age at migration, and spawn timing are adopted in response to the habitats and environment in which the fish have evolved. A population will have a greater likelihood of persisting through a range of environmental conditions if it has a greater range in expression of these traits. A population that loses life-history traits, or has the variation of traits reduced, is at risk of not being able to respond to certain environmental or anthropogenic situations which could lead to population decline.

Assessing if a population has lost historical life-history traits requires being able to catalogue all of the historical traits and documenting which of those traits are currently being expressed. While there is some information available for coastal salmon, steelhead and trout populations to suggest some life-histories that likely were historically present, the complete inventory of historical traits will never be known. In addition, current monitoring of these populations is not adequate to document all life-history traits being expressed. As a result, the approach to assessing the loss or alteration of life-history diversity blended available population-specific information, inference from studies conducted outside of the SMUs and professional judgment to determine the likelihood that life-history traits had either been lost or their variation reduced. The available information was considered for each population and the number of lost traits, or traits whose variation had been reduced, were tallied and scored for risk as outlined in Table A-II: 10.

Table A-II: 10. Risk scoring for the loss/reduced variation of life-history traits within a population.

Description	Score
No evidence of loss, reduced variability, or change in any trait	1
Evidence of change in pattern of variation in 1 trait (e.g., migration timing, age structure, size-at-age)	2
Loss of 1 trait or evidence of meaningful change in pattern of variation in 2 or more traits	3
Loss of 1 or more traits and evidence of change in pattern of variation in 2 or more traits; or change in pattern of variation of 3 or more traits (e.g., loss of a spawning peak and significant reduction in older age fish)	4
Permanent loss of major pathway (e.g., anadromy for *O. mykiss*, or loss of a juvenile pathway)	5

Scores for each criterion described above were derived for each population. To assess overall diversity risk, the two scores for the diversity criteria were averaged.

In assessing the loss or alteration of traits in the Nehalem, Tillamook, Nestucca, Siletz, Alsea, and Coquille Chinook populations, the alteration in the spring/summer-run life-history variant (sometimes referred to as spring- or summer-run Chinook) believed to historically exist in these populations needed to be acknowledged. Unfortunately, there is very little information to suggest just how prevalent this life-history variant was historically compared with the later returning component of the run. It was not possible to determine if this life-history variant had been significantly altered or not. Based on an assumption that the early life-history variant was of the same proportion of the overall Chinook run in all of these populations, ODFW looked at the current abundance of this life-history variant in these populations and determined to what level the variant had been altered. The Nehalem and Siletz currently have the higher abundances of the early life-history variant as compared to the other populations. These two populations were given an additional 0.25 risk score with the assumption that these variants have been altered but not substantially. The Tillamook, Nestucca and Alsea populations currently have fewer naturally produced early life-history variants and were assumed to have been altered more so than the Nehalem and Siletz variants. These three populations received an additional 0.5 risk score. In the Coquille, very few early life-history variants have been documented in the recent past. As a result, this population was given an additional 0.75 risk score. Risk scores of less than one level were given to these populations because there is uncertainty related to the historical contribution of these life-history variants in these populations and how it compares to their current contribution.

Appendix II (Current Status): Results

The current status assessments found all strata and SMUs to be viable, except chum for which the SMU viability is unknown. Table A-II: 11 provides specific abundance and productivity, spatial structure, and diversity viability assessment results for populations, strata, and SMUs, as well as a summary of indicators in viability result confidence and the overall current status for each SMU.

Table A-II: 11. Viability results, indicators of confidence in the viability results, and overall current status for populations, strata, and SMUs. Populations and strata with scores ≤ 2.5 are viable. "---" indicates that there were not enough data to assess the metric. "N / A" indicates that the item is not applicable for that population. Nehalem A&P winter steelhead results are based on estimates for the Salmonberry River. Chinook A&P results are averages from two PVA methods, and "A&P Model Divergence" indicates whether the viability result was different between these two models. Other metrics and the status categories are described in the sections discussing methods.

			Viable Salmonid Population (VSP) Parameter Assessment									Viability Results			Indicators of Confidence in Viability Results			STATUS
			Abundance and Productivity					Spatial Structure		Diversity								
SMU	Stratum	Population	Historic Population Size	Capacity	Productivity	Extinction Risk	Score	% Historic Distribution Score	% Non-Linear and Spawning Score	Ecoregion Loss Score	Life History Loss Score	Population Score	100-Year Viability	Stratum Score (% Viable)	A&P Model Divergence	Trend Score	Incomplete VSP Data	
CHINOOK	North Coast	Necanicum	N/A	---	---	---	---	1	2	1	3	1.75	Viable	1.88	---	---	Yes	Strong - Guarded
		Nehalem	medium	18,840	6.5	0.0%	1	1	1	1	3.25	1.19	Viable		No	4	No	
		Tillamook	medium	14,698	5.2	2.6%	2	1	1.5	1	3.5	2.00	Viable		Yes	5	No	
		Nestucca	medium	19,153	4.4	15.8%	2.5	1	1.5	1	3.5	2.50	Viable		Yes	5	No	
	Mid Coast	Salmon	small	3,067	3.9	7.5%	2	1	2.5	1	3	2.00	Viable	1.26	Yes	4	No	
		Siletz	medium	8,423	8.5	0.0%	1	1	1	1	3.25	1.19	Viable		No	4	No	
		Yaquina	medium	7,522	12.8	0.1%	1	1	1	1	3	1.17	Viable		No	4	No	
		Alsea	medium	11,682	9.1	0.0%	1	1	1	1	3.25	1.19	Viable		No	2	No	
		Yachats **Aggregate**	N/A	---	---	---	---	1	1	1	3	1.50	Viable		---	---	Yes	
		Siuslaw	medium	24,488	7.2	0.0%	1	1	1	1	3	1.17	Viable		No	3	No	
	Umpqua	Lower Umpqua	N/A	---	---	---	---	1	1	1	3	1.50	Viable	1.44	---	---	Yes	
		Middle Umpqua	N/A	---	---	---	---	1	1.5	1	3	1.63	Viable		---	---	Yes	
		South Umpqua	medium	7,357	7.7	0.1%	1	1	1.5	1	3	1.21	Viable		No	2	No	
	Mid-South Coast	Coos	large	10,856	6.4	0.0%	1	1	1.5	1	3	1.21	Viable	1.42	No	1	No	
		Coquille	large	16,688	6.0	0.1%	1	1	1	1	3.75	1.23	Viable		No	1	No	
		Floras	small	1,518	8.2	2.9%	2	1	3	1	3	2.00	Viable		Yes	2	No	
		Sixes	small	3,781	4.8	0.1%	1	1	2	1	3	1.25	Viable		No	2	No	
		Elk	small	2,911	2.0	16.9%	3	1	2	1	3	3.00	Not Viable		No	2	No	
	SMU Total													100%	4	7	4	
SPRING CHINOOK	Umpqua	North Umpqua	medium	8,351	5.0	0.0%	1	1	1.5	1	3	1.21	Viable	1.66	N/A	5	No	Sensitive - Vulnerable
		South Umpqua	small	478	5.7	4.6%	3	1	1.5	1	3	3.00	Not Viable		N/A	1	No	
	SMU Total													100%	N/A	1	0	
CHUM	North Coast	Necanicum	N/A	---	---	---	---	---	---	---	---	---	Unknown	---	N/A	5	Yes	Sensitive - Critical
		Nehalem	N/A	N/A	4.4	0.0%	1	---	---	---	---	1.00	Viable		N/A	1	Yes	
		Tillamook	N/A	N/A	3.0	1.9%	2	---	---	---	---	2.00	Viable		N/A	1	Yes	
		Netarts	N/A	N/A	2.5	6.8%	3	---	---	---	---	---	Not Viable		N/A	5	Yes	
		Nestucca	N/A	---	---	---	---	---	---	---	---	---	Unknown		N/A	5	Yes	
	Mid Coast	Salmon	N/A	---	---	---	---	---	---	---	---	---	Unknown	---	N/A	---	Yes	
		Siletz	N/A	---	---	---	---	---	---	---	---	---	Unknown		N/A	4	Yes	
		Yaquina	N/A	N/A	2.6	0.1%	1	---	---	---	---	1.00	Viable		N/A	1	Yes	
		Alsea	N/A	---	---	---	---	---	---	---	---	---	Unknown		N/A	---	Yes	
		Siuslaw	N/A	---	---	---	---	---	---	---	---	---	Unknown		N/A	---	Yes	
	Umpqua	Umpqua	N/A	---	---	---	---	---	---	---	---	---	Unknown	---	N/A	---	Yes	
	Mid-South Coast	Coos	N/A	---	---	---	---	---	---	---	---	---	Unknown	---	N/A	---	Yes	
		Coquille	N/A	---	---	---	---	---	---	---	---	---	Unknown		N/A	---	Yes	
	SMU Total													---	N/A	4	13	

			Viable Salmonid Population (VSP) Parameter Assessment									Viability Results			Indicators of Confidence in Viability Results			STATUS
			Abundance and Productivity					Spatial Structure		Diversity								
SMU	Stratum	Population	Historic Population Size	Capacity	Productivity	Extinction Risk	Score	% Historic Distribution Score	% Non-Linear and Spawning Score	Ecoregion Loss Score	Life History Loss Score	Population Score	100-Year Viability	Stratum Score (% Viable)	A&P Model Divergence	Trend Score	Incomplete VSP Data	
WINTER STEELHEAD	North Coast	Necanicum	N/A	---	---	---	---	1	2	1	2	1.50	Viable	1.22	N/A	---	Yes	Strong - Guarded
		Nehalem	medium	2,421	3.8	0.3%	1	1	1	1	2	1.08	Viable		N/A	4	No	
		Tillamook	N/A	---	---	---	---	1	1	1	2	1.25	Viable		N/A	---	Yes	
		Nestucca	N/A	---	---	---	---	1	1	1	2	1.25	Viable		N/A	---	Yes	
	Mid Coast	Salmon	N/A	---	---	---	---	1	2	1	2	1.50	Viable	1.27	N/A	---	Yes	
		Siletz	N/A	---	---	---	---	1	1	1	2	1.25	Viable		N/A	---	Yes	
		Yaquina	N/A	---	---	---	---	1	1	1	2	1.25	Viable		N/A	---	Yes	
		Alsea	N/A	---	---	---	---	1	1	1	2	1.25	Viable		N/A	---	Yes	
		Yachats **Aggregate**	N/A	---	---	---	---	1	1	1	2	1.25	Viable		N/A	---	Yes	
		Siuslaw	N/A	---	---	---	---	1	1	1	2	1.25	Viable		N/A	---	Yes	
	Umpqua	Lower Umpqua	N/A	---	---	---	---	1	1	1	2	1.25	Viable	1.22	N/A	---	Yes	
		Middle Umpqua	N/A	---	---	---	---	1	1	1	2	1.25	Viable		N/A	---	Yes	
		North Umpqua	medium	8,307	2.6	0.0%	1	1	1	1	2	1.08	Viable		N/A	4	No	
		South Umpqua	N/A	---	---	---	---	1	1	1	2	1.25	Viable		N/A	---	Yes	
	Mid-South Coast	Tenmile	N/A	---	---	---	---	1	2	1	2	1.50	Viable	1.32	N/A	---	Yes	
		Coos	N/A	---	---	---	---	1	1	1	2	1.25	Viable		N/A	---	Yes	
		Coquille	N/A	---	---	---	---	1	1	1	2	1.25	Viable		N/A	---	Yes	
		Floras	N/A	---	---	---	---	1	1	1	2	1.25	Viable		N/A	---	Yes	
		Sixes	N/A	---	---	---	---	1	2	1	2	1.50	Viable		N/A	---	Yes	
	SMU Total													100%	N/A	2	17	
SUMMER STEELHEAD	Mid Coast	Siletz	medium	596	2.1	0.7%	1	1	1	1	2	1.08	Viable	1.08	N/A	1	No	Sensitive - Vulnerable
	Umpqua	North Umpqua	large	4,538	2.0	0.3%	1	1	1	1	2	1.08	Viable	1.08	N/A	1	No	
	SMU Total													100%	N/A	0	0	
CUTTHROAT TROUT	North Coast	Necanicum	N/A	---	---	---	---	1	2	1	2	1.50	Viable	1.28	N/A	---	Yes	Strong - Guarded
		Nehalem	N/A	---	---	---	---	1	1	1	2	1.25	Viable		N/A	---	Yes	
		Tillamook	N/A	---	---	---	---	1	1	1	2	1.25	Viable		N/A	---	Yes	
		Nestucca	N/A	---	---	---	---	1	1	1	2	1.25	Viable		N/A	---	Yes	
	Mid Coast	Salmon	N/A	---	---	---	---	1	2	1	2	1.50	Viable	1.27	N/A	---	Yes	
		Siletz	N/A	---	---	---	---	1	1	1	2	1.25	Viable		N/A	---	Yes	
		Yaquina	N/A	---	---	---	---	1	1	1	2	1.25	Viable		N/A	---	Yes	
		Alsea	N/A	---	---	---	---	1	1	1	2	1.25	Viable		N/A	---	Yes	
		Yachats **Aggregate**	N/A	---	---	---	---	1	1	1	2	1.25	Viable		N/A	---	Yes	
		Siuslaw	N/A	---	---	---	---	1	1	1	2	1.25	Viable		N/A	---	Yes	
	Umpqua	Lower Umpqua	N/A	---	---	---	---	1	1	1	2	1.25	Viable	1.25	N/A	---	Yes	
		Middle Umpqua	N/A	---	---	---	---	1	1	1	2	1.25	Viable		N/A	---	Yes	
		North Umpqua	N/A	---	---	---	---	1	1	1	2	1.25	Viable		N/A	---	Yes	
		South Umpqua	N/A	---	---	---	---	1	1	1	2	1.25	Viable		N/A	---	Yes	
	Mid-South Coast	Tenmile	N/A	---	---	---	---	1	2	1	2	1.50	Viable	1.32	N/A	---	Yes	
		Coos	N/A	---	---	---	---	1	1	1	2	1.25	Viable		N/A	---	Yes	
		Coquille	N/A	---	---	---	---	1	1	1	2	1.25	Viable		N/A	---	Yes	
		Floras	N/A	---	---	---	---	1	1	1	2	1.25	Viable		N/A	---	Yes	
		Sixes	N/A	---	---	---	---	1	2	1	2	1.50	Viable		N/A	---	Yes	
	SMU Total													100%	N/A	0	19	

Abundance and Productivity Results

Where there were data to develop a stock-recruit relationship and run the PVA model, most populations were found to be viable, with an extinction risk less than 5% (most were under 1%). There were two populations which were found to be non-viable: Elk Chinook and South Umpqua spring Chinook[72]. A third assessment found a non-viable population for Netarts chum, but whether this represents a conservation concern is not known because it is unclear if this was an historical population of chum.

Spatial Structure Results

The assessment of spatial structure found that most populations continue to occupy almost all of their historical distribution (Table A-II: 11). No populations were found to have lost significant access to historical habitat (SS Criterion 1). Populations in the Necanicum, Salmon, Tenmile, Sixes, and Elk population areas were unable to achieve the lowest risk score for SS Criterion 2 due to their innate small size. Several Chinook populations had slightly higher SS Criterion 2 risk scores than others due to the loss of major spawning areas, though those areas still sustain minor spawning. In the Floras population, the linear distribution of Chinook spawning (no tributary or branched spawning) led to a higher SS Criterion 2 score. Looking across each SMU at current spatial structure it appears that spatial structure is not a risk to the persistence of any SMUs. Most of the risk identified in certain populations is an artifact of the composition of the population area and not an indication of deteriorating spatial structure.

Diversity Results

The assessment of population diversity found that all SMUs have experienced a minor loss of diversity. All populations occupy all historical EPA Level IV ecoregions and achieved the lowest risk score for Diversity Criterion 1. There was little population-level information with which to assess Diversity Criterion 2 directly. Smolt trapping in certain locations has shown there is a variation in smolt out-migration timing and size of smolts, but there is no information to suggest what historical variation for these traits was. Similarly, there is limited information to document the variation of historical spawn timing for any of the species. Based on documented changes in freshwater and estuarine habitat composition and quality it was assumed that such disturbances have led to less variation in at least one life history trait for all species and populations within each SMU. As a result, all populations in all SMUs could not receive a risk score less than two for Diversity Criterion 2.

In addition to the loss of variation in diversity from habitat alterations, Chinook and spring Chinook populations were assumed to have also experienced an alteration in age composition due to the ocean fisheries they experience during their ocean rearing (Kendall et al. 2009). Chinook that mature at older ages, and hence spend more years rearing in the ocean, are susceptible to greater harvest than fish that mature at an earlier age. This in turn leads to fewer older fish surviving to spawn than would have historically. The risk score for all Chinook and spring Chinook populations was increased to a score of three to account for two traits being altered (habitat disturbance being the first altered trait). In addition, those Chinook populations with a spring-run and summer-run component also received additional risk relative to the current abundances of these runs (with greater risk for those which are less abundant). Based on the assessment of the Diversity Criterion 2 for the Chinook populations, the Chinook SMU is at greater risk from loss of diversity than the other SMUs. This may simply be an artifact of the types of available information for all of the SMUs. However, the level of diversity risk for the Chinook SMU is not substantially higher than the other SMUs when the overall diversity scores are compared.

Confidence in Viability Results

Within all SMUs except summer steelhead, there were indicators that warrant a cautious approach to implementing management actions based solely on the viability assessment results. These included divergent extinction risk results for four Chinook populations, varying levels of negative abundance trends for populations, and the availability of data for fewer than all four VSP parameters. Chum in particular provided an assessment challenge given a lack of understanding around historical abundance, distribution, and population structure.

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[72] Even though South Umpqua spring Chinook had an extinction risk indicating they were viable (4.6%, which is slightly less than the 5% threshold), capacity (i.e., *Neq*) was less than MET so the abundance and productivity score was lowered per the viability criteria. This resulted in the status assessment for this population to indicate it is not viable.

Appendix III – Desired Status and Limiting Factor Metrics and Goals

This appendix identifies the measurable criteria by which progress towards implementing the CMP can be assessed. The metrics associated with VSP parameters, the Desired Status for VSP metrics (also referred to as "goals"), metrics associated with limiting factors within Management Categories, and targets for several Management Category metrics (which are also considered "goals") are presented below.

VSP Metrics and Goals

The first desired status for the SMUs covered in the CMP is to assure that all populations that are currently viable remain so, and that those not viable become so[73]. The second, aspirational, overall desired status is to have all populations viable and productive enough that they can provide greater ecological and fisheries benefits than is currently being provided. Table A-III: 1 defines the specific measurable criteria to achieve the overall desired status associated with VSP parameters (and primary biological attributes defined in the NFCP) that will be monitored. These goals, supported by actions and targets in Management Categories, along with the improved monitoring summarized in Table A-V: 4 (**Appendix V – Monitoring Approach**), directly support the SMU-scale goals identified in Table 9.

Table A-III: 1. VSP and primary biological attribute measurable criteria to achieve the overall desired status for populations within SMUs. Not all populations will be monitored for each parameter. "Investigate" indicates that there are no specific goals for this metric, but efforts will be made to collect information that helps to determine them in the future. "Stable" indicates that the desire is that this metric not indicate a decline in population status, although the specific criteria to determine this are yet to be developed. "Track" indicates that there are no specific goals for this metric, but monitoring will be conducted. "---" indicates that monitoring is not feasible or proposed for this metric. See *Appendix V – Monitoring Approach* for information about which parameters will be monitored in which management area, population, or stratum.

VSP Parameter	NFCP Primary Biological Attribute	Metric	Chinook	Spring Chinook	Chum	Winter Steelhead	Summer Steelhead	Cutthroat
Abundance	• adult fish abundance for constituent populations	Spawners	See Table A-III: 2		Increase (Peak Density)	See Table A-III: 2		Increase Trend (anadromous)
Productivity	• survival rate to each critical life history stage • standardized rate of population growth for constituent natural populations	Intrinsic Productivity (Pre-Harvest Adults/Spawners[74])	>7	>7	>7	>4	>4	---
Persistence	• forecast likelihood of species management unit persistence in the near and long terms	100-Year Extinction Risk	<1%	<1%	<1%	<1%	<1%	---
Spatial Structure	• distribution of populations within unit • population connectivity	Site Occupancy (Spawners)	100%	100%	Investigate	100%	---	100%
Diversity[75]	• within and among population diversity	Direct Genetic Measure	To Be Determined					
		Spawner Age Composition	*Stable*	---	*Investigate*	*Investigate*	---	---
		Adult Spawn Timing	*Stable*	---	*Stable*	*Stable*	---	---
		Adult Migration Timing	*Investigate*	*Stable*	---	*Track*	*Stable*	*Stable*

[73] To address the first desired status, viable populations identified in Table A-II: 11 should maintain the current level of metrics and scores identified in that table. Also to address the first desired status, populations that are not viable in this table (note that Netarts chum are not known to be an historically independent population) should have improved metrics and scores that meet the population viability criteria identified in **Appendix II – Current Status Methods and Results**.
[74] Productivity to other life stages will also be assessed if monitoring is instituted or data are available.
[75] Secondary biological attributes and criteria which are direct measures of wild fish performance (*italicized metrics* in the table), other surrogates for diversity, or derived measures from other VSP parameters will be used until a direct genetic measure and criteria are developed.

Abundance will be assessed annually (see Table A-III: 2 for population-specific abundance goals) to inform the adaptive actions related to abundance levels that have been established. The desired status for all populations, except the non-viable Chinook and spring Chinook populations (which required greater increases), is to achieve the 75th percentile of the observed abundances[76] over the period for which the populations were assessed (see Table A-III: 2). The 75th percentile was chosen, as opposed to a percentage increase, because it represents abundance levels that are both improved and attainable because percentiles standardize increases across populations and capture variability through time better than percentage increases of a mean (note that the 75th percentile values were greater than a 20% increase of the median [50th] percentile where it was used). The 75th percentile was used, as opposed to a value based on the stock-recruit relationship or PVA results, because most results indicated populations were already viable and, regardless of this, some improvements in populations are desired (which have the potential to change the future stock-recruit relationship and PVA results). The desire is to have a population's abundance be greater or equal to the goal half the time, rather than only a quarter of the time as it is now (i.e., in essence having the current 50th percentile move toward the current 75th percentile). This will provide for improved fishing opportunity and a buffer against future threats. Abundance goals for chum and cutthroat are based on increasing trends of peak density and anadromous counts at fixed locations because there are no population abundance data currently available to determine other goals.

Future Threats: Climate Change and Population Growth

A stationarity assumption was inherent in the current status viability assessment. The stationarity assumption is that the recent past is a reasonable predictor of future fish performance. This assumption would be violated if future environmental conditions are different from the recent past (where "environment" is broadly defined to include anything that affects salmon and trout). In the viability assessment, no attempt was made to conduct an assessment of likely future environmental conditions and their predicted impacts on population biological status. Instead, the stationarity assumption was used. Given that it is generally believed that the future effects of climate change, resulting ocean shifts (e.g., productivity, acidification, sea-level rise), and human population growth and development[77] on these salmonid populations will likely be negative (ODFW, 2011), precautionary adjustments to all populations' abundance goals were made[78].

Productivity will be measured as the intrinsic productivity at low spawner abundances identified in a stock-recruit relationship. The identified productivity goals are based on observations across the Northwest of productivity within populations with low hatchery influence, which were assumed to have optimal intrinsic productivity (from Chilcote et al. 2011). Note that increases in productivity (as opposed to abundance capacity) or decreases in data variability are the primary ways that the Elk River Chinook population (which was not viable) and three of the four Chinook populations which had an extinction risk greater than 5% from one of the PVA models (i.e., the divergent PVA model results[79]) will achieve acceptable extinction risks. See Figure A-III: 1 for a viability curve as an example showing the need for increased productivity (i.e., moving along the vertical confidence bar representing abundance does not change extinction risk, though moving along the horizontal bar representing intrinsic productivity does, as does shrinking the "sphere of results" representing variability).

Productivity will not be assessed annually. A long time series of data is necessary to estimate productivity, so re-estimating productivity after a few years will not show much change regardless of whether the true productivity is increasing or declining. To provide a more informative look at productivity, it will be assessed after 12 years - at the next status assessment (see **Implementation** for the timeframe).

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[76] The percentile is of the log-normal distribution.

[77] Note that localized effects of climate change and human population growth would work through the limiting factors identified in this plan (e.g., water quality/temperature, water quantity, physical habitat quality).

[78] The increase in the abundance goal was chosen to provide increased societal benefits. It is also a temporary approach to buffer potential impacts of population growth and climate change. It is currently not possible to accurately estimate the level of productivity loss, if any, that populations will experience due to these factors. The increase was added to ensure that an increasing trend in population health would occur at the initial implementation of the plan to buffer against future negative impacts and allow time for actions addressing limiting factors through which these threats will occur to be taken. If goals are not able to be achieved, and especially if status starts to decline, the rate of actions will need to be increased in order to maintain current abundance levels, as well as prevent serious declines.

[79] Viability results for Floras indicated an increase in capacity or productivity were possible to decrease extinction risk. An increase in capacity is the primary need for South Umpqua spring Chinook.

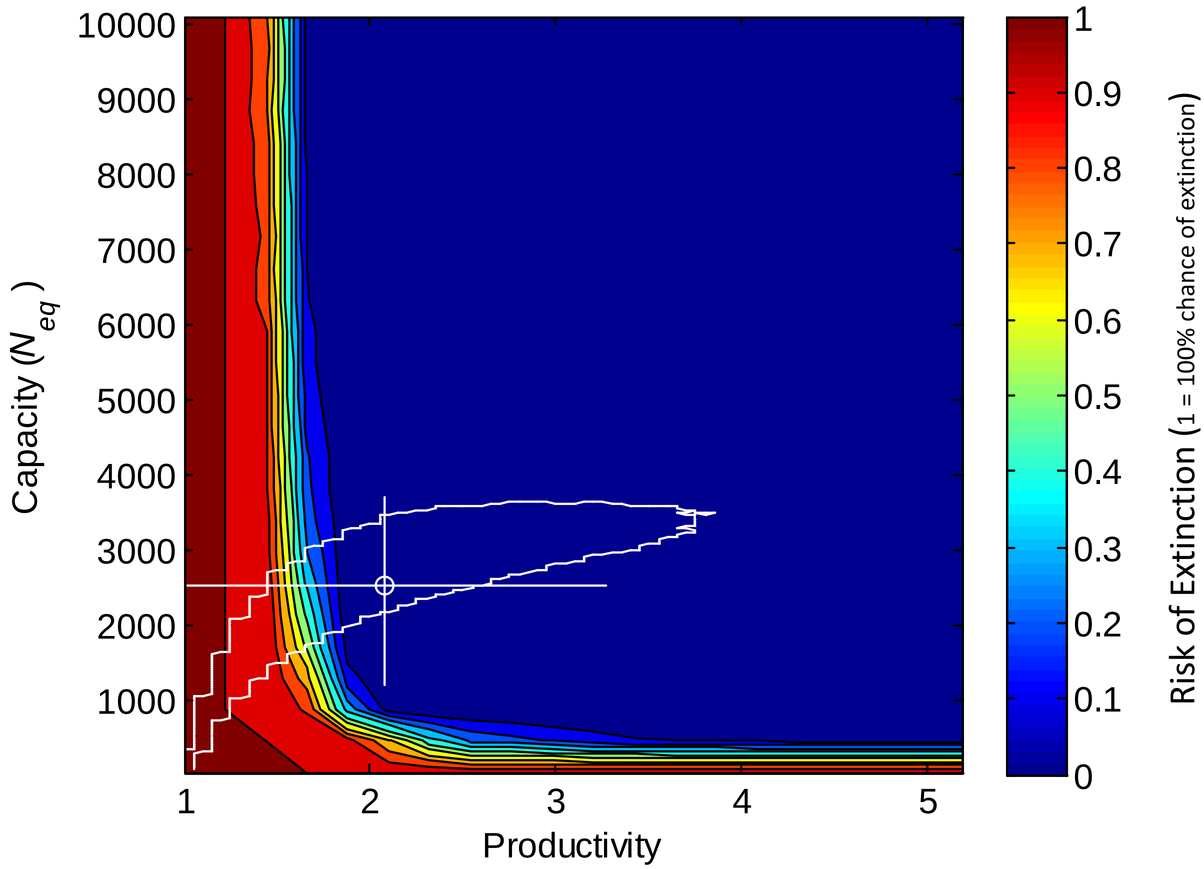

Figure A-III: 1. Viability curve resulting from the PVA for Elk River Chinook.

Persistence will also be assessed at the next status assessment through the use of a PVA to generate extinction risks (ER). The ER goal for all populations for which there will be data is <1% (i.e., a very low probability of extinction and a very high persistence level).

Spatial structure will also be assessed at the next status assessment, generally as it was assessed for criterion 2 for spatial structure: aggregating occupancy information from spawner or redd surveys across the period between assessments, with the goal being to have occupancy in all major tributaries over the assessment period. Spatial structure for chum, which are less widely distributed in basins, will be investigated to determine spawning locations outside of existing standard surveys.

Diversity will also be assessed at the next status assessment through several metrics, depending on the SMU. Age composition will be assessed for those SMUs where these data are obtainable during spawner surveys or adult trapping. Spawner timing will be assessed for many populations. Migration timing will be assessed for populations which pass a fixed observation point. Goals are not indicated for diversity metrics given limited existing data. However, as data are gathered and prior to the next status assessment, ODFW will compare the metrics against historical information (where available), literature values, angler catch timing, and hatchery fish influences in order to get an "early warning" about diversity concerns.

The metrics in Table A-III: 1 are for adults because adults are historically the primary "currency" for management considerations. However, understanding other life history stages is important for understanding potential life stage "bottlenecks" that limit population levels. So, efforts will be made to obtain information for the following metrics relative to juvenile fish: density or abundance, freshwater productivity (outmigrants from parental spawners), ocean productivity (resulting spawners from outmigrants), juvenile occupancy, and juvenile outmigrant timing. These efforts will depend on resources and the outcome of feasibility work to collect the data.

Detailed Abundance Goals and Management Implications

Table A-III: 2. Population- and strata-specific abundances for Desired Status, sliding scale harvest decisions, observed range, and conservation decisions. Empty cells indicate that there are no data at the given scale. "*TBD*" indicates that additional data or analyses are needed to determine target abundances in the future. "---" indicates that there is no population, but angling in this area may be affected by the indicated harvest thresholds and conservation levels. "N / A" indicates that the metric is not applicable for the population or stratum. Light green shading indicates values that are for reference only (i.e., management decisions are not based directly on these).

			WILD Spawners							
SMU	Stratum	Population	Desired Abundance (75th)		High Harvest Threshold	Observed Abundance (50th)		Low Harvest Threshold	Critical Abundance	
CHINOOK	North Coast	Necanicum	34,500	*TBD*	*TBD*	24,300		*TBD*	9,100	*TBD*
		Nehalem		12,100			9,900			3,800
		Tillamook		10,500			7,800			3,700
		Nestucca		11,900			6,600			1,600
	Mid Coast	Salmon	55,000	1,800	*TBD*	40,600	1,200	*TBD*	14,700	400
		Siletz		8,100			5,800			2,300
		Yaquina		9,600			6,300			2,200
		Alsea		9,300			7,600			2,900
		Yachats **Aggregate**		*TBD*						*TBD*
		Siuslaw		26,200			19,700			6,900
	Umpqua	Lower Umpqua	6,500	*TBD*	*TBD*	4,300		*TBD*	1,500	*TBD*
		Middle Umpqua		*TBD*						*TBD*
		North Umpqua		---			---			---
		South Umpqua		6,500			4,300			1,500
	Mid-South Coast	Tenmile	27,700	---	*TBD*	20,000	---	*TBD*	7,400	---
		Coos		6,300			4,400			1,800
		Coquille		14,300			10,700			3,500
		Floras		700			400			100
		Sixes		4,400			2,800			1,200
		Elk		2,000			1,700			800
	SMU Total		123,700	123,700	*TBD*	89,200	89,200	*TBD*	32,700	32,700
SPRING CHINOOK	Umpqua	Lower Umpqua	5,200	---	*TBD*	3,500	---	*TBD*	2,000	---
		Middle Umpqua		---			---			---
		North Umpqua		4,600			3,300			2,000
		South Umpqua		600			200			*N / A*
	SMU Total		5,200	5,200	*TBD*	3,500	3,500	*TBD*	2,000	2,000
WINTER STEELHEAD	North Coast	Necanicum	21,800	5%	N / A	19,800		N / A	9,900	*TBD*
		Nehalem		20%			1,800			600
		Tillamook		50%						*TBD*
		Nestucca		25%						*TBD*
	Mid Coast	Salmon	18,500	10%	N / A	14,400		N / A	7,200	*TBD*
		Siletz		25%						*TBD*
		Yaquina		10%						*TBD*
		Alsea		25%						*TBD*
		Yachats **Aggregate**		10%						*TBD*
		Siuslaw		20%						*TBD*
	Umpqua	Lower Umpqua	24,600	10%	N / A	19,100		N / A	8,200	*TBD*
		Middle Umpqua		20%						*TBD*
		North Umpqua		40%			6,900			2,200
		South Umpqua		30%						*TBD*
	Mid-South Coast	Tenmile	20,700	5%	N / A	16,000		N / A	8,000	*TBD*
		Coos		30%						*TBD*
		Coquille		50%						*TBD*
		Floras		5%						*TBD*
		Sixes		10%						*TBD*
	SMU Total		85,600	---	---	69,300	---	---	33,300	---
SUMMER STEELHEAD	Mid Coast	Siletz	---	600	N / A	---	300	N / A	---	200
	Umpqua	North Umpqua	---	4,200	N / A	---	3,200	N / A	---	1,200
	SMU Total		---	4,800	---	---	3,500	---	---	1,400

Notes for Table A-III: 2:

- Desired Abundance is the mean future wild spawner abundance goal which actions across Management Categories identified in the CMP are trying to attain. Desired Abundance for populations has no direct harvest management implications. Unless otherwise indicated, Desired Abundance is equivalent to the recent observed 75th percentile of estimated spawners (across the period indicated for each SMU below[80]), which in almost all cases is greater than a 20% increase of the Observed Abundance. This increase in Desired Abundance is intended to strengthen populations, provide greater resiliency of the populations to future threats such as climate change and development associated with human population growth or expansion, and provide more consistent and improved fisheries.

- The High and Low Harvest Thresholds have not yet been determined. Thresholds should only be identified after an intended forecast model is identified, so consistent abundance determinations are utilized in the forecast and threshold. Currently a forecast model exists for Chinook, but the CMP identifies the desire to develop an improved forecast model, likely considering marine survival indicators as well as abundance. The intended result of applying a sliding scale for Chinook harvest, and therefore identification of the High and Low Harvest Thresholds, is to allow increased harvest during periods similar to the late 1990's and early 2000's when there was an extended period of above average abundances and to limit retention during periods similar to the late 2000's when there was an extended period of low abundances.

- Observed Abundance is the 50th percentile of the log-normal distribution of wild spawner abundance for the period indicated below for each SMU.

- The Critical Abundance is an historically low wild spawner abundance below which long-term persistence becomes uncertain and at which no harvest will be allowed within a population if this level is reached in two successive years (i.e., one year observed at this level and a second forecasted to be at this level). However, given uncertainty associated with the population abundance estimates and the forecasting results, ODFW will apply a weight of evidence approach utilizing all available information, including the professional opinions of local biologists, to determine if the population in question is actually experiencing a serious decline in abundance. If Critical Abundance levels for a stratum are observed in two successive years, ODFW shall initiate an evaluation of additional actions that are warranted to protect the stratum from long-term decline. Unless otherwise indicated within SMU-specific notes below, Critical Abundance levels are calculated as (SMSY+20%)*0.5, where SMSY is the spawner abundance at maximum sustainable yield from the stock-recruit relationship for the population (described in the Current Status section for Abundance and Productivity), the 20% increase in SMSY is a risk buffer for uncertainty in the estimation of SMSY and future threats to populations, and taking half of the resulting product is consistent with Critical Abundances identified in other plans (ODFW 2013) and ocean harvest management forums (PFMC 2012, see Amendment 16). Note that Critical Abundance levels are intended to be high enough to allow time for management actions to be implemented to improve a population's status before risk becomes too great, but not too high that they unnecessarily constrain fisheries when viability is not at risk.

- In order to maintain valid comparisons, future spawner abundance estimates will be calculated in the same manner as the values in this table were developed, as indicated below in the SMU-specific notes. If methods producing different results are employed, abundance targets will be revised at the time of re-assessment.

- Values in this table are estimates, which will be improved through time as sampling methods or protocols improve (see **Appendix V – Monitoring Approach** for critical uncertainties and actions for improving estimates).

[80] See **Appendix II – Current Status Methods and Results** for a description of how the data periods were determined.

Chinook

- Spawner abundances are from a) mark-recapture calibrated aerial redd counts (South Umpqua population), b) the "new" method of spawner estimation using a habitat-based model calibrated to mark-recapture estimates to expand results from standard survey sites, c) established relationships between mark-recapture estimates and standard survey results, and d) mark-recapture estimates.

- Spawner abundances exclude spring-run and summer-run life history variants where present, due to the lack of forecasting methods for these runs, the lack of population-level expansions from different sampling methods, an inability to adequately account for them in the PVA models, and harvest limits and closures intended to add extra measures of protection to these runs.

- The data range for abundance percentiles is from 1986-2011.

- The Desired Abundance for Elk River Chinook (the non-viable Chinook population) is the 50^{th} percentile plus 20%, which was greater than the 75^{th} percentile.

- The Critical Abundance for the four Chinook populations with divergent PVA results (Tillamook, Nestucca, Salmon, and Floras) is the 5^{th} percentile of spawner abundance rather than (SMSY+20%)*0.5 given the conflicting model results (which are used to derive SMSY).

- The abundance goals used in the Pacific Salmon Treaty (PST) process for Escapement Indicator Stocks are currently different from those indicated here given different spawner expansion methods and different purposes, although ODFW will work to include the methods and goals of the CMP in the PST process as appropriate.

- Current forecast methods utilizing sibling regression will be utilized until improved methods are developed.

- Mark-recapture and PCM accuracy and the relative magnitude of spawner estimates across populations will be assessed through time given professional opinion by some that results may be inaccurate (e.g., too low for the Tillamook and Siletz and too high for the Siuslaw).

Spring Chinook

- Spawner abundances are from a) Winchester Dam counts (North Umpqua population) and b) holding pool counts in the South Umpqua.

- The data range for abundance percentiles is from 1972-2010.

- The Desired Abundance for South Umpqua Spring Chinook, which were found to not be viable because they were below the Minimum Equilibrium Threshold (MET = 500), is MET plus 20%.

- South Umpqua Spring Chinook do not have a Critical Abundance because there is already no harvest on this population within the South Umpqua.

- A forecast model for North Umpqua Spring Chinook will be developed.

Winter Steelhead

- Spawner abundances are from a) Winchester Dam counts (North Umpqua population), b) an expansion of standard surveys in the Salmonberry (a portion of the Nehalem population), and c) random redd surveys (expanded to abundance[81]) conducted at the stratum scale.

- The data range for abundance percentiles is from 1946-2011 (North Umpqua), 1973-2011 (Salmonberry/Nehalem), and 2003-2012 (strata).

- The Desired Abundance for populations is the expected apportionment of strata goals to populations, based on a variety of information, including population-specific kilometers of distribution and estimated population redd densities using data aggregated from 2003-2012, juvenile snorkel surveys, smolt trap data, historical harvest data, and professional judgment; the apportionment is preliminary and will be monitored and adjusted as necessary as new data are collected (apportionment in the Mid Coast stratum is particularly noted as in need of verification). Strata goals are the observed 75^{th} percentile of spawners monitored at the strata scale (2003-2012), plus the 75^{th} percentile for North Umpqua winter steelhead (which is not included in strata monitoring) for the Umpqua stratum.

- The strata-level Critical Abundances are 1/2 of Observed Abundances given that the time period to develop percentiles was limited and seems to have encompassed relatively abundant years over the past several decades based on data in the two populations with abundances over longer time periods; resulting values are less than the 1^{st} percentile over this data period, but roughly equivalent to the 5^{th}:50^{th} percentile ratio for SMUs with longer time periods.

Summer Steelhead

- Spawner abundances are from a) Winchester Dam counts (North Umpqua population) and b) counts at the Siletz Falls trap (Siletz population).

- The data range for abundance percentiles is from 1947-2009 (North Umpqua) and 1993-2010 (Siletz).

Chum and Cutthroat Trout

- Spawner abundance goals are not established given there are no data upon which to base these, and no anticipated monitoring to measure this into the future.

- Cutthroat harvest will be reduced when: a) coho exhibit extremely low marine survival (mainstem harvest in tidally-influenced areas across the SMU will not be allowed to protect the searun life history; tributaries will remain open) and b) harvest is considered an issue for cutthroat when winter steelhead hit stratum-level Critical Abundances in consecutive years (if harvest is considered a concern for cutthroat, the geographic scale of harvest reduction will range from local mainstem and/or tributary closures within Management Areas to the stratum, depending on available information).

<u>Limiting Factor Metrics and Targets</u>

ODFW will use the following measurable criteria (Table A-III: 3) to track progress of actions addressing limiting factors within Management Categories. Future decisions on SMU health and overall management success will primarily be made by using the VSP criteria identified in Table A-III: 1, although it is possible that some of the criteria in Table A-III: 3 may be considered in SMU status assessments as well. Note that there are only a few identified goals for Management Categories. This is because there are not enough data to assess specific effects of each limiting factor as they relate to the VSP parameters (especially abundance and

[81] The relationship between the number of adult females and males and redds is variable between sites and years and the lower, constant conversion rate currently used for expansion (*adults* = 1.04**redds*+42; ODFW 2005b) is likely an underestimate of the actual number of winter steelhead present in a stratum and is currently being revisited.

productivity) for these SMUs, and therefore the quantity of response necessary to achieve Desired Status is unknown and will only be known after the effects are seen through VSP monitoring. The metrics below are intended to track progress in order to get a general understanding of whether there are any changes occurring in the limiting factors. Those with targets are ones within ODFW's direct control and for which adaptive management may be necessary at some point in the future to meet objectives in the CMP, if warranted due to limiting factors in these Management Categories.

Table A-III: 3. Management Category metrics. See *Appendix V – Monitoring Approach* for a description of how metrics will be evaluated. Management targets are only defined for pHOS and steelhead harvest. "Track" indicates that there are no specific targets for this metric, but monitoring will be conducted. "*" indicates proposed metrics; ODFW will work with other agencies to identify the most appropriate and feasible metrics (e.g., Dent et al. 2005). Abbreviations are: pHOS – percent of hatchery fish on spawning grounds, DCCO – double-crested cormorant, and SMB – smallmouth bass.

	Metric	Chinook	Spring Chinook	Chum	Winter Steelhead	Summer Steelhead	Cutthroat
Hatchery Fish	pHOS	*variable - see Table A-III: 4 for details*					
Fishing/Harvest	Total Harvest Rate	Track	Track	0%	<10%	<10%	Investigate
	# Harvested	Track	Track	Track	Track	Track	---
Other Species-Predation	Pinniped Injury Marks	Track					
	Cumulative Spring Maximum Daily DCCO #	Track					
	SMB Abundance/Index	Track					
Habitat: Water Quality	% Compliant Miles-Temperature*	Track					
	Summer Base Temperature (7-day mean max)*	Track					
	% Compliant Miles-Toxic Pollutants*	Track					
	% Compliant Miles-Sedimentation*	Track					
Habitat: Water Quantity	% Under-Allocated Miles*	Track					
	% Miles with Instream Flows*	Track					
	Summer Base Flow	Track					
Habitat: Access	% Miles Accessible	Track					
	Estuarine and Mainstem Acreage	Track					
	Sea-Level Rise in Estuary*	Track					
Habitat: Physical	HabRate-Chinook	Track					
	HabRate-Steelhead	Track					
	HabRate-Coho	Track					
Habitat: Restoration/Conservation Expenditures ($)*		Track					

pHOS Targets

The following objectives for managing hatchery fish risk and setting pHOS targets are based upon a practical approach that acknowledges both the importance of hatchery programs to provide fishing opportunity and the potential risk that they may pose to wild populations (see **Hatchery Fish)**. The intent of the pHOS targets is for all hatchery programs to be managed such that their impact to wild populations does not affect their viability. The approach sets an overall pHOS target for a wild population's spawning grounds, except in areas close to acclimation/release sites and hatcheries. Ideally, the lowest pHOS target identified in Table A-III: 4 for each population would be observed throughout the population; however, higher rate targets are identified and will be allowed in areas close to hatchery release facilities as long as the wild population's viability is not jeopardized[82]. It is impossible for all returning

[82] A pHOS target is identified for the majority of each wild population's spawning areas. In the case of populations where hatchery fish are not released, or some populations with hatchery releases that are targeted for special emphasis, this target is a population-wide target. The population-specific target for the majority of the wild spawning area is based on a risk allowance for the population and will be <10%, ≤10% or ≤30% for populations with no stocked hatchery fish, lower risk levels, and higher risk levels, respectively. In populations where hatchery fish are stocked, allowances are made for locations with high numbers of hatchery fish if those areas are near acclimation or hatchery sites or are not used heavily by wild fish. If the population-level estimate of pHOS is above the population-wide/majority spawning area target (e.g., a randomly selected annual spawner survey site occurs near a hatchery or release site), an alternative calculation to assess pHOS can be made by excluding the immediate area of the hatchery or acclimation/release site from the calculation. The immediate area of hatchery or release sites is defined as all upstream and downstream reaches, including tributaries, within a two- or four-mile radius for Chinook and steelhead, respectively. If this alternative calculation is used, the pHOS target for most areas where wild fish spawn (i.e., everywhere besides the excluded area) will be the

hatchery fish to be harvested, or collected at traps, so efforts must be made to keep the numbers that do escape the fishery as low as possible and to try to attract the hatchery fish to areas that are less preferred by wild spawners. The targets are summarized in Table A-III: 4 and are intended to be evaluated as a running nine-year average. A nine-year average is used to allow for some variability in the level of naturally spawning hatchery fish, but ensures that the long-term impact from hatchery fish is at, or below, targets. Assessing the effectiveness of actions taken to achieve the pHOS targets will occur on an annual basis and actions may be modified if it appears the 9-year average target will be surpassed. Also, although not monitored at the Management Area scale annually, the pHOS target for Wild Fish Emphasis Areas is <10%.

Chinook

Fall-Run Chinook

The fall run of Chinook is the predominant run of Chinook into coastal basins and wild fall-run Chinook support 80% of the very popular coast-wide bay and river Chinook fisheries. These fish are also harvested at significant levels in ocean fisheries leading to harvest being a significant risk factor for these populations. To ensure the coastal fisheries are sustained or improved, it will be important to maintain or increase the productivity of wild Chinook populations. The productivity of these populations is primarily affected by the following factors that can be controlled: habitat quality and quantity; harvest levels; and hatchery fish interactions. This plan identifies actions to address the first two factors in separate sections. Hatchery fish interactions with wild Chinook populations will be controlled by managing where hatchery fish are released and the level of hatchery fish that spawn with wild fish.

Hatchery fall-run Chinook are currently released into half of the Chinook population areas in the SMU (Necanicum, Tillamook, Nestucca, Salmon, Lower Umpqua, Middle Umpqua, Coos, Coquille, and Elk). Those populations currently not receiving hatchery fall-run Chinook (Nehalem, Siletz, Yaquina, Alsea, Yachats, Siuslaw, South Umpqua, and Sixes) will be managed for wild Chinook only. Of those population areas with hatchery fall-run Chinook releases, the goal will be to keep the level of naturally spawning hatchery fish fairly low in most of them, but allow somewhat higher levels of hatchery fish in a few areas that are spread across the SMU.

The proportion of hatchery fish that comprise natural spawners in the Tillamook, Nestucca, Lower Umpqua, Middle Umpqua, Coos and Coquille is targeted for a lower risk level of 10% or less for the majority of the wild spawning areas. Targets of less than 30% and 60% for significant and less significant spawning areas[83], respectively, within a two-mile radius of the hatchery or release site are also allowed if these sites skew the population-wide rate in any given year. In most of these populations, the release location attracts the hatchery fish to areas where they can be more effectively harvested and will be less likely to spawn in the more preferred wild spawning areas. Where traps are located near release sites, ODFW will make efforts to remove returning hatchery fish to prevent them from spawning in the wild.

In the Necanicum, Salmon, and Elk[84] Chinook population areas, a higher level of risk from hatchery fish will be allowed. The target for the level of hatchery fish that comprise natural spawners is 30% or less for the majority of the wild spawning areas. In the Necanicum and Salmon, targets of less than 60% and 90% for significant and less significant spawning areas, respectively, within a two-mile radius of the hatchery or release site are also allowed if these sites skew the population-wide rate in any given year. The CMP identifies actions in the **Hatchery Fish Actions** section for Salmon River to attempt to attract more fish into the hatchery trap and reduce the number of hatchery fish spawning in preferred wild fish spawning areas. In Elk River, which requires actions to become viable, there is no allowance for exclusion of any areas around the hatchery, and weirs will be used in two tributaries of the Elk River (Anvil Creek and Rock Creek), along with reductions in

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population-wide/majority spawning area target. The target for the immediate area of the hatchery or release site will be based both on the risk allowance for the larger population area and whether the area contains significant wild spawning habitat. A population with a lower risk allowance will have targets of <30% and <60% pHOS for significant and less significant spawning areas, respectively. A population with a higher risk allowance will have targets of <60% and <90% pHOS for significant and less significant spawning areas, respectively. Also, in determining the population-level pHOS estimate, the spawning habitats will be weighted by their wild fish use (i.e., areas with a higher proportion of the wild spawning population will be weighted heavier than areas with low percentages of the wild spawning population; quality and proportion of spawning habitat within an area may also be considered in the weighting). This will allow for higher pHOS levels in areas that are not significantly used by wild fish, but must be offset by pHOS estimates that are lower in areas that are more heavily used by the wild population to meet the population-wide/majority spawning area target.

[83] Significant wild spawning areas will be determined based on the quality of the spawning habitat within the area and the proportion of all spawning habitat that it represents.

[84] Although Elk River Chinook are allowed a higher risk rate, this still represents a significantly reduced risk from current risk levels, and the numerous actions identified to reduce the hatchery risk for this non-viable population (see **Hatchery Fish Actions**) are intended to improve the viability of the wild fall-run Chinook population.

releases and modifications of trap operation at the hatchery, to remove hatchery fish attempting to spawn in preferred wild fish spawning areas. Also, ODFW will conduct research with support from the Oregon Hatchery Research Center to develop methods for attracting more hatchery fish into the hatchery trap.

Spring-Run Chinook

There are hatchery spring-run Chinook releases in two Chinook population areas that have a wild spring-run life-history component (Tillamook and Nestucca). In the Tillamook population, the proportion of hatchery spring-run Chinook that comprise natural spring-run Chinook spawners is targeted for a level of 10% or less for the majority of the wild spawning areas. Targets of less than 30% and 60% for significant and less significant spawning areas, respectively, within a two-mile radius of the hatchery are also allowed if these sites skew the population-wide rate in any given year. The removal of hatchery releases from the Wilson River, a significant portion of the preferred wild spawning habitat, is identified in the **Hatchery Fish Actions** section to help achieve this pHOS target.

In the Nestucca Chinook population area, a higher level of risk from hatchery fish will be allowed. The target for the level of hatchery fish that comprise natural spawners is 30% or less for the majority of the wild spawning areas. Targets of less than 60% and 90% for significant and less significant spawning areas, respectively, within a two-mile radius of the hatchery and release sites are also allowed if these sites skew the population-wide rate in any given year. ODFW will make efforts to prevent returning hatchery fish from spawning in the wild by removing them at the hatchery weir.

Experimental Spring-Run Hatchery Programs in Yaquina and Coos Bays

If implemented, the experimental releases of hatchery spring-run Chinook into Yaquina Bay and Coos Bay will use a non-local broodstock, and, as a result, there is a risk from these fish spawning with wild Chinook (either local fall-run Chinook or spring-run Chinook in adjacent basins [because there are no local spring-run variants in these basins]). These non-local, hatchery spring-run Chinook do not trigger an allowance for an increased proportion of natural spawners with wild fall-run or spring-run Chinook in local or nearby populations, respectively (i.e., these also must fit within allowable pHOS targets within wild populations and do not constitute a separate allowance). ODFW will be able to determine the contribution of these fish to pHOS levels because hatchery fish released for these programs will be uniquely marked with a distinct fin-clip or coded-wire tag.

Spring Chinook

Only two independent wild spring Chinook populations have been defined in this SMU, and they are both in the Umpqua Basin. ODFW believes these fish are harvested at significant levels in ocean fisheries, as well as in the river fishery in the Umpqua - leading to harvest being a significant risk to these populations. The South Umpqua population has been at low abundances for some time, and ODFW assessed this population to be non-viable. Management must seek to prevent further decline and begin to improve the productivity of this population. The North Umpqua spring Chinook population was found to be viable and produces several thousand spawners each year, as well as contributing to the popular fishery in the mainstem Umpqua and North Umpqua. Since the North Umpqua is the only viable population in this SMU, management of this population must be conservative to ensure the long-term sustainability of this population and SMU, in addition to ensuring its continued contribution to the river fishery.

The North Umpqua wild spring Chinook population coexists with a large hatchery spring Chinook program. Because of the importance of this wild population, it is targeted for low risk from naturally spawning hatchery spring Chinook. The proportion of hatchery fish that comprise natural spawners in the North Umpqua is targeted for a level of 10% or less for the majority of the wild spawning areas. Targets of less than 30% and 60% for significant and less significant spawning areas, respectively, within a two-mile radius of the hatchery are also allowed if these sites skew the population-wide rate in any given year. ODFW will make efforts to remove returning hatchery fish at the hatchery trap to prevent them from spawning in the wild.

The proportion of hatchery fish that comprise natural spawners in the South Umpqua is targeted at well less than 10% in all areas where wild fish spawn (there is no release of hatchery spring Chinook in the South Umpqua). ODFW will manage this population for wild fish only, unless it is necessary to use hatchery fish to conserve the population.

Winter Steelhead

Wild winter steelhead in this SMU are not subjected to any significant harvest in ocean fisheries, and ODFW expects low impacts from river fisheries that primarily target hatchery winter steelhead. As a result, harvest is not considered a significant risk to wild populations in this SMU. Since habitat is the only other significant limiting factor for most winter steelhead populations, some populations in this SMU can be exposed to somewhat higher risks from hatchery programs than Chinook, and still be expected to achieve Desired Status. This somewhat higher risk will be allowed by considering higher proportions of hatchery-origin spawners in a larger area around the hatchery release site. In some population areas, both hatchery summer and winter steelhead are released and cannot be differentiated on the spawning grounds, and their spawning can overlap with the spawning of wild steelhead. The targets described below are for any hatchery steelhead and should include a combination of winter and summer fish if present.

Hatchery winter steelhead will be released into 11 of the 20 wild winter steelhead populations. In those population areas where hatchery fish are not released, the areas will be managed for wild fish only. These populations should have very low proportions of hatchery winter steelhead among natural spawners.

The proportion of hatchery winter steelhead that comprise natural spawners in the Nehalem, Tillamook, Siletz, Alsea, Siuslaw, South Umpqua, Coos, and Coquille winter steelhead population areas is targeted for a level of 10% or less for the majority of the wild spawning areas. Targets of less than 30% and 60% for significant and less significant spawning areas, respectively, within a four-mile radius of the hatchery or release site are also allowed if these sites skew the population-wide rate in any given year. Where traps are located near the release sites, ODFW will make efforts to remove returning hatchery winter steelhead to prevent them from spawning in the wild.

In the Necanicum, Nestucca and Tenmile winter steelhead population areas, a higher level of risk from hatchery fish will be allowed. In the Necanicum River, the CMP identifies actions in the **Hatchery Fish Actions** section to consider methods to attract and remove returning hatchery fish. The Nestucca has an important and productive winter steelhead population. Given this, there is no allowance for exclusion of any areas around acclimation/release sites or the hatchery in the Necanicum and Nestucca Rivers. In all three populations, the target for the level of hatchery fish that comprise natural spawners is 30% or less for the entire populations. In Tenmile Lake, targets of less than 60% and 90% for significant and less significant spawning areas, respectively, within a four-mile radius of the hatchery or release site are also allowed if these sites skew the population-wide rate in any given year. Where traps are located near the release sites, ODFW will make efforts to remove returning hatchery fish to prevent them from spawning in the wild.

Summer Steelhead

There are only two wild summer steelhead populations in this SMU (Siletz and North Umpqua), and both population areas have releases of hatchery summer steelhead. Both populations are targeted for low risk from hatchery fish due to their unique life-histories. The Siletz wild summer steelhead population spawns almost exclusively in the areas above Siletz Falls, while hatchery summer and winter steelhead releases are made in the Siletz well below Siletz Falls. A fish ladder over Siletz Falls provides passage above the falls and allows for hatchery fish to be removed and prevented from accessing the areas above the falls. The proportion of hatchery steelhead (winter or summer) that comprise natural steelhead spawners is targeted for a level of 5% or less in the spawning areas above Siletz Falls.

The proportion of hatchery summer steelhead that comprise natural spawners in the North Umpqua summer steelhead population area is targeted for a level of 10% or less for the majority of the wild spawning areas. Targets of less than 30% and 60% for significant and less significant spawning areas, respectively, within a four-mile radius of the hatchery are also allowed if these sites skew the population-wide rate in any given year. ODFW will make efforts to remove returning hatchery summer steelhead at the Rock Creek Hatchery trap to prevent them from spawning in the wild.

Chum and Cutthroat Trout

No hatchery releases of chum or cutthroat trout are identified in this plan, and ODFW will manage all populations in these SMUs for wild fish only. Chum conservation hatchery programs will be allowed if it is determined that such programs are necessary to maintain or improve the viability of the SMU.

Adaptive Management of Hatchery Risk

As mentioned above, it is currently difficult to measure the impact of individual hatchery programs on some individual wild populations without additional monitoring or research. The targets outlined above are based on the current understanding of the risk from interactions with hatchery fish. The Desired Status goal for those populations with a higher pHOS target is to still maintain and improve viability and become more productive. ODFW will periodically assess the productivity of wild populations as part of the adaptive management component of the CMP. If the productivity assessment of any wild population indicates that their productivity is declining, these hatchery risk targets will be re-evaluated.

The current ability to quantitatively measure the impact to a wild population from hatchery fish interactions is poor and is represented in the CMP by the proportion of hatchery fish spawning in wild spawning areas (i.e., pHOS). ODFW will be working, in coordination with the Oregon Hatchery Research Center, to pursue research that can be used to better understand the risk from hatchery fish and to develop better methods to quantitatively measure the impact from hatchery fish (e.g., the use of parental-based tagging of hatchery fish may provide the ability to determine the level of genetic introgression of hatchery fish genes into a wild population). The results of such research will be incorporated into the adaptive management process of the CMP, possibly resulting in the modification of the targets for hatchery fish interactions if appropriate.

Table A-III: 4. Stray rate targets for hatchery fish on natural spawning grounds (pHOS). Different targets for a population pertain to different locations within the population; specifically, levels inside parentheticals are for the immediate area around acclimation and hatchery release sites and whether they contain significant (lower value) or less significant (higher value) spawning habitat. The immediate area around release sites is a 2-mile radius for Chinook/Spring Chinook and a 4-mile radius for steelhead. "---" indicates that there is no population. "N / A" indicates that there are no hatchery programs which might interbreed with wild fish. Gray shading indicates that a wild spring-run or summer-run life-history variant is present (though not a population) and pHOS targets must be met for this reproductive period (where hatchery spring Chinook are stocked in these or adjacent basins).

Stratum	Basin/Population Area	Chinook	Spring Chinook	Chum	Winter Steelhead	Summer Steelhead	Cutthroat
North Coast	Necanicum	≤30 (<60/<90)	---	*N / A*	≤30	---	*N / A*
	Nehalem	<10	<10	*N / A*	≤10 (<30/<60)	---	*N / A*
	Tillamook	≤10 (<30/<60)	≤10 (<30/<60)	*N / A*	≤10 (<30/<60)	---	*N / A*
	Nestucca	≤10 (<30/<60)	≤30 (<60/<90)	*N / A*	≤30	---	*N / A*
Mid Coast	Salmon	≤30 (<60/<90)	---	*N / A*	<10	---	*N / A*
	Siletz	<10	<10	*N / A*	≤10 (<30/<60)	<5	*N / A*
	Yaquina	<10 [a]	---	*N / A*	<10	---	*N / A*
	Alsea	<10	<10	*N / A*	≤10 (<30/<60)	---	*N / A*
	Yachats Aggregate	<10	---	---	<10	---	*N / A*
	Siuslaw	<10	---	*N / A*	≤10 (<30/<60)	---	*N / A*
Umpqua	Lower Umpqua	≤10 (<30/<60)	---	*N / A*	<10	---	*N / A*
	Middle Umpqua	≤10 (<30/<60)	---	---	<10	---	*N / A*
	North Umpqua	---	≤10 (<30/<60)	---	<10	≤10 (<30/<60)	*N / A*
	South Umpqua	<10	<10	---	≤10 (<30/<60)	---	*N / A*
Mid-South Coast	Tenmile	---	---	*N / A*	≤30 (<60/<90)	---	*N / A*
	Coos	≤10 (<30/<60) [a]	---	*N / A*	≤10 (<30/<60)	---	*N / A*
	Coquille	≤10 (<30/<60)	<10	*N / A*	≤10 (<30/<60)	---	*N / A*
	Floras	<10	---	---	<10	---	*N / A*
	Sixes	<10	---	---	<10	---	*N / A*
	Elk	≤30	---	---	*out-of-SMU*	---	*out-of-SMU*

[a] Includes new hatchery spring Chinook programs that overlap.

Appendix IV – Salmonid Ecosystem Value (SEV) Habitat Scores

Table A-IV: 1. Salmonid Ecosystem Value (SEV) scores for coastal Oregon HU-12s. See Table 22 for steps in scoring methodology. ChF= fall-run Chinook, StW = winter steelhead, ChS= spring Chinook, StS= summer steelhead.

Stratum and Population Area	HU-12	HU-12 name	I. Criteria Scores									II.	III.	IV. Trumps			Final SEV (map)	Other	
			Magnitude of Salmonid Habitat			Modeled Intrinsic Potential			Salmonid Diversity			SEV_c	Relative SEV Score	IP	Estuary	chum		Federal Key WS	AFS ADA
			coho	ChF	StW	coho	ChF	StW	ChS	StS	chum								
NC Necanicum	171002010101	Upper Necanicum River	2	1	2	3	4	4	0	0	0	16	2	no	no	no	2	no	no
NC Necanicum	171002010102	Middle Necanicum River	2	1	2	3	4	4	0	0	5	21	4	no	no	yes	5	no	no
NC Necanicum	171002010103	Lower Necanicum River	4	2	3	4	5	2	0	0	5	25	5	ChF	yes	yes	5	no	no
NC NMDOT	171002010104	Ecola Creek	1	1	1	4	5	4	0	0	0	16	2	ChF	no	no	5	no	yes
NC NMDOT	171002010105	Arch Cape Creek	1	0	1	2	0	3	0	0	0	7	1	no	no	no	1	no	no
NC Nehalem	171002020101	Lousignont Creek	3	1	2	4	4	4	5	0	0	23	4	no	no	no	4	no	yes
NC Nehalem	171002020102	Wolf Creek	1	1	1	3	4	5	5	0	0	20	3	StW	no	no	5	no	no
NC Nehalem	171002020103	Clear Creek	2	1	1	4	5	4	5	0	0	22	4	ChF	no	no	5	no	yes
NC Nehalem	171002020104	Upper Rock Creek	2	0	1	3	0	4	0	0	0	10	1	no	no	no	1	no	yes
NC Nehalem	171002020105	Middle Rock Creek	2	1	2	3	5	5	5	0	0	23	4	ChF, StW	no	no	5	no	yes
NC Nehalem	171002020106	Lower Rock Creek	2	1	2	4	5	5	5	0	0	24	4	ChF, StW	no	no	5	no	yes
NC Nehalem	171002020107	Pebble Creek	2	0	1	3	0	4	0	0	0	10	1	no	no	no	1	no	yes
NC Nehalem	171002020108	East Fork Nehalem River	3	1	2	4	4	3	5	0	0	22	4	no	no	no	4	no	yes
NC Nehalem	171002020109	Coon Creek	3	2	2	4	5	4	5	0	0	25	5	ChF	no	no	5	no	no
NC Nehalem	171002020201	Crooked Creek	2	1	1	4	4	3	5	0	0	20	3	no	no	no	3	no	yes
NC Nehalem	171002020202	Deer Creek	3	1	1	4	5	4	5	0	0	23	4	ChF	no	no	5	no	yes
NC Nehalem	171002020203	Lundgren Creek	2	1	1	4	4	3	5	0	0	20	3	no	no	no	3	no	no
NC Nehalem	171002020204	Fishhawk Creek	2	1	1	4	5	4	5	0	0	22	4	ChF	no	no	5	no	yes
NC Nehalem	171002020205	Calvin Creek	2	1	1	5	4	3	5	0	0	21	4	coho	no	no	5	no	no
NC Nehalem	171002020206	Deep Creek	2	0	0	4	0	0	0	0	0	6	1	no	no	no	1	no	yes
NC Nehalem	171002020207	Northrup Creek	3	2	2	4	4	4	5	0	0	24	4	no	no	no	4	no	yes
NC Nehalem	171002020303	Squaw Creek	2	2	1	3	4	4	5	0	0	21	4	no	no	no	4	no	no
NC Nehalem	171002020302	Beneke Creek	3	1	2	3	5	4	0	0	0	18	3	ChF	no	no	5	no	yes
NC Nehalem	171002020301	Little Fishhawk Creek	2	1	2	3	5	4	0	0	0	17	2	ChF	no	no	5	no	yes
NC Nehalem	171002020304	Buster Creek	2	1	1	4	4	4	5	0	0	21	4	no	no	no	4	no	yes

Stratum and Population Area	HU-12	HU-12 name	I. Criteria Scores									II.	III.	IV. Trumps			Final SEV (map)	Other	
			Magnitude of Salmonid Habitat			Modeled Intrinsic Potential			Salmonid Diversity			SEV$_c$	Relative SEV Score	IP	Estuary	chum		Federal Key WS	AFS ADA
			coho	ChF	StW	coho	ChF	StW	ChS	StS	chum								
NC Nehalem	171002020305	Cow Creek	3	3	2	3	4	4	5	0	0	24	4	no	no	no	4	no	no
NC Nehalem	171002020306	Humbug Creek	3	2	2	3	5	4	5	0	0	24	4	ChF	no	no	5	no	yes
NC Nehalem	171002020307	Cronin Creek	2	3	2	2	3	5	5	0	0	22	4	StW	no	no	5	no	no
NC Nehalem	171002020401	Upper Salmonberry River	1	1	1	2	3	5	5	0	0	18	3	StW	no	no	5	no	yes
NC Nehalem	171002020402	North Fork Salmonberry River	1	1	1	0	0	5	0	0	0	8	1	StW	no	no	5	no	yes
NC Nehalem	171002020403	Lower Salmonberry River	1	2	2	2	3	5	5	0	0	20	3	StW	no	no	5	no	yes
NC Nehalem	171002020501	Upper North Fork Nehalem River	2	2	2	3	4	4	0	0	0	17	2	no	no	no	2	no	no
NC Nehalem	171002020502	Middle North Fork Nehalem River	3	2	2	3	5	4	0	0	0	19	3	ChF	no	no	5	no	no
NC Nehalem	171002020503	Lower North Fork Nehalem River	3	3	3	4	4	4	5	0	5	31	5	no	yes	yes	5	no	no
NC Nehalem	171002020602	Lost Creek	2	2	2	2	3	4	5	0	0	20	3	no	no	no	3	no	no
NC Nehalem	171002020601	Cook Creek	2	1	2	2	3	4	0	0	0	14	2	no	no	no	2	no	no
NC Nehalem	171002020603	Foley Creek	2	1	1	4	4	3	0	0	5	20	3	no	no	yes	5	no	yes
NC Nehalem	171002020604	Anderson Creek	2	2	2	3	4	4	5	0	5	27	5	no	yes	yes	5	no	no
NC Nehalem	171002020605	Nehalem Bay	2	2	1	4	5	3	5	0	5	27	5	ChF	yes	yes	5	no	no
NC Nestucca	171002030101	Upper Little Nestucca River	2	1	2	3	4	3	0	0	0	15	2	no	no	no	2	no	no
NC Nestucca	171002030102	Middle Little Nestucca River	2	1	2	3	4	5	0	0	0	17	2	StW	no	no	5	no	no
NC Nestucca	171002030103	Lower Little Nestucca River	2	1	2	4	5	3	0	0	5	22	4	ChF	yes	yes	5	no	no
NC Nestucca	171002030201	Upper Nestucca River	1	1	1	2	3	4	0	0	0	12	2	no	no	no	2	no	no
NC Nestucca	171002030202	Upper Nestucca River-Elk Creek	1	2	1	3	4	5	5	0	0	21	4	StW	no	no	5	yes	yes
NC Nestucca	171002030203	Upper Nestucca River-Testament Creek	2	2	2	2	3	5	5	0	0	21	4	StW	no	no	5	no	no
NC Nestucca	171002030204	Nestucca River- Niagara Creek	2	1	2	2	3	5	5	0	0	20	3	StW	no	no	5	yes	yes
NC Nestucca	171002030205	Moon Creek	1	1	2	2	3	5	0	0	0	14	2	StW	no	no	5	no	no
NC Nestucca	171002030206	Middle Nestucca River-Powder Creek	3	3	3	2	3	4	5	0	0	23	4	no	no	no	4	yes	yes
NC Nestucca	171002030207	Beaver Creek	3	2	3	4	4	4	0	0	0	20	3	no	no	no	3	no	no
NC Nestucca	171002030208	Three Rivers	2	2	2	3	4	4	5	0	5	27	5	no	no	yes	5	yes	no
NC Nestucca	171002030209	Lower Nestucca River-Farmer Creek	3	3	3	3	4	4	5	0	5	30	5	no	no	yes	5	no	no
NC Nestucca	171002030210	Lower Nestucca River (bay)	3	3	2	4	5	3	5	0	5	30	5	ChF	yes	yes	5	no	no
NC Tillamook Bay	171002030301	Upper Tillamook River	4	2	3	4	4	3	0	0	5	25	5	no	no	yes	5	no	no
NC Tillamook Bay	171002030302	Lower Tillamook River	3	2	3	5	5	2	5	0	5	30	5	coho, ChF	yes	yes	5	no	no

Stratum and Population Area	HU-12	HU-12 name	I. Criteria Scores									II.	III.	IV. Trumps			Final SEV (map)	Other	
			Magnitude of Salmonid Habitat			Modeled Intrinsic Potential			Salmonid Diversity			SEV_c	Relative SEV Score	IP	Estuary	chum		Federal Key WS	AFS ADA
			coho	ChF	StW	coho	ChF	StW	ChS	StS	chum								
NC Tillamook Bay	171002030401	Middle Fork of North Fork of Trask River	3	2	2	2	0	4	5	0	0	18	3	no	no	no	3	yes	no
NC Tillamook Bay	171002030402	North Fork of Trask River	2	3	2	2	4	5	5	0	0	23	4	StW	no	no	5	no	no
NC Tillamook Bay	171002030403	East Fork South Fork Trask River	2	1	2	2	3	4	5	0	0	19	3	no	no	no	3	no	no
NC Tillamook Bay	171002030404	South Fork Trask River	2	2	2	2	3	4	5	0	0	20	3	no	no	no	3	no	no
NC Tillamook Bay	171002030405	Upper Trask River	1	2	1	2	3	5	5	0	5	24	4	StW	no	yes	5	no	no
NC Tillamook Bay	171002030406	Lower Trask River	3	3	2	5	5	2	5	0	5	30	5	coho, ChF	yes	yes	5	no	no
NC Tillamook Bay	171002030502	Lower Devils Lake Fork Wilson River	2	1	2	3	3	4	5	0	0	20	3	no	no	no	3	no	no
NC Tillamook Bay	171002030501	South Fork Wilson River	1	1	1	1	3	4	0	0	0	11	2	no	no	no	2	no	no
NC Tillamook Bay	171002030503	North Fork Wilson River	2	1	2	2	3	4	0	0	0	14	2	no	no	no	2	no	no
NC Tillamook Bay	171002030504	Upper Wilson River-Cedar Creek	2	2	2	2	4	5	5	0	0	22	4	no	no	no	5	no	no
NC Tillamook Bay	171002030505	Jordan Creek	1	1	2	1	3	4	0	0	0	12	2	no	no	no	2	no	no
NC Tillamook Bay	171002030506	Middle Wilson River	2	2	2	2	4	4	5	0	0	21	4	no	no	no	4	no	no
NC Tillamook Bay	171002030507	Little North Fork Wilson River	1	1	1	2	4	5	0	0	5	19	3	StW	no	yes	5	yes	yes
NC Tillamook Bay	171002030508	Lower Wilson River	2	3	2	4	5	4	5	0	5	30	5	ChF	yes	yes	5	no	no
NC Tillamook Bay	171002030601	North Fork of Kilchis River	2	1	2	2	3	5	0	0	0	15	2	StW	no	no	5	yes	no
NC Tillamook Bay	171002030602	Little SF Kilchis River	3	2	3	3	4	4	0	0	5	24	4	no	no	yes	5	no	no
NC Tillamook Bay	171002030701	Upper Miami River	2	1	2	3	4	4	0	0	5	21	4	no	no	yes	5	no	yes
NC Tillamook Bay	171002030702	Lower Miami River	2	1	2	3	5	3	0	0	5	21	4	ChF	yes	yes	5	no	yes
NC Tillamook Bay	171002030800	Tillamook Bay	3	3	3	4	5	2	5	0	5	30	5	ChF	yes	yes	5	no	no
NC NMDOT	171002030901	Netarts Bay	1	0	1	3	0	2	0	0	5	12	2	no	yes	yes	5	no	no
NC NMDOT	171002030902	Sand Creek	2	1	2	4	5	2	0	0	5	21	4	ChF	yes	yes	5	no	no
NC NMDOT	171002030903	Neskowin Creek	2	1	2	4	4	3	0	0	5	21	4	no	yes	yes	5	no	no
NC NMDOT	171002030904	Spring Creek	1	0	1	4	0	1	0	0	0	7	1	no	no	no	1	no	no
MC Yaquina	171002040101	Yaquina River-Young Creek	1	1	1	4	5	3	0	0	0	15	2	ChF	no	no	5	no	no
MC Yaquina	171002040102	Yaquina River-Olalla Creek	3	2	3	5	5	4	0	0	0	22	4	coho, ChF	no	no	5	no	no
MC Yaquina	171002040103	Little Elk Creek	2	1	2	4	5	3	0	0	0	17	2	ChF	no	no	5	no	no
MC Yaquina	171002040104	Simpson Creek	3	2	3	4	5	4	0	0	5	26	5	ChF	no	yes	5	no	no
MC Yaquina	171002040201	Upper Big Elk Creek	3	2	3	4	4	3	0	0	0	19	3	no	no	no	3	no	no
MC Yaquina	171002040202	Middle Big Elk Creek	3	2	3	4	4	4	0	0	0	20	3	no	no	no	3	no	no

Stratum and Population Area	HU-12	HU-12 name	I. Criteria Scores									II.	III.	IV. Trumps			Final SEV (map)	Other	
			Magnitude of Salmonid Habitat			Modeled Intrinsic Potential			Salmonid Diversity			SEV_c	Relative SEV Score	IP	Estuary	chum		Federal Key WS	AFS ADA
			coho	ChF	StW	coho	ChF	StW	ChS	StS	chum								
MC Yaquina	171002040203	Lower Big Elk Creek	3	2	3	4	4	5	0	0	0	21	4	StW	no	no	5	no	no
MC Yaquina	171002040301	Yaquina River-Olalla Creek	3	2	3	5	5	3	0	0	5	26	5	coho, ChF	yes	yes	5	no	no
MC Yaquina	171002040302	Drift Creek	3	2	3	4	5	2	0	0	5	24	4	ChF	yes	yes	5	no	no
MC Yaquina	171002040303	Poole Slough	4	2	3	4	5	3	0	0	5	26	5	ChF	yes	yes	5	no	no
MC Siletz	171002040401	Upper North Fork of Siletz River	0	1	1	0	1	5	5	5	0	18	3	StW	no	no	5	yes	yes
MC Siletz	171002040402	Lower North Fork of Siletz River	0	1	1	0	5	4	5	5	0	21	4	ChF	no	no	5	yes	yes
MC Siletz	171002040403	South Fork Siletz River	0	1	2	0	5	2	5	5	0	20	3	ChF	no	no	5	no	no
MC Siletz	171002040501	Sunshine Creek	2	3	4	3	3	4	5	5	0	29	5	no	no	no	5	no	no
MC Siletz	171002040502	Mill Creek	3	3	4	3	4	4	5	5	0	31	5	no	no	no	5	no	no
MC Siletz	171002040601	Little Rock Creek	2	1	2	4	4	3	0	0	0	16	2	no	no	no	2	no	no
MC Siletz	171002040602	Big Rock Creek	1	2	2	4	5	4	5	0	0	23	4	ChF	no	no	5	no	no
MC Siletz	171002040701	Sam Creek	2	2	3	4	4	4	5	5	0	29	5	no	no	no	5	no	no
MC Siletz	171002040702	Euchre Creek	1	1	1	4	4	5	0	5	5	26	5	StW	no	yes	5	no	no
MC Siletz	171002040703	Upper Siletz River	3	4	5	4	4	4	5	5	5	39	5	no	no	yes	5	no	no
MC Siletz	171002040704	Middle Siletz River	4	4	5	4	4	4	5	5	5	40	5	no	yes	yes	5	no	no
MC Siletz	171002040706	Upper Drift Creek-Siletz River	2	1	2	2	3	5	0	5	0	20	3	StW	no	no	5	yes	no
MC Siletz	171002040707	Lower Drift Creek-Siletz River	2	2	4	4	5	4	5	5	0	31	5	ChF	yes	no	5	yes	no
MC Siletz	171002040708	Schooner Creek	2	1	2	3	5	5	5	0	0	23	4	ChF, StW	yes	no	5	no	no
MC Siletz	171002040705	Lower Siletz River	2	2	2	3	5	4	5	5	5	33	5	ChF	yes	yes	5	no	no
MC Siletz	171002040709	Siletz Bay	1	2	1	4	5	3	5	5	5	31	5	ChF	yes	yes	5	no	no
MC Salmon	171002040801	Slick Rock Creek	1	1	1	1	2	5	0	0	0	11	2	StW	no	no	5	no	no
MC Salmon	171002040802	Upper Salmon River	2	1	2	3	4	4	0	0	0	16	2	no	no	no	2	no	no
MC Salmon	171002040803	Lower Salmon River	3	2	3	3	5	4	0	0	5	25	5	ChF	yes	yes	5	no	no
MC NMDOT	171002040901	Devils Lake	1	0	1	4	0	2	0	0	0	8	1	no	no	no	1	no	no
MC NMDOT	171002040902	Rocky Creek	1	0	1	4	0	1	0	0	0	7	1	no	no	no	1	no	no
MC NMDOT	171002040903	Moolack Creek	2	0	2	4	0	2	0	0	0	10	1	no	no	no	1	no	no
MC Alsea	171002050101	Upper South Fork of Alsea River	1	1	1	0	0	0	0	0	0	3	1	no	no	no	1	no	no
MC Alsea	171002050102	Crooked Creek	1	1	1	3	4	4	0	0	0	14	2	no	no	no	2	no	no
MC Alsea	171002050103	Upper North Fork of Alsea River	1	2	1	3	4	5	5	0	0	21	4	StW	no	no	5	no	no

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			coho	ChF	StW	coho	ChF	StW	ChS	StS	chum								
MC Alsea	171002050104	Lower South Fork of Alsea River	3	2	3	4	4	4	5	0	0	25	5	no	no	no	5	no	no
MC Alsea	171002050105	Lower North Fork of Alsea River	2	1	2	4	5	3	5	0	0	22	4	ChF	no	no	5	no	no
MC Alsea	171002050201	Upper Lobster Creek	3	1	2	3	5	4	0	0	0	18	3	ChF	no	no	5	yes	yes
MC Alsea	171002050202	Upper Five Rivers	2	1	2	4	4	4	0	0	0	17	2	no	no	no	2	no	no
MC Alsea	171002050203	Middle Five Rivers	3	2	3	4	4	4	0	0	0	20	3	no	no	no	3	no	no
MC Alsea	171002050204	Lower Lobster Creek	3	2	3	4	5	4	5	0	0	26	5	ChF	no	no	5	yes	yes
MC Alsea	171002050205	Lower Five Rivers	2	2	2	3	4	4	5	0	0	22	4	no	no	no	4	no	no
MC Alsea	171002050301	Upper Drift Creek-Alsea River	2	1	2	3	4	4	0	0	0	16	2	no	no	no	2	yes	yes
MC Alsea	171002050302	Middle Drift Creek-Alsea River	2	2	2	3	4	4	5	0	0	22	4	no	no	no	4	yes	yes
MC Alsea	171002050303	Lower Drift Creek-Alsea River	3	3	3	3	4	5	5	0	0	26	5	StW	yes	no	5	yes	yes
MC Alsea	171002050401	Fall Creek	2	1	2	2	3	5	5	0	0	20	3	StW	no	no	5	no	no
MC Alsea	171002050402	Alsea River-Cow Creek	4	4	4	4	5	4	5	0	0	30	5	ChF	no	no	5	no	no
MC Alsea	171002050403	Alsea River-East Fork of Scott Creek	2	2	2	3	3	5	5	0	5	27	5	StW	no	yes	5	no	no
MC Alsea	171002050404	Canal Creek	3	2	3	3	4	4	5	0	5	29	5	no	yes	yes	5	no	yes
MC Alsea	171002050405	Alsea River-Eckman Creek	3	2	3	4	5	3	5	0	5	30	5	ChF	yes	yes	5	no	no
MC NMDOT	171002050501	Beaver Creek	4	1	3	4	5	3	0	0	0	20	3	ChF	yes	no	5	yes	yes
MC NMDOT	171002050502	Collins Creek - Frontal Pacific	1	0	1	4	0	2	0	0	0	8	1	no	no	no	1	no	no
MC Yachats	171002050601	Upper Yachats River	3	1	3	3	4	4	0	0	0	18	3	no	no	no	3	no	no
MC Yachats	171002050602	Lower Yachats River	2	1	2	4	5	3	0	0	0	17	2	ChF	no	no	5	no	no
MC NMDOT	171002050701	Cummins Creek	1	0	2	2	0	5	0	0	0	10	1	StW	no	no	5	yes	yes
MC NMDOT	171002050702	Tenmile Creek	2	1	2	3	4	4	0	0	0	16	2	no	no	no	2	yes	yes
MC NMDOT	171002050703	Cape Creek	3	1	3	3	3	5	0	0	0	18	3	StW	no	no	5	yes	yes
MC NMDOT	171002050704	Mercer Lake	2	0	1	4	0	3	0	0	0	10	1	no	no	no	1	no	no
MC NMDOT	171002050503	Big Creek	1	0	1	3	0	2	0	0	0	7	1	no	no	no	1	yes	yes
MC Siuslaw	171002060301	South Fork Siuslaw River	2	0	2	4	0	2	0	0	0	10	1	no	no	no	1	no	no
MC Siuslaw	171002060302	North Fork Siuslaw River	2	0	2	5	0	2	0	0	0	11	2	coho	no	no	5	no	no
MC Siuslaw	171002060303	Letz Creek-Douglas Creek	2	1	2	5	5	3	0	0	0	18	3	coho, ChF	no	no	5	no	no
MC Siuslaw	171002060304	Siuslaw River-Siuslaw Falls	3	1	2	5	4	3	0	0	0	18	3	coho	no	no	5	no	no
MC Siuslaw	171002060305	Dogwood Creek	4	2	3	4	4	4	0	0	0	21	4	no	no	no	4	no	no

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			Magnitude of Salmonid Habitat			Modeled Intrinsic Potential			Salmonid Diversity			SEV_c	Relative SEV Score	IP	Estuary	chum		Federal Key WS	AFS ADA
			coho	ChF	StW	coho	ChF	StW	ChS	StS	chum								
MC Siuslaw	171002060306	Siuslaw River-Siuslaw Bend	3	2	3	4	5	4	0	0	0	21	4	ChF	no	no	5	no	no
MC Siuslaw	171002060307	Esmond Creek	2	1	2	4	4	4	0	0	0	17	2	no	no	no	2	no	no
MC Siuslaw	171002060308	Whitaker Creek	3	2	3	4	4	5	0	0	0	21	4	StW	no	no	5	no	yes
MC Siuslaw	171002060101	Upper Wolf Creek	3	1	3	4	4	3	0	0	0	18	3	no	no	no	3	no	no
MC Siuslaw	171002060102	Lower Wolf Creek	3	2	3	4	5	4	0	0	0	21	4	ChF	no	no	5	no	no
MC Siuslaw	171002060201	Upper Wildcat Creek	2	1	2	4	5	3	0	0	0	17	2	ChF	no	no	5	no	no
MC Siuslaw	171002060202	Lower Wildcat Creek	3	2	4	4	4	4	0	0	0	21	4	no	no	no	4	no	no
MC Siuslaw	171002060601	Upper Lake Creek	2	1	1	3	5	4	0	0	0	16	2	ChF	no	no	5	no	no
MC Siuslaw	171002060602	Triangle Lake	4	2	3	4	5	3	0	0	0	21	4	ChF	no	no	5	no	no
MC Siuslaw	171002060603	Lake Creek-Greenleaf Creek	2	1	2	4	4	4	0	0	0	17	2	no	no	no	2	no	no
MC Siuslaw	171002060604	Lower Lake Creek	3	2	3	4	4	4	0	0	0	20	3	no	no	no	3	no	no
MC Siuslaw	171002060401	Upper Deadwood Creek	4	2	3	4	4	4	0	0	0	21	4	no	no	no	4	no	no
MC Siuslaw	171002060402	Lower Deadwood Creek	3	2	3	4	5	4	0	0	0	21	4	ChF	no	no	5	no	no
MC Siuslaw	171002060501	Upper Indian Creek	4	3	4	4	4	4	0	0	0	23	4	no	no	no	4	yes	yes
MC Siuslaw	171002060502	Lower Indian Creek	2	2	2	3	5	5	0	0	0	19	3	ChF, StW	no	no	5	no	no
MC Siuslaw	171002060701	Upper North Fork Siuslaw River	4	2	3	3	3	4	0	0	0	19	3	no	no	no	3	yes	no
MC Siuslaw	171002060702	Lower North Fork Siuslaw River	5	3	3	4	5	3	0	0	0	23	4	ChF	yes	no	5	no	no
MC Siuslaw	171002060801	Turner Creek	3	2	3	3	4	4	0	0	0	19	3	no	no	no	3	no	no
MC Siuslaw	171002060803	Knowles Creek	5	3	4	3	4	4	0	0	0	23	4	no	yes	no	5	no	yes
MC Siuslaw	171002060802	Sweet Creek	2	1	1	4	5	4	0	0	0	17	2	ChF	no	no	5	yes	yes
MC Siuslaw	171002060804	Bernhardt Creek	5	2	3	4	5	3	0	0	0	22	4	ChF	yes	no	5	no	no
MS NMDOT	171002070101	Maple Creek	3	0	2	4	0	3	0	0	0	12	2	no	no	no	2	no	no
MS NMDOT	171002070102	Fiddle Creek	3	0	2	4	0	3	0	0	0	12	2	no	no	no	2	no	no
MS NMDOT	171002070103	Siltcoos Lake	4	0	1	4	0	2	0	0	0	11	2	no	no	no	2	no	no
MS NMDOT	171002070104	Tahkenitch Lake-Tahkenitch Creek	5	0	2	4	0	2	0	0	0	13	2	no	no	no	2	no	no
UM North Ump	171003010101	Diamond Lake South	0	0	0	0	0	0	0	0	0	0	1	no	no	no	1	no	no
UM North Ump	171003010102	Silent Creek	0	0	0	0	0	0	0	0	0	0	1	no	no	no	1	no	no
UM North Ump	171003010103	Diamond Lake	0	0	0	0	0	0	0	0	0	0	1	no	no	no	1	no	no
UM North Ump	171003010201	North Umpqua Headwaters	0	0	0	0	0	0	0	0	0	0	1	no	no	no	1	yes	no

Stratum and Population Area	HU-12	HU-12 name	I. Criteria Scores									II.	III.	IV. Trumps			Final SEV (map)	Other	
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			coho	ChF	StW	coho	ChF	StW	ChS	StS	chum								
UM North Ump	171003010202	Bradley Creek	0	0	0	0	0	0	0	0	0	0	1	no	no	no	1	no	no
UM North Ump	171003010204	Lake Creek	0	0	0	0	0	0	0	0	0	0	1	no	no	no	1	no	no
UM North Ump	171003010203	Thirsty Creek	0	0	0	0	0	0	0	0	0	0	1	no	no	no	1	no	no
UM North Ump	171003010205	Lemolo Reservoir	0	0	0	0	0	0	0	0	0	0	1	no	no	no	1	no	no
UM North Ump	171003010501	Warm Springs Creek	0	0	0	0	0	0	0	0	0	0	1	no	no	no	1	no	no
UM North Ump	171003010502	Loafer Creek	0	0	0	0	0	0	0	0	0	0	1	no	no	no	1	no	no
UM North Ump	171003010503	North Umpqua River-Potter Creek	0	0	0	0	0	0	0	0	0	0	1	no	no	no	1	no	no
UM North Ump	171003010504	Deer Creek	0	0	0	0	0	0	0	0	0	0	1	no	no	no	1	no	no
UM North Ump	171003010505	Soda Springs Reservoir	0	0	0	0	0	0	0	0	0	0	1	no	no	no	1	no	no
UM North Ump	171003010301	Clearwater River Headwaters	0	0	0	0	0	0	0	0	0	0	1	no	no	no	1	no	no
UM North Ump	171003010302	Bear Creek	0	0	0	0	0	0	0	0	0	0	1	no	no	no	1	no	no
UM North Ump	171003010303	Stump Lake	0	0	0	0	0	0	0	0	0	0	1	no	no	no	1	no	no
UM North Ump	171003010304	Lower Clearwater River	0	0	0	0	0	0	0	0	0	0	1	no	no	no	1	no	no
UM North Ump	171003010401	Fish Creek Headwaters	0	0	0	0	0	0	0	0	0	0	1	no	no	no	1	no	yes
UM North Ump	171003010402	Rough Creek	0	0	0	0	0	0	0	0	0	0	1	no	no	no	1	no	no
UM North Ump	171003010403	Middle Fish Creek	0	0	0	0	0	0	0	0	0	0	1	no	no	no	1	no	no
UM North Ump	171003010404	Lower Fish Creek	0	0	0	0	0	0	0	0	0	0	1	no	no	no	1	no	no
UM North Ump	171003010801	Boulder Creek-North Umpqua River	1	0	1	1	0	0	0	5	0	8	1	no	no	no	1	yes	yes
UM North Ump	171003010802	Copeland Creek	1	1	1	0	4	5	5	5	0	22	4	StW	no	no	5	yes	yes
UM North Ump	171003010803	Illahee Facial	1	1	2	3	3	5	5	5	0	25	5	StW	no	no	5	no	no
UM North Ump	171003010804	Calf Creek	1	0	1	2	0	5	0	5	0	14	2	StW	no	no	5	yes	yes
UM North Ump	171003010805	Panther Creek	1	0	1	0	0	3	0	5	0	10	1	no	no	no	1	no	no
UM North Ump	171003010806	Apple Creek Facial	1	1	2	3	4	5	5	5	0	26	5	StW	no	no	5	no	no
UM North Ump	171003010807	Williams Facial	1	1	2	2	2	5	5	5	0	23	4	StW	no	no	5	no	no
UM North Ump	171003010808	Blitzen Facial	1	1	2	2	4	5	5	5	0	25	5	StW	no	no	5	no	no
UM North Ump	171003010809	Susan Creek	1	2	3	3	3	4	5	5	0	26	5	no	no	no	5	no	no
UM North Ump	171003010701	Steamboat Headwaters	0	0	4	0	0	5	0	5	0	14	2	StW	no	no	5	yes	no
UM North Ump	171003010702	Upper Steamboat Facial	0	0	3	0	0	4	0	5	0	12	2	no	no	no	2	no	no
UM North Ump	171003010703	Big Bend Creek	0	0	1	0	0	5	0	5	0	11	2	StW	no	no	5	yes	yes

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			coho	ChF	StW	coho	ChF	StW	ChS	StS	chum								
UM North Ump	171003010704	Middle Steamboat Facial	1	1	2	0	4	5	5	5	0	23	4	StW	no	no	5	no	no
UM North Ump	171003010705	Steelhead Creek	0	0	1	0	0	0	0	5	0	6	1	no	no	no	1	no	no
UM North Ump	171003010706	Lower Steamboat Facial	1	1	2	0	4	5	5	5	0	23	4	StW	no	no	5	no	no
UM North Ump	171003010601	Upper Canton Creek	0	0	2	0	0	4	0	5	0	11	2	no	no	no	2	yes	yes
UM North Ump	171003010602	Pass Creek	0	0	2	0	0	4	0	5	0	11	2	no	no	no	2	yes	no
UM North Ump	171003010603	Lower Canton Creek	1	1	4	0	0	5	5	5	0	21	4	StW	no	no	5	yes	yes
UM North Ump	171003010901	Upper Rock Creek	1	1	2	2	3	5	5	5	0	24	4	StW	no	no	5	no	no
UM North Ump	171003010902	East Fork Rock Creek	1	0	3	2	0	4	0	5	0	15	2	no	no	no	2	no	no
UM North Ump	171003010903	Lower Rock Creek	2	1	4	3	3	4	5	5	0	27	5	no	no	no	5	no	no
UM North Ump	171003011001	Little River Headwaters	0	0	1	0	0	5	0	5	0	11	2	StW	no	no	5	no	no
UM North Ump	171003011002	Black Creek	0	0	1	0	0	0	0	5	0	6	1	no	no	no	1	no	no
UM North Ump	171003011003	Upper Little River	1	1	2	3	4	5	5	5	0	26	5	StW	no	no	5	no	no
UM North Ump	171003011004	Emile Creek	1	0	1	0	0	0	0	5	0	7	1	no	no	no	1	no	no
UM North Ump	171003011005	Middle Little River	1	1	2	3	4	5	5	5	0	26	5	StW	no	no	5	no	no
UM North Ump	171003011006	Upper Cavitt Creek	1	0	1	0	0	3	0	0	0	5	1	no	no	no	1	no	no
UM North Ump	171003011007	Lower Cavitt Creek	2	0	2	3	0	4	0	0	0	11	2	no	no	no	2	no	no
UM North Ump	171003011008	Lower Little River	1	2	3	3	4	4	5	5	0	27	5	no	no	no	5	no	no
UM North Ump	171003011102	Oak Creek	1	0	1	4	0	2	0	5	0	13	2	no	no	no	2	no	no
UM North Ump	171003011101	Bradley Creek	2	2	3	3	4	4	5	5	0	28	5	no	no	no	5	no	no
UM North Ump	171003011103	Cooper Creek	2	2	4	3	4	4	5	5	0	29	5	no	no	no	5	no	no
UM North Ump	171003011104	Sutherlin Creek	2	0	2	4	0	2	0	0	0	10	1	no	no	no	1	no	no
UM North Ump	171003011105	Lower North Umpqua River	2	3	3	3	4	5	5	5	0	30	5	StW	no	no	5	no	no
UM South Ump	171003020101	Castle Rock Fork	0	1	2	0	3	5	5	0	0	16	2	StW	no	no	5	yes	yes
UM South Ump	171003020102	Black Rock Fork	0	1	2	0	2	5	5	0	0	15	2	StW	no	no	5	yes	yes
UM South Ump	171003020103	Quartz Creek	0	0	1	0	0	4	0	0	0	5	1	no	no	no	1	yes	yes
UM South Ump	171003020105	South Umpqua River-Skillet Creek	1	1	2	3	4	5	5	0	0	21	4	StW	no	no	5	no	no
UM South Ump	171003020104	Budkeye Creek	1	1	1	3	4	5	5	0	0	20	3	StW	no	no	5	yes	yes
UM South Ump	171003020201	Jackson Headwater	0	0	1	0	0	3	0	0	0	4	1	no	no	no	1	yes	no
UM South Ump	171003020202	Upper Jackson Facial	1	1	2	3	4	4	5	0	0	20	3	no	no	no	3	no	no

Stratum and Population Area	HU-12	HU-12 name	I. Criteria Scores									II.	III.	IV. Trumps			Final SEV (map)	Other	
			Magnitude of Salmonid Habitat			Modeled Intrinsic Potential			Salmonid Diversity			SEV_c	Relative SEV Score	IP	Estuary	chum		Federal Key WS	AFS ADA
			coho	ChF	StW	coho	ChF	StW	ChS	StS	chum								
UM South Ump	171003020203	Squaw Creek	1	0	1	1	0	5	0	0	0	8	1	StW	no	no	5	yes	yes
UM South Ump	171003020204	Beaver Creek	1	0	1	2	0	4	0	0	0	8	1	no	no	no	1	yes	yes
UM South Ump	171003020205	Lower Jackson Facial	2	1	3	3	4	5	5	0	0	23	4	StW	no	no	5	no	no
UM South Ump	171003020301	Boulder Creek-Middle South Umpqua	1	1	2	2	4	4	5	0	0	19	3	no	no	no	3	yes	yes
UM South Ump	171003020302	Dumont Creek	1	1	1	2	4	5	5	0	0	19	3	StW	no	no	5	yes	yes
UM South Ump	171003020303	South Umpqua River-Ash Creek	1	1	1	3	4	4	5	0	0	19	3	no	no	no	3	no	no
UM South Ump	171003020304	Francis Facial	1	1	1	3	4	5	5	0	0	20	3	StW	no	no	5	no	no
UM South Ump	171003020305	Deadman Creek	1	0	1	3	0	5	0	0	0	10	1	StW	no	no	5	no	no
UM South Ump	171003020306	South Umpqua River-Dompier Creek	1	1	1	4	4	5	5	0	0	21	4	StW	no	no	5	no	no
UM South Ump	171003020401	Elk Headwater	1	0	1	3	0	3	0	0	0	8	1	no	no	no	1	no	no
UM South Ump	171003020402	Upper Elk Facial	1	0	1	3	0	4	0	0	0	9	1	no	no	no	1	no	no
UM South Ump	171003020403	Drew Creek	1	0	1	2	0	5	0	0	0	9	1	StW	no	no	5	no	no
UM South Ump	171003020404	Lower Elk Facial	2	1	2	3	3	5	5	0	0	21	4	StW	no	no	5	no	no
UM South Ump	171003020501	Coffee Creek	1	0	1	0	0	0	0	0	0	2	1	no	no	no	1	no	no
UM South Ump	171003020502	Corn Creek	1	1	1	3	4	5	5	0	0	20	3	StW	no	no	5	no	no
UM South Ump	171003020503	Stouts Creek	1	0	2	2	0	4	0	0	0	9	1	no	no	no	1	no	no
UM South Ump	171003020504	Saint John Creek	2	1	2	3	3	4	5	0	0	20	3	no	no	no	3	no	no
UM South Ump	171003020505	Days Creek	2	0	2	4	0	5	0	0	0	13	2	StW	no	no	5	no	no
UM South Ump	171003020506	Shively Creek	2	1	2	3	4	5	5	0	0	22	4	StW	no	no	5	no	no
UM South Ump	171003020507	Canyon Creek	2	1	2	3	3	5	0	0	0	16	2	StW	no	no	5	no	no
UM South Ump	171003020508	O'Shea Creek	2	2	2	3	4	4	5	0	0	22	4	no	no	no	4	no	no
UM South Ump	171003020601	South Fork Cow Creek	0	0	0	0	0	0	0	0	0	0	1	no	no	no	1	no	no
UM South Ump	171003020602	Cow Creek-Dismal Creek	0	0	0	0	0	0	0	0	0	0	1	no	no	no	1	no	no
UM South Ump	171003020603	Cow Creek-Galesville Reservoir	0	0	0	0	0	0	0	0	0	0	1	no	no	no	1	no	no
UM South Ump	171003020701	Cow Creek-Whitehorse Creek	2	1	2	4	5	4	0	0	0	18	3	ChF	no	no	5	no	no
UM South Ump	171003020702	Cow Creek-Quines Creek	2	1	2	4	4	4	0	0	0	17	2	no	no	no	2	no	no
UM South Ump	171003020703	Cow Creek-Fortune Branch	2	1	2	5	5	3	5	0	0	23	4	coho, ChF	no	no	5	no	no
UM South Ump	171003020704	Windy Creek	2	0	2	4	0	4	0	0	0	12	2	no	no	no	2	no	no
UM South Ump	171003020705	Cow Creek-McCullough Creek	2	1	2	4	4	3	5	0	0	21	4	no	no	no	4	no	no

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			coho	ChF	StW	coho	ChF	StW	ChS	StS	chum								
UM South Ump	171003020706	Cow Creek-Dads Creek	1	1	2	3	3	5	5	0	0	20	3	StW	no	no	5	no	no
UM South Ump	171003020707	Cow Creek-Riffle Creek	1	1	1	3	3	5	5	0	0	19	3	StW	no	no	5	no	no
UM South Ump	171003020801	Upper West Fork Cow Creek	1	0	1	0	0	3	0	0	0	5	1	no	no	no	1	no	no
UM South Ump	171003020802	West Fork Cow Creek-Gold Mountain Creek	1	0	2	2	0	5	0	0	0	10	1	StW	no	no	5	no	no
UM South Ump	171003020803	West Fork Cow Creek-Elk Valley Creek	2	1	2	3	3	5	0	0	0	16	2	StW	no	no	5	no	no
UM South Ump	171003020804	West Fork Cow Creek-Bear Creek	1	1	2	3	3	5	0	0	0	15	2	StW	no	no	5	yes	no
UM South Ump	171003020901	Middle Creek	2	1	3	3	3	5	0	0	0	17	2	StW	no	no	5	yes	no
UM South Ump	171003020902	Union Creek	1	2	2	3	4	5	5	0	0	22	4	StW	no	no	5	no	no
UM South Ump	171003020903	Cattle Creek	1	1	2	4	3	4	5	0	0	20	3	no	no	no	3	no	no
UM South Ump	171003020904	Doe Creek	2	2	2	3	3	4	5	0	0	21	4	no	no	no	4	no	no
UM South Ump	171003020905	Lower Cow Creek	2	2	3	4	3	3	5	0	0	22	4	no	no	no	4	no	no
UM South Ump	171003021101	Judd Creek	2	2	2	4	4	4	5	0	0	23	4	no	no	no	4	no	no
UM South Ump	171003021102	Willis Creek	2	2	2	4	4	4	5	0	0	23	4	no	no	no	4	no	no
UM South Ump	171003021103	Rice Creek	2	1	2	4	4	4	5	0	0	22	4	no	no	no	4	no	no
UM South Ump	171003021001	Upper South Myrtle Creek	3	0	3	4	0	4	0	0	0	14	2	no	no	no	2	no	no
UM South Ump	171003021002	Lower South Myrtle Creek	2	1	1	5	5	5	0	0	0	19	3	coho, ChF, StW	no	no	5	no	no
UM South Ump	171003021003	Upper North Myrtle Creek	2	0	3	4	0	4	0	0	0	13	2	no	no	no	2	no	no
UM South Ump	171003021004	Lower North Myrtle Creek	3	1	2	4	5	4	0	0	0	19	3	ChF	no	no	5	no	no
UM South Ump	171003021201	Thompson Creek	1	0	2	3	0	4	0	0	0	10	1	no	no	no	1	no	no
UM South Ump	171003021202	Berry Creek	1	0	1	0	0	0	0	0	0	2	1	no	no	no	1	no	no
UM South Ump	171003021203	Olalla Creek	2	0	2	4	0	5	0	0	0	13	2	StW	no	no	5	no	no
UM South Ump	171003021204	Tenmile Creek	2	0	3	4	0	4	0	0	0	13	2	no	no	no	2	no	no
UM South Ump	171003021205	Morgan Creek	1	0	1	4	0	3	0	0	0	9	1	no	no	no	1	no	no
UM South Ump	171003021206	Lookingglass Creek	2	2	2	5	5	4	0	0	0	20	3	coho, ChF	no	no	5	no	no
UM South Ump	171003021302	Upper Deer Creek	3	1	3	4	4	4	0	0	0	19	3	no	no	no	3	no	no
UM South Ump	171003021303	Lower Deer Creek	1	1	1	4	5	4	0	0	0	16	2	ChF	no	no	5	no	no
UM South Ump	171003021301	Roberts Creek	1	0	1	4	0	3	0	0	0	9	1	no	no	no	1	no	no
UM South Ump	171003021304	Champagne Creek	2	0	2	4	0	2	0	0	0	10	1	no	no	no	1	no	no
UM South Ump	171003021305	Lower South Umpqua River	3	5	3	4	4	4	5	0	0	28	5	no	no	no	5	no	no

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			coho	ChF	StW	coho	ChF	StW	ChS	StS	chum								
UM Middle Ump	171003030201	Upper Umpqua River	3	3	4	4	4	3	5	5	0	31	5	no	no	no	5	no	no
UM Middle Ump	171003030202	Hubbard Creek	2	0	2	3	0	5	0	0	0	12	2	StW	no	no	5	no	no
UM Middle Ump	171003030203	Cougar Creek	2	2	3	3	3	5	5	5	0	28	5	StW	no	no	5	no	no
UM Middle Ump	171003030204	Wolf Creek	3	0	4	3	0	4	0	0	0	14	2	no	no	no	2	no	no
UM Middle Ump	171003030205	Lost Creek	2	2	4	3	3	5	5	5	0	29	5	StW	no	no	5	no	no
UM Middle Ump	171003030206	Yellow Creek	2	0	2	3	0	5	0	0	0	12	2	StW	no	no	5	no	no
UM Middle Ump	171003030207	McGee Creek	2	2	4	3	4	5	5	5	0	30	5	StW	no	no	5	no	no
UM Middle Ump	171003030208	Mehl Creek	3	3	5	3	4	4	5	5	0	32	5	no	no	no	5	no	no
UM Middle Ump	171003030101	Headwaters Calapooya Creek	1	0	2	3	0	5	0	0	0	11	2	StW	no	no	5	no	no
UM Middle Ump	171003030102	Upper Calapooya Creek	2	0	3	3	0	4	0	0	0	12	2	no	no	no	2	no	no
UM Middle Ump	171003030103	Middle Calapooya Creek	3	1	3	4	4	4	0	0	0	19	3	no	no	no	3	no	no
UM Middle Ump	171003030104	Oldham Creek	3	0	3	4	0	4	0	0	0	14	2	no	no	no	2	no	no
UM Middle Ump	171003030105	Cabin Creek	3	1	3	5	5	4	0	0	0	21	4	coho, ChF	no	no	5	no	no
UM Middle Ump	171003030106	Lower Calapooya Creek	3	1	4	5	5	3	0	0	0	21	4	coho, ChF	no	no	5	no	no
UM Middle Ump	171003030301	Headwaters Elk Creek	2	0	2	4	0	4	0	0	0	12	2	no	no	no	2	no	no
UM Middle Ump	171003030302	Upper Elk Creek	4	0	4	5	0	3	0	0	0	16	2	coho	no	no	5	no	no
UM Middle Ump	171003030303	Yoncalla Creek	1	0	3	4	0	2	0	0	0	10	1	no	no	no	1	no	no
UM Middle Ump	171003030304	Upper Pass Creek	2	0	3	5	0	2	0	0	0	12	2	coho	no	no	5	no	no
UM Middle Ump	171003030305	Lower Pass Creek	3	0	4	5	0	3	0	0	0	15	2	coho	no	no	5	no	no
UM Middle Ump	171003030306	Billy Creek	2	0	2	4	0	4	0	0	0	12	2	no	no	no	2	no	no
UM Middle Ump	171003030307	Middle Elk Creek	3	1	4	4	4	4	0	0	0	20	3	no	no	no	3	no	no
UM Middle Ump	171003030308	Brush Creek	2	1	2	4	4	4	0	0	0	17	2	no	no	no	2	no	no
UM Middle Ump	171003030309	Big Tom Folley Creek	2	1	2	3	3	4	0	0	0	15	2	no	no	no	2	no	no
UM Middle Ump	171003030310	Lower Elk Creek	2	2	2	4	4	4	0	0	0	18	3	no	no	no	3	no	no
UM Lower Ump	171003030401	Paradise Creek	2	1	2	4	4	4	0	0	0	17	2	no	no	no	2	yes	no
UM Lower Ump	171003030402	Lutsinger Creek-Sawyer Creek	3	3	4	3	4	4	5	5	0	31	5	no	no	no	5	no	no
UM Lower Ump	171003030403	Little Mill Creek-Weatherly Creek	3	3	4	2	3	4	5	5	0	29	5	no	yes	no	5	no	no
UM Lower Ump	171003030501	Upper Lake Creek-Loon Lake	0	0	0	0	0	0	0	0	0	0	1	no	no	no	1	no	no
UM Lower Ump	171003030502	Lower Lake Creek-Loon Lake	0	0	0	0	0	0	0	0	0	0	1	no	no	no	1	no	no

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			coho	ChF	StW	coho	ChF	StW	ChS	StS	chum								
UM Lower Ump	171003030503	Upper Camp Creek	0	0	0	0	0	0	0	0	0	0	1	no	no	no	1	no	no
UM Lower Ump	171003030504	Lower Camp Creek	2	1	2	4	4	5	0	0	0	18	3	StW	no	no	5	no	no
UM Lower Ump	171003030505	Loon Lake-Mill Creek	1	1	1	3	4	5	0	0	0	15	2	StW	no	no	5	no	yes
UM Lower Ump	171003030601	Headwaters Smith River	4	0	5	4	0	4	0	0	0	17	2	no	no	no	2	yes	no
UM Lower Ump	171003030602	Halfway Creek	5	2	5	4	4	4	0	0	0	24	4	no	no	no	4	no	no
UM Lower Ump	171003030603	South Sister Creek	3	1	3	4	4	4	0	0	0	19	3	no	no	no	3	no	no
UM Lower Ump	171003030604	Big Creek-Lower Umpqua River	5	3	5	3	4	5	0	0	0	25	5	StW	no	no	5	no	no
UM Lower Ump	171003030701	West Fork Smith River-Lower Umpqua River	3	2	3	4	4	4	0	0	0	20	3	no	no	no	3	no	no
UM Lower Ump	171003030702	Vincent Creek	2	1	2	3	4	5	0	0	0	17	2	StW	no	no	5	no	no
UM Lower Ump	171003030703	Wassen Creek	1	1	1	4	4	4	0	0	0	15	2	no	no	no	2	no	no
UM Lower Ump	171003030704	Spencer Creek-Johnson Creek	4	3	4	4	4	4	0	0	0	23	4	no	yes	no	5	no	no
UM Lower Ump	171003030705	Upper North Fork Smith River-Lower Umpqua River	3	2	3	3	4	4	0	0	0	19	3	no	no	no	3	yes	yes
UM Lower Ump	171003030706	Lower North Fork Smith River-Lower Umpqua River	3	2	3	3	4	4	0	0	0	19	3	no	no	no	3	yes	yes
UM Lower Ump	171003030707	Lower Smith River-Lower Umpqua River	5	2	5	5	5	3	0	0	0	25	5	coho, ChF	yes	no	5	no	no
UM Lower Ump	171003030801	Dean Creek	4	3	5	4	4	3	5	5	0	33	5	no	yes	no	5	no	no
UM Lower Ump	171003030802	Scholfield Creek	3	1	3	5	5	3	0	0	0	20	3	coho, ChF	yes	no	5	no	no
UM Lower Ump	171003030803	Umpqua River Estuary	2	2	3	4	5	3	5	5	0	29	5	ChF	yes	no	5	no	no
MS Coos	171003040101	Williams River	2	1	3	3	2	5	0	0	0	16	2	StW	no	no	5	no	no
MS Coos	171003040102	Cedar Creek	3	2	3	3	4	4	0	0	0	19	3	no	no	no	3	no	no
MS Coos	171003040103	Bottom Creek	1	1	2	3	4	5	0	0	0	16	2	StW	no	no	5	no	no
MS Coos	171003040105	Fall Creek	1	1	1	3	0	4	0	0	0	10	1	no	no	no	1	no	no
MS Coos	171003040104	Tioga Creek	3	2	3	3	4	4	0	0	0	19	3	no	no	no	3	yes	no
MS Coos	171003040106	Williams River-South Fork Coos River	3	2	3	3	4	5	0	0	0	20	3	StW	no	no	5	no	no
MS Coos	171003040201	Matson Creek	1	1	1	2	2	5	0	0	0	12	2	StW	no	no	5	no	no
MS Coos	171003040202	Glenn River	1	1	1	0	0	0	0	0	0	3	1	no	no	no	1	no	no
MS Coos	171003040203	East Fork Millicoma River	3	2	3	3	4	5	0	0	0	20	3	StW	no	no	5	no	no
MS Coos	171003040204	West Fork Millicoma River	5	2	5	3	5	5	0	0	0	25	5	ChF, StW	no	no	5	no	no
MS Coos	171003040107	Daniels Creek-South Fork Coos River	4	3	4	4	5	4	0	0	0	24	4	ChF	yes	no	5	no	no
MS Coos	171003040205	Millicoma River	2	1	2	5	5	3	0	0	0	18	3	coho, ChF	yes	no	5	no	no

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			coho	ChF	StW	coho	ChF	StW	ChS	StS	chum								
MS Coos	171003040301	Coos River	1	1	1	5	5	3	0	0	0	16	2	coho, ChF	yes	no	5	no	no
MS Coos	171003040302	Catching Slough	3	2	3	4	5	1	0	0	0	18	3	ChF	yes	no	5	no	no
MS Coos	171003040303	Isthmus Slough	4	2	4	4	5	2	0	0	0	21	4	ChF	yes	no	5	no	no
MS Coos	171003040306	Coos Bay	4	3	5	4	5	3	0	0	0	24	4	ChF	yes	no	5	no	no
MS Coos	171003040304	Haynes Inlet	3	2	4	5	5	2	0	0	0	21	4	coho, ChF	yes	no	5	no	no
MS Coos	171003040307	North Spit Frontal	0	0	0	0	0	0	0	0	0	0	1	no	no	no	1	no	no
MS Coos	171003040305	South Slough	3	1	4	4	5	2	0	0	0	19	3	ChF	yes	no	5	no	no
MS Coos	171003040308	Cape Arago Frontal	1	0	1	4	0	2	0	0	0	8	1	no	no	no	1	no	no
MS Tenmile	171003040401	North Tenmile Lake	3	0	4	4	0	2	0	0	0	13	2	no	no	no	2	no	yes
MS Tenmile	171003040402	Tenmile Lake-Tenmile Creek	3	0	5	4	0	3	0	0	0	15	2	no	no	no	2	no	no
MS Tenmile	171003040403	Tenmile Creek	2	0	2	5	0	2	0	0	0	11	2	coho	yes	no	5	no	yes
MS Coquille	171003040404	Clear Creek-Frontal Pacific Ocean	1	0	1	4	0	0	0	0	0	6	1	no	no	no	1	no	no
MS Coquille	171003050101	Headwaters Middle Fork Coquille River	0	0	0	0	0	0	0	0	0	0	1	no	no	no	1	no	no
MS Coquille	171003050102	Twelve Mile Creek	0	0	2	0	0	5	0	0	0	7	1	StW	no	no	5	no	no
MS Coquille	171003050103	Upper Rock Creek	1	1	1	0	0	0	0	0	0	3	1	no	no	no	1	no	no
MS Coquille	171003050104	Slater Creek	2	2	2	3	4	5	5	0	0	23	4	StW	no	no	5	no	no
MS Coquille	171003050105	Sandy Creek	1	1	1	4	4	5	0	0	0	16	2	StW	no	no	5	no	no
MS Coquille	171003050106	Rock Creek	2	1	2	3	4	5	0	0	0	17	2	StW	no	no	5	no	no
MS Coquille	171003050109	Big Creek-Middle Fork Coquille River	2	1	2	3	4	5	0	0	0	17	2	StW	no	no	5	no	no
MS Coquille	171003050108	Middle Fork Coquille River-Belieu Creek	1	2	1	3	3	4	5	0	0	19	3	no	no	no	3	no	no
MS Coquille	171003050107	Myrtle Creek	1	1	1	4	5	5	0	0	0	17	2	ChF, StW	no	no	5	no	no
MS Coquille	171003050110	Indian Creek	2	2	2	3	4	4	5	0	0	22	4	no	no	no	4	no	no
MS Coquille	171003050201	Headwaters South Fork Coquille River	1	1	1	2	3	5	5	0	0	18	3	StW	no	no	5	yes	yes
MS Coquille	171003050202	Johnson Creek	1	1	1	1	2	5	0	0	0	11	2	StW	no	no	5	no	no
MS Coquille	171003050203	Delta Creek-South Fork Coquille River	1	2	1	3	4	5	5	0	0	21	4	StW	no	no	5	no	no
MS Coquille	171003050204	Coal Creek	1	1	1	0	0	0	5	0	0	8	1	no	no	no	1	no	no
MS Coquille	171003050205	Mill Creek	2	2	1	3	3	5	5	0	0	21	4	StW	no	no	5	no	no
MS Coquille	171003050206	Salmon Creek	2	1	2	3	4	4	5	0	0	21	4	no	no	no	4	yes	yes
MS Coquille	171003050207	Rowland Creek	2	2	2	3	4	5	5	0	0	23	4	StW	no	no	5	no	no

Stratum and Population Area	HU-12	HU-12 name	I. Criteria Scores: Magnitude of Salmonid Habitat			I. Criteria Scores: Modeled Intrinsic Potential			I. Criteria Scores: Salmonid Diversity			II.	III.	IV. Trumps			Final SEV (map)	Other	
			coho	ChF	StW	coho	ChF	StW	ChS	StS	chum	SEV_c	Relative SEV Score	IP	Estuary	chum		Federal Key WS	AFS ADA
MS Coquille	171003050208	Dement Creek	3	3	3	4	4	4	5	0	0	26	5	no	no	no	5	no	no
MS Coquille	171003050209	Catching Creek	4	2	4	5	5	3	5	0	0	28	5	coho, ChF	no	no	5	no	no
MS Coquille	171003050301	Lost Creek	0	0	0	0	0	0	0	0	0	0	1	no	no	no	1	no	no
MS Coquille	171003050302	Camas Creek	0	0	1	0	0	5	0	0	0	6	1	StW	no	no	5	no	no
MS Coquille	171003050303	Brummit Creek	1	0	1	0	0	5	0	0	0	7	1	StW	no	no	5	no	no
MS Coquille	171003050304	Brewster Canyon	1	1	2	3	3	4	5	0	0	19	3	no	no	no	3	no	no
MS Coquille	171003050305	Elk Creek-East Fork Coquille River	1	1	1	2	3	4	0	0	0	12	2	no	no	no	2	no	no
MS Coquille	171003050306	Yankee Run	3	3	3	4	5	4	5	0	0	27	5	ChF	no	no	5	no	no
MS Coquille	171003050401	Moon Creek	3	1	3	3	5	5	5	0	0	25	5	ChF, StW	no	no	5	no	no
MS Coquille	171003050402	Middle Creek-Cherry Creek	4	3	5	4	5	4	0	0	0	25	5	ChF	no	no	5	yes	yes
MS Coquille	171003050403	Woodward Creek-Hudson Creek	3	3	4	4	5	4	5	0	0	28	5	ChF	no	no	5	no	no
MS Coquille	171003050404	Lower North Fork Coquille River	3	4	3	4	5	4	5	0	0	28	5	ChF	no	no	5	no	yes
MS Coquille	171003050501	Hall Creek	3	2	4	5	5	3	5	0	0	27	5	coho, ChF	yes	no	5	no	no
MS Coquille	171003050502	Cunningham Creek	3	2	3	5	5	2	5	0	0	25	5	coho, ChF	yes	no	5	no	no
MS Coquille	171003050503	Beaver Slough	2	1	2	5	5	2	5	0	0	22	4	coho, ChF	yes	no	5	no	no
MS Coquille	171003050504	Lower Coquille River	2	2	2	4	5	3	5	0	0	23	4	ChF	yes	no	5	no	no
MS Coquille	171003050505	Bear Creek	3	2	3	4	4	4	0	0	0	20	3	no	yes	no	5	no	no
MS Coquille	171003050506	Coquille River Estuary	2	2	2	5	5	2	5	0	0	23	4	coho, ChF	yes	no	5	no	no
MS Floras	171003060101	Upper Floras Creek-New River Frontal	0	0	2	0	0	4	0	0	0	6	1	no	no	no	1	no	no
MS Floras	171003060102	Lower Floras Creek-New River Frontal	2	1	3	4	5	4	0	0	0	19	3	ChF	no	no	5	no	no
MS Floras	171003060103	Floras Lake-New River Frontal	2	0	2	5	0	2	0	0	0	11	2	coho	yes	no	5	no	no
MS Floras	171003060104	Croft Lake-New River Frontal	3	1	3	5	5	2	0	0	0	19	3	coho, ChF	yes	no	5	no	no
MS Floras	171003060105	Fourmile Creek-New River Frontal	2	1	2	4	5	4	0	0	0	18	3	ChF	yes	no	5	no	no
MS Floras	171003060106	Twomile Creek-New River Frontal	2	1	2	5	4	2	0	0	0	16	2	coho	no	no	5	no	no
MS Sixes	171003060201	Upper Sixes River	3	2	5	3	4	5	0	0	0	22	4	StW	no	no	5	no	yes
MS Sixes	171003060202	Middle Sixes River	2	2	2	3	4	5	0	0	0	18	3	StW	no	no	5	no	no
MS Sixes	171003060203	Lower Sixes River	2	2	3	4	5	3	0	0	0	19	3	ChF	yes	no	5	no	no
MS Elk	171003060301	Upper Elk River	3	3	3	2	3	5	0	0	0	19	3	StW	no	no	5	yes	yes
MS Elk	171003060302	Lower Elk River	3	2	3	3	4	4	0	0	0	19	3	no	yes	no	5	no	no

Appendix V – Monitoring Approach

For the SMUs addressed in the CMP, ODFW's monitoring approach is guided by the information needed to meet the ODFW Native Fish Conservation Policy (NFCP; Table A-V: 1), which states that "Each native fish conservation plan shall include specific, measurable criteria of species performance. Depending upon available information, ODFW will develop criteria for the following primary biological *attributes*[85]:

(a) distribution of populations within unit;
(b) adult fish abundance for constituent populations;
(c) within and among population diversity;
(d) population connectivity;
(e) survival rate to each critical life history stage;
(f) standardized rate of population growth for constituent natural populations;
(g) forecast likelihood of species management unit persistence in the near and long terms.

The ability to evaluate these biological performance attributes over time is influenced by the feasibility of collecting data for each attribute. Therefore, this monitoring plan is structured to provide estimates of biological performance at several spatial and temporal scales. Monitoring types and efforts are contingent on future funding, and the monitoring described below is a product of some rebalance and greater resource coordination among existing monitoring programs. While this monitoring plan reflects ODFW's current and planned efforts, the approach outlined below is dynamic and should be expected to change through time in response to monitoring and research results, implementation experience, adaptive management, and fluctuations in funding.

Table A-V: 1. The relationship of the primary biological attributes listed above to monitoring candidate indicators of these attributes associated with the CMP. Measurable criteria for these attributes and parameters are in Table A-III: 1 and Table A-III: 2.

NFCP Biological Attribute	CMP VSP Parameters	Metrics
Distribution of populations within unit	Spatial Structure	Estimated occurrence or distribution of adult spawners across available spawning habitat
Adult fish abundance for constituent populations	Abundance	Estimated abundance of naturally produced spawners
Within and among population diversity	Diversity	Direct measure of genetic diversity (to be determined), phenotypic variability in life history traits associated with genetic diversity, or other surrogate measure(s) [86]
Population connectivity	Spatial Structure	Derived from other metrics
Survival rate to each critical life history stage	Productivity	Estimated survival to critical life history stages[87]
Standardized rate of population growth for constituent natural populations	Productivity	Spawner/recruit data, based on estimates of adult abundance and age composition
Forecast likelihood of species management unit persistence in the near and long terms	*Persistence*	Extinction Risk (over 100 modeled years in PVA simulations)

See Table A-V: 2, Table A-V: 3, and Table A-V: 4 for details on metrics, monitoring components, and spatial monitoring scale.

[85] A measurable component in an environmental system.
[86] The estimated proportion of hatchery-origin spawners to total spawners on spawning grounds (pHOS) has been used as a surrogate for direct biological attributes and may be used to address the reproductive independence of a conservation unit and compatibility of hatchery programs with conservation goals.
[87] This will depend on new monitoring efforts or the availability of data.

Spatial and Temporal Considerations to Monitoring Measurable Criteria

Fundamental features for estimating metrics of salmonid biological performance are that site selection (the samples for the estimate) is non-biased and sampling is spatially and temporally comprehensive to account for the dynamic nature of salmonid migrations. The generalized random tessellation stratified (GRTS) design (Stevens and Olsen 2004) provides these properties, achieving a spatially balanced sample distribution that is nonetheless random. This approach to survey site selection maximizes coverage of the available sampling frame through an annual, random selection of survey sites. Another attractive feature of the GRTS design is that it can incorporate spatial patterns of resource distribution into estimates of variance, thereby providing higher precision for a given level of sampling effort (Stevens and Olsen 2003).

The GRTS design is particularly well-suited for estimating the status (current condition) of a criterion, which provides a comparative baseline for assessing future conditions. The GRTS-based design also is flexible for trend monitoring, which involves measurements taken at repeated intervals to assess the long-term tendency of a particular metric. ODFW standard survey sites have provided some information on trends in spawner abundance based on consistent multi-year sampling within specific spawning reaches. However, inference from these surveys is limited to where fish were sampled (not spatially or temporally comprehensive), and the direction and magnitude of bias in resulting spawner estimates is poorly known. The GRTS-based design can overcome these limitations by incorporating sampling from a rotating panel design, where a set of randomly-selected “annual” sites are sampled every year.

Estimation of the measurable criteria identified in the CMP will be based principally on a GRTS design (unless otherwise noted) and made at several spatial scales of inference. In addition to GRTS-based monitoring, some individual populations will have additional monitoring from which annual estimates of some criteria can be made. For example, abundance, productivity, and diversity data for some populations can be derived from fish ladder census counts or mark-recapture efforts, but these types of monitoring are less useful for assessing spatial structure. In some population areas, finer-scale information will be needed for determining the effects of specific management actions such as wild harvest or hatchery programs. These smaller spatial units are called Management Areas, and more focused and context-specific monitoring may occur there.

A Note on Measures of Productivity

There are three metrics of productivity relevant to the CMP. Adult-Adult Survival (AAS) measures the overall survival of one generation to the next and is the basis of most conventional stock-recruitment analyses. In its simplest form, a spawner-to-spawner ratio can be used to estimate AAS. In general, these are cases where age of maturity is relatively fixed and little harvest occurs. For conservation units impacted by substantial harvest mortality and having variable age of maturity, annual estimates of fishery impact and spawner age composition are needed to accurately estimate recruitment. Smolt-to-Adult Returns (SAR) measures the survival of smolts to adulthood. In most cases, SAR is used as a metric of survival during the marine portion of the life cycle. Corresponding estimates of smolts at their time of seaward migration and returning adults are needed to calculate SAR. Adult-Outmigrant Survival (AOS) measures the survival of the portion of the life cycle confined to freshwater, and it is directly applicable to assessing actions associated with freshwater habitat conservation and restoration. However, for most SMUs addressed in the CMP, rigorous estimates of smolt abundance are difficult to obtain. Because of this, SAR and AOS cannot be widely assessed.

SMU Details of VSP Monitoring

See Table A-V: 4 for a summary of the work described in this section.

Coho

Criteria for coho are defined in the *Oregon Coast Coho Conservation Plan* (ODFW 2007). The following provides a summary of the monitoring conducted for coho to assess those criteria.

Abundance
The abundance criterion for coho spawners will be estimated from the GRTS-based monitoring design developed by the U.S. EPA (Stevens 2002) and currently employed by ODFW. Survey field methods will follow those developed by the ODFW Oregon Adult Salmonid Inventory and Sampling (OASIS) program.[88] Abundance estimates derived from this GRTS-based design will represent the annual status of coho spawner abundance for each stratum. Dependent on funding, ODFW will make population-level estimates using one of the following approaches:

- GRTS-based monitoring design with a survey intensity targeting annual, population-level estimates with recommended levels of precision for all populations (see Crawford and Rumsey 2009 for ESA-listed species).
- GRTS-based monitoring design with a survey intensity targeting annual population-level estimates with recommended levels of precision for specific Indicator Populations.[89] For all other populations, abundance estimates would require aggregation of data over a 3-year period to meet precision targets.
- GRTS-based monitoring design with a survey intensity targeting annual stratum-level estimates with aggregation of data over a 3-year period required to meet precision targets at the population level.
- Other methods such as expansion of spawner counts made at randomly-selected "annual" sites that are sampled every year as a part of the GRTS-based monitoring design.

Annual estimates of spawner abundance in Siltcoos, Tahkenitch and Tenmile Lakes will continue to be made using the methodology developed by ODFW (Jacobs et al. 2002). Estimates of spawner abundance in the North Umpqua population area will be estimated through video census counts at Winchester Dam.[90] Wild fish will be distinguished from hatchery fish by the absence of adipose fin-clips.

Productivity
GRTS-based monitoring for adult abundance will be the foundation for annual stratum-level AAS estimates. Annual population-level AAS estimates may be possible if funding is available to support the required survey intensity. Variation in coho age composition (jack-adult ratios) will be assumed to be fixed and dominated by age-3 adults. Marine and in-river harvest impacts will be estimated through ongoing ODFW fishery sampling programs or mandatory angler tag reporting.

ODFW will assess SAR and AOS on an annual basis at Life Cycle Monitoring Sites (LCMS). These sites are currently located in all four strata and facilitate direct estimates of smolt and adult abundance through trapping activities (Suring et al. 2012). It is assumed that SAR and AOS estimates from these LCMS are representative of productivity in the larger strata. Although LCMS were not selected by a statistical design, the aggregate habitat conditions of the sites are representative of ESU conditions in terms of spawner abundance and freshwater productivity (Anlauf et al. 2009). Locations of LCMS have been as follows: North Coast Stratum: North Fork Nehalem River (2 sites), East Fork of the South Fork Trask River; Mid Coast Stratum: Mill Creek (Siletz River), Mill Creek (Yaquina Bay), Cascade Creek (Alsea); Umpqua Stratum: West Fork Smith River; Mid-South Stratum: Winchester Creek (Coos Bay). The Mill Creek (Yaquina Bay) LCMS provides coho jack data that are essential to setting the annual allowable maximum fishery impact for coho through Amendment 13 (A-13) to the PFMC's Salmon Fishery Management Plan (PFMC, 2012), and this work will continue. Other LCMS, existing and possibly new, provide opportunities to answer specific mechanistic research questions and ensure that unexpected changes at the Mill Creek (Yaquina Bay) LCMS do not undermine its utility for A-13 purposes.

Marine and in-river harvest impacts will be estimated through ongoing ODFW fishery sampling programs or mandatory angler tag reporting. Current angler reporting takes at least 2 years; therefore, ODFW will explore new technologies and methodologies that increase the ability to gather and analyze data annually.

[88] http://oregonstate.edu/dept/ODFW/spawn/pdf%20files/reports/2012_CohoSSManual.pdf
[89] An indicator population is one where the number of GRTS monitoring sites is increased relative to other populations to provide an annual estimate with a set precision target. These populations would tentatively include the Nehalem, Siletz, Lower Umpqua, and Coquille populations for the North Coast, Mid Coast, Umpqua, and Mid-South Coast strata respectively.
[90] This number is adjusted for harvest above the dam, based on harvest card data.

Also relevant to assessment of productivity, ODFW has conducted random surveys for juvenile coho in wadeable streams to provide stratum-level information on juvenile distribution, density, and abundance. Although current funding cannot sustain these surveys at intensities sufficient to support precise stratum-level estimates, ODFW is exploring the feasibility of incorporating juvenile surveys into habitat survey protocols to provide ESU-level estimates.

Spatial Structure

ODFW will evaluate spatial structure criteria for each population at the next assessment called for in the CMP. This evaluation will be based on the occurrence of naturally-produced adult spawners in GRTS-based surveys over the assessment period. Specific distribution benchmarks will be used in conjunction with spawner density frequency distributions to measure and assess spatial patterns.

Phenotypic Diversity

ODFW will measure diversity on an annual basis through GRTS-based surveys within each respective stratum and at each LCMS. Specific metrics and associated field measurements include:

- Spawn Timing: Date of peak spawner count
- Adult-Jack Ratios: Length categories for spawner counts[91]
- Adult Size Composition: Length frequency at LCMS and GRTS survey sites
- Migration Timing: Smolt and adult catch frequency versus date at LCMS

To account for influences of inter-annual variability in environmental conditions, ODFW will assess these measures over multi-year periods.

Proportion of Hatchery Origin Spawners (pHOS)

ODFW will use GRTS-based spawner surveys to provide annual estimates of pHOS within each stratum. Under current sampling protocol, all recovered carcasses are inspected for the presence of adipose fin-clips, and un-clipped fish are assumed to be wild. Proportions of fin-clipped fish in the sample are used as a direct measure of pHOS. Live fish are inspected for the presence of adipose fin-clips and classified as clipped, un-clipped, or unknown status. Data from live fish are used in pHOS calculations only if there is inadequate data from carcasses (fewer than 10).

Critical Uncertainties

Relative to other SMUs addressed in the CMP, there are only minor uncertainties associated with monitoring coho. Their life history traits fit well into the capabilities of current monitoring methodologies. For example, their age at spawning is relatively fixed, and they spawn and complete rearing in small streams that are conducive to visual surveys and trapping of migrants.

Chinook

Abundance

ODFW will estimate the abundance criterion for Chinook spawners using several monitoring efforts with the intent of determining the best long-term approach during the CMP implementation period. Effort will typically be scaled to provide strata and population-level estimates. Eighteen individual populations have been identified for coastal Chinook and generally consist of individual watersheds with separate estuaries. Where they occur, the spring-run components of these populations are not systematically sampled, although ODFW will conduct regular surveys in some locations. ODFW will explore the feasibility of increasing survey efforts earlier in the season. For example, in 2013 ODFW's Coastal Chinook Research and Monitoring Program (CCRMP) started monitoring in mid-September to better characterize the early-run

[91] Jack counts are often biased low because smaller fish are harder to find, so reported ratios may need some calibration.

components of Chinook where they are present in significant numbers (i.e., Nehalem, which is also sampled by the District annually). In the Siletz population area, the local ODFW District office oversees mainstem spawning surveys conducted in September and October by Lincoln County SWCD staff. Some of these fish can also be counted at Siletz Falls. Aerial surveys (i.e., helicopter) of redds also have been conducted for South Umpqua fall-run Chinook[92], and there are supplemental spawning surveys in Willow Creek for Floras Chinook.[93]

Expansion of Standard Survey Peak Counts

ODFW has traditionally used standard index surveys to monitor the abundance of coastal Chinook spawners. These surveys were first established by the Oregon Fish Commission around 1950 and have continued annually since then. Standard index sites were selected based on the judgment of local biologists who considered factors such as ease of access, high use for spawning, and feasibility of conducting foot surveys. Since their inception, the consistency of sites used as standard surveys in the Coastal SMU has varied, ranging from 9-56 sites. Starting in 1986, funding from the Pacific Salmon Commission (PSC) was used to enhance the survey program, and 56 sites (50 miles) were established. Due to issues with access to sites located on private property, only 47 sites are presently sampled. Given these limitations, there has been concern that these surveys do not represent an unbiased or representative sample of Chinook spawning habitat from which to derive spawner abundance estimates. However, recent habitat modeling efforts have allowed for better expansion of spawner abundance from standard survey peak count data (the new model is referred to as the Peak Count Model [PCM]). For most of the Chinook populations, the NFCP abundance and productivity criteria for Chinook spawners will be estimated using the PCM.[94,95] These expansion estimates can be evaluated annually at a population level to determine if any populations are within the abundance criteria set for critical status (see Table A-III: 2). These population expansion estimates also can be run through a forecast model used by ODFW's Ocean Salmon Columbia River Program (OSCRP), where population forecasts can be summed to the stratum level to support annual stratum-level harvest limit decisions (i.e., for the sliding scale harvest matrix).[96,97]

Mark-Recapture Estimates

Annual population-level abundance estimates for some populations can be augmented by mark-recapture methods.[98] Through research funding from the PSC, ODFW's CCRMP has conducted mark-recapture studies in all three Escapement Indicator Stock (EIS) basins (Nehalem, Siletz, and Siuslaw). The intent of these studies is to develop a means to expand standard index surveys in these basins using relationships to abundance estimates derived through mark-recapture. Typically, the relationship between index surveys and mark-recapture estimates has been examined through two techniques: a simple calibration factor approach and/or a weighted least squares regression. In addition to the current standard index surveys, CCRMP is investigating additional index survey sites in each basin as needed to provide better representation of spawning habitat and redundancy in sampling design. This monitoring is ongoing for the Nehalem and Siletz populations but is funded by a PSC program that is slated to expire in the near future.[99,100] For the Siuslaw population, mark-recapture is no longer conducted, and in recent years spawner abundance has been estimated by a four-point (4 years of sampling) relationship between mark-recapture estimates and spawner counts at selected standard index sites. CCRMP has conducted mark-recapture studies and creel surveys in other basins as well, including a current research project in the Nestucca. Even after cessation of annual mark-recapture studies,

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92 Future funding for these surveys is uncertain.
93 This, and other, supplemental surveys may be included in the determination of future spawner estimates for populations.
94 The utility of this model can potentially be improved through development of a state-space model that can account for any observation error that affects PCM model results
95 New and more representative standard survey sites, especially in populations with divergent PVA results, will be investigated.
96 Research is needed to continue to improve the forecast model.
97 Elk River fall-run Chinook abundance estimates are based on carcass counts rather than standard peak count index surveys.
98 Adult fish are captured and tagged as they enter tide water and re-sampled as carcasses on the spawning grounds.
99 Pacific Salmon Commission will fund research to investigate methods to improve estimation techniques like calibration efforts in the Nehalem and Siletz, but as of the writing of this plan it is up to the respective agencies involved in the PST to fund and provide data related to the escapement indicators. That is why ODFW has pursued calibration efforts and initiated the feasibility of employing GRTS-based sampling for aggregating abundance data at the stratum level.
100 ODFW has also conducted research and analyses to propose additional EISs in the mid/south-Coast area using the Umpqua and Coquille rivers; work is ongoing but these populations are not currently used as EISs in the PST process.

periodic revisits to each basin will be necessary to update the calibrations as needed given changing environmental and biological conditions.

In addition to studies in EIS basins, mark-recapture/index survey calibration methods covered by PSC base program funding can be used to estimate annual abundance of natural spawners in the Salmon River, and limited-term research funding from PSC is currently used to conduct similar work in the Elk River. The hatchery populations from the Salmon and Elk rivers are currently monitored annually as Pacific Salmon Treaty (PST) Exploitation Rate Indicator Stocks (ERIS) using a calibration from mark-recapture estimates.[101] Wild fish proportions can be obtained from spawning ground surveys in these basins, and due to their small size, census-based estimates may be possible.

GRTS-based Monitoring

The objective for implementing GRTS-based monitoring for Chinook is to establish a quantifiable relationship with other abundance estimation methods. For example, there is a need to ground truth the PCM with an independent method and to provide more information in a weight-of-evidence process where there is a great need for certainty about management actions.[102] In addition, because 4 of the 18 Chinook population areas do not have standard survey sites, mark-recapture efforts, or other monitoring methods to support population-level abundance estimates[103], GRTS-based samples in these areas can supplement existing information. ODFW also may use GRTS-based sampling to identify alternative standard survey sites for Chinook and, potentially, chum.

By leveraging ODFW's current GRTS-based effort for coho (above), this survey design can be used to provide independent stratum-level estimates of Chinook spawner abundance on an annual basis. Population-level abundance estimates based on GRTS monitoring will have poor precision when evaluated on an annual basis, but population-level abundance can be assessed by aggregating samples over a five-year period to meet precision targets.[104] These differing assessment intervals can provide reasonable levels of precision given the level of sampling effort that can be sustained with current funding. Additionally, abundance estimates with higher spatial and temporal resolution may be possible depending on the intensity of the survey effort for coho, as described above (e.g., indicator populations[105]).

In contrast to coho, the GRTS-based sampling distribution (sampling frame) for Chinook spawning habitat includes the selection of sites in two tiers; wadeable (smaller tributaries) and non-wadeable streams (larger tributaries and mainstem river reaches). In the wadeable tier there is overlap with the adult coho sample frame, and in those cases the same sites will be sampled for each species in any given year. The non-wadeable tier consists of the portion of the Chinook sample frame downstream from the adult coho sample frame and above tidewater. In this tier, a stratified sample of equal size will be selected such that each stratum has an identical sample size. Funding has been used and allocated to examine the feasibility of conducting GRTS-based monitoring in this tier, with field sampling methods being developed by ODFW's CCRMP. Feasibility tests conducted by CCRMP in 2012 and 2013 were structured to sample enough sites for strata-level estimates for the North Coast and Mid Coast. Following the feasibility study, the sampling design for the non-wadeable tier will be revisited to adjust sample sizes or to substitute a census for GRTS-based sampling[106].

[101] https://nrimp.dfw.state.or.us/CRL/Reports/Info/2012-01.pdf
[102] Examples include where PVA model indicates a non-viable population or where PVA results are highly sensitive to parameter inputs.
[103] Necanicum, Yachats aggregate, Lower Umpqua, and Middle Umpqua
[104] ODFW's Coastal Chinook Research and Monitoring Project (CCRMP) sampled a high number of sites in the Nestucca River in 2012 and are working with ODFW GRTS analysts to see if a Nestucca population estimate can be obtained.
[105] These would tentatively include the Nehalem, Siletz, Lower Umpqua, and Coquille populations for the North Coast, Mid Coast, Umpqua, and Mid-South Coast strata, respectively. Chinook populations with divergent PVA results (e.g., Tillamook, Nestucca, Salmon, Floras), and thus more uncertainty with respect to status, will also be considered for population-level random surveys as funding allows.
[106] Following the first year of sampling in the non-wadeable portion of Chinook spawning habitat (approximately 35% of available habitat, > 900 km), it was determined that a census was not possible given the current staffing levels and the need to collect scale samples from a representative portion of the population (e.g., scales from 250 fish per basin).

Protocols for GRTS-based surveys will follow those employed by OASIS to obtain peak spawner counts with the additional need to collect scale samples from every carcass encountered.[107] A metric of abundance estimates will be derived using the ***spsurvey*** package of R developed by the U.S. EPA (Diaz-Ramos 1996). This metric of spawner abundance will be computed as the index of peak abundance, which is essentially an estimate of the peak abundance extrapolated over the entire sample frame. Because of different sampling densities, separate estimates will be derived for the wadeable and non-wadeable tiers. Each peak spawner abundance value will have an associated estimate of precision calculated as the 90% confidence interval derived using the GRTS neighborhood variance estimator available through ***spsurvey***. This metric does not currently represent an actual abundance estimate. Expansion to an actual abundance estimate will require research on appropriate measures and uncertainty around spawning life, observer error, and annual variability in habitat accessibility.

Productivity

ODFW will calculate AAS on an annual basis for each EIS (i.e., Nehalem, Siletz, Siuslaw) and will evaluate intrinsic productivity at the next assessment period called for in the CMP. AAS will be estimated on a brood-year basis where surviving members of a specific cohort will be estimated through cohort reconstruction methodology. This methodology requires estimates of annual spawner age composition and estimates of marine and freshwater harvest impacts. Annual variation in age composition will be estimated from scales sampled from carcasses. Marine and in-river harvest impacts will be estimated through ongoing ODFW fishery sampling programs or mandatory angler tag reporting. Currently, the PSC provides funding to estimate marine harvest impacts through an Exploitation Rate Indicator Stock (ERIS) consisting of Chinook released from Salmon River Hatchery (Elk River Hatchery returns may also be used for this purpose). The Salmon River hatchery annually releases approximately 200,000 Chinook salmon smolts in the Salmon River on Oregon's north coast. Each fish has had its adipose fin removed and has been coded wire tagged to identify the stock from which it originated and the year of its release. Fish caught in the ocean and terminal fisheries along the West Coast of the U.S. (including Alaska) and Canada are sampled for coded wire tags to estimate the harvest rate and catch distribution. Freshwater harvest impacts are currently estimated through creel sampling programs in the Salmon, Nehalem, and Siletz basins, although the funding for the Nehalem and Siletz surveys is provided via research grants rather than implementation-level funding.[108] ODFW will estimate SAR and AOS where estimates of Chinook smolt abundance are available.

Spatial Structure

ODFW will evaluate spatial structure for each population at the next assessment called for in the CMP and will be based on the occurrence of naturally-produced adult spawners in GRTS-based surveys over the period.[109] Specific distribution benchmarks will be used in conjunction with spawner density frequency distributions to measure spatial patterns.

Phenotypic Diversity

On an annual basis, ODFW will measure metrics of phenotypic diversity through surveys within each respective stratum and for each EIS. Specific metrics and associated field measurements include:

- Spawn Timing: Date of peak spawner count
- Spawner Age Composition: Scale analysis (for certain populations-to be determined)
- Adult Size Composition: Length frequency
- Juvenile Migration Timing: Salmon River (possibly others, with the Umpqua as the tentative priority)

To account for influences of inter-annual variability in environmental conditions, ODFW will evaluate these measures at the next assessment period called for in the CMP.

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[107] Scales are sub-sampled prior to analysis to achieve 250 scale samples and are collected in order to document any changes in age composition or other population features.
[108] Creel sampling in these basins was not funded in 2013.
[109] These data can be supplemented by distribution data gathered during any mark-recapture studies.

Proportion of Hatchery Origin Spawners (pHOS)
ODFW will use GRTS-based spawner surveys to support annual estimates of pHOS within each stratum. All recovered carcasses will be inspected for the presence of adipose fin-clips, and non-clipped fish will be assumed to be wild[110]. Proportions and locations of fin-clipped fish in the sample along with the numbers and locations of wild fish in the sample will be used to measure pHOS.

Critical Uncertainties

- Status of non-independent early-run Chinook
- Long-term feasibility of surveying non-wadeable channels for spawners
- Ability to estimate outmigrants
- Long-term performance of relationships between mark-recapture and survey counts to provide spawner abundance estimates
- Accuracy and precision of GRTS-based and standard surveys
- Relationship between GRTS-based surveys and actual abundance

Spring Chinook
The CMP defines two independent populations of Spring Chinook: North Umpqua Spring Chinook and South Umpqua Spring Chinook. Naturally produced spring-run and summer-run Chinook also occur in other locations but are not considered as conservation units separate from fall-run Chinook populations. The monitoring described here pertains only to the two independent Umpqua populations.

Abundance
ODFW will estimate the abundance of North Umpqua Spring Chinook through video census counts at Winchester Dam. Wild fish will be distinguished from hatchery fish by the absence of adipose fin-clips.[111] Counts will be adjusted to remove recreational harvest impacts by subtracting harvest in the North Umpqua from angler tag reporting of un-clipped Chinook harvested upstream of Winchester Dam. The difference between video census counts and angler tag estimates will be used as the estimate of naturally-produced spawners.

The abundance of South Umpqua Spring Chinook will be estimated through snorkel and dive counts in resting holes in the upper portion of the South Umpqua River. These counts consist of underwater observations of summer-holding adults in select pools. These counts have been conducted annually by ODFW for over 40 years and provide a long term index of trend for this population. As such, counts are assumed to represent spawner abundance.

Productivity
ODFW will use size composition to assess productivity measures. Although a lack of age composition, marine harvest impacts or current smolt abundance estimates precludes AAS, SAR or AOS estimation at this time, there is some ability to collect age information during existing and planned sampling. For example, ODFW collects size data at Winchester Dam (the North Umpqua population) and also collects scales from the broodstock, which are ~70% wild fish.

Spatial Structure
Spatial structure is not directly assessed for Spring Chinook because sampling is not conducted throughout the range of spawning or rearing habitat for these populations.

[110] This is dependent upon a very high marking rate for hatchery fish.
[111] This is dependent upon a very high marking rate for hatchery fish.

Phenotypic Diversity

Measurement of phenotypic diversity is limited to estimates of run timing of North Umpqua Spring Chinook at Winchester Dam. To account for influences of inter-annual differences in environmental conditions, ODFW will evaluate run timing at the next assessment period called for in the CMP.

Proportion of Hatchery Origin Spawners (pHOS)

ODFW will make annual estimates of pHOS for the North and South Umpqua populations. Estimates of the abundance of naturally spawning hatchery fish will be derived by subtracting Rock Creek Hatchery returns and angler-tag estimates of fin-clipped fish in the North Umpqua upstream of Winchester Dam from video census counts of fin-clipped fish at the dam. This estimate will be used in conjunction with the estimate of naturally produced spawners to provide a measure of pHOS. Spawning ground surveys conducted in preferred wild spawning reaches of the North Umpqua can also help define areas where pHOS may be above desired levels.

Critical Uncertainties

- Precision of South Umpqua resting-hole counts[112]
- Lack of spatial structure estimates
- Lack of productivity estimates
- Lack of diversity estimates

Chum

Chum salmon spawn in the lower reaches of small to large-sized streams and rivers of the Oregon coast. Relative to other coastal Oregon salmon and trout, their distribution is very restricted. Within the Oregon Coastal SMU, eight basins are thought to have some level of consistent returns, with the largest population occurring in Tillamook Bay. Other significant populations are located in lower portions of the Nehalem, Necanicum and Yaquina population areas. Chum have a relatively short freshwater residence, with adults spawning in the fall and juveniles migrating to the ocean soon after their emergence the following spring. Currently, fishery impacts on Oregon Coastal chum are likely minor or insignificant. No target fisheries occur except for a brief recreational catch-and-release fishery in Tillamook Bay tributaries. Chum have traditionally been monitored through adult spawner surveys at standard survey sites, some of which have been surveyed for over 60 years. Currently, these surveys are limited to population areas north of, and including, the Yaquina.

Abundance

ODFW will assess abundance through counts of spawning adults. Nineteen standard survey sites are currently monitored in seven populations: Necanicum, Nehalem, Tillamook, Netarts Bay, Nestucca, Siletz and Yaquina. Monitoring at these sites will be continued to provide an index of the abundance trend for these populations. Additional standard survey sites might be added in the Coos Bay population area if evidence of a persistent population emerges.[113] Because of the inherent variability in spawner abundance and survey conditions, ODFW will assess abundance trends on a multi-year basis (> 5 years).

In addition to the standard surveys described above, chum are observed during some GRTS-based surveys for coho and Chinook. Locations at which chum have been consistently observed will be explored for the feasibility of making them annual survey sites, especially in populations where standard survey sites currently do not exist. During exceptional return years, observations of chum during coho and Chinook surveys also may provide an indication for locations that may more consistently support spawning chum as abundance of this species increases.

[112] ODFW did a full-river calibration in 2010 and will determine if additional work is needed
[113] There is a small spawning group in the Coos basin, most commonly seen in lower ¾ mile of Marlow Creek.

Productivity

ODFW will estimate age composition through analyses of scales from carcasses collected at standard survey sites in some basins, allowing AAS assessment.

Spatial Structure

ODFW will monitor changes in chum distribution through a combination of standard surveys targeting chum and observations of chum in GRTS-based surveys targeting coho and Chinook. Specific distribution benchmarks will be used in conjunction with occupancy or spawner density frequency distributions to measure spatial patterns. Because of their limited distribution, trends in spatial structure will be evaluated at the next assessment period called for in the CMP.

Phenotypic Diversity

The historical population structure and distribution within potential population areas of chum is unknown, although it is presumed that their abundance and distribution have been reduced from historical levels more than other SMUs. It is unknown whether current locations periodically or regularly occupied by chum were historically independent populations. Without this understanding, it is difficult to reconstruct the historical distribution for chum or to establish desired-status goals. Genetic techniques have potential for determining the uniqueness of different chum "populations" on the Oregon coast, but collection and analysis of samples for such an effort will require a new source of funding.

Monitoring of phenotypic diversity includes estimates of spawner age composition (for certain populations, through scale analysis), spawn timing, and spawner size composition. To account for influences of inter-annual variability in environmental conditions, ODFW will evaluate these parameters at the next assessment period called for in the CMP.

Proportion of Hatchery Origin Spawners (pHOS)

Oregon Coastal chum will not be systematically assessed for pHOS because no hatchery programs exist in the Coastal SMU. Although hatchery chum are not expected in the SMU, chum carcasses that are observed in standard and GRTS-based spawning ground surveys will be checked for the presence of finclips and/or tags.

Critical Uncertainties

- Current and historical population structure and distribution
- Annual estimates of age composition of spawners (requires assessment)
- Freshwater and estuarine limiting factors

Winter Steelhead

Abundance

ODFW will monitor adult winter steelhead spawners using cumulative redd counts converted to abundance to provide annual stratum-level estimates. Population-level estimates of spawner abundance will require aggregation of five-years of data to obtain estimates with acceptable precision. Population-level abundance and productivity data obtained within the timeframe of CMP implementation and viability re-assessment may require acceptance of higher annual levels of uncertainty, expansion, and assumptions in order to support a comprehensive viability assessment.

The GRTS-based sampling design will be used to select sample sites for redd surveys. Stratifying location by channel size may be employed to sample mainstem reaches at a higher rate than tributaries. Survey field methods will follow those developed by ODFW's OASIS program.[114] Proportions of live spawners observed with adipose fin-clips will be applied to redd counts to provide estimates of redds attributed to wild spawners.

[114] http://oregonstate.edu/dept/ODFW/spawn/pdf%20files/reports/STWManual2013_Final.pdf

ODFW will estimate the spawner abundance of adult winter steelhead in the North Umpqua population through video census counts at Winchester Dam. Wild fish will be distinguished from hatchery fish by the absence of adipose fin-clips. District staff also conduct additional redd surveys in some standard locations.

Productivity

ODFW will assess age composition at several LCMS. ODFW also conducts random juvenile surveys in wadeable streams to provide information on juvenile distribution, density, and abundance.

Spatial Structure

Spatial Structure will be evaluated for each population at the next assessment called for in the CMP and will be based on the occurrence of naturally-produced adult spawners in GRTS-based surveys over the period. ODFW will use specific distribution benchmarks in conjunction with redd density frequency distributions to measure spatial patterns.

Phenotypic Diversity

On an annual basis, ODFW will measure metrics of phenotypic diversity through GRTS-based surveys within each respective stratum and at each LCMS. Specific metrics and associated field measurements include:

- Spawn Timing: Date of peak redd counts
- Spawner Age Composition: Scale analysis (for certain populations)
- Adult Size Composition: Length frequency at LCMS[115]
- Migration Timing: Smolt and adult catch frequency versus date at LCMS

To account for influences of inter-annual variability in environmental conditions, ODFW will evaluate these measures at the next assessment period called for in the CMP.

Proportion of Hatchery Origin Spawners (pHOS)

ODFW will use GRTS-based spawner surveys to support annual estimates of pHOS within each stratum. Because recovery of steelhead carcasses is generally low, live spawners will be inspected for the presence of adipose fin-clips, and un-clipped fish will be assumed to be wild. Proportions and locations of fin-clipped fish in the sample along with the numbers and locations of wild fish will be used to measure pHOS. Other methods to determine proportions of hatchery fish in a population will be explored.

Critical Uncertainties

- Distribution of rearing juveniles prior to smolt migration
- Smolt abundance and ability to estimate outmigrant numbers
- Conversion of redd estimates to total abundance
- Annual estimates of age composition of spawners
- Accuracy of fin-clip observations for live spawners

Summer Steelhead

Only two populations of naturally produced summer steelhead occur within the Oregon Coastal SMU: Siletz and North Umpqua. Fortunately for monitoring purposes, the vast majority of fish in both populations spawn in the portions of these two watersheds that are located upstream from passage barriers where direct counts of adult fish are made. Hatchery programs occur in both populations, and all hatchery fish are fin-marked.

[115] ODFW also collects this information in the North Umpqua population.

Abundance

ODFW will estimate the spawner abundance of adult summer steelhead in the Siletz population through trap counts at Siletz Falls. Wild fish will be distinguished from hatchery fish by the absence of adipose fin-clips. It is not clear if summer steelhead can navigate the falls without using the trap, so ODFW will evaluate trap efficiencies in the future.

ODFW will estimate the spawner abundance of adult summer steelhead in the North Umpqua population through video census counts at Winchester Dam, where wild fish will be distinguished from hatchery fish by the absence of adipose fin-clips. ODFW also conducts snorkel counts at Steamboat and Canton, providing localized information on abundance trends. Snorkel counts may also be useful to determine the presence of hatchery fish.

Productivity

ODFW conducts random juvenile surveys in wadeable streams to provide information on juvenile distribution, density, and abundance. Methods to distinguish juvenile winter and summer steelhead will be needed to draw conclusions specific to summer steelhead.

Spatial Structure

Spatial structure will not be assessed for summer steelhead because sampling is not conducted throughout the range of spawning or rearing habitat.

Phenotypic Diversity

Monitoring of phenotypic diversity is limited to estimates of run timing at Siletz Falls and Winchester Dam. To account for influences of inter-annual variability in environmental conditions, ODFW will evaluate run timing at the next assessment period called for in the CMP.

Proportion of Hatchery Origin Spawners (pHOS)

Because no hatchery-origin fish are passed upstream of Siletz Falls, estimates of pHOS are not needed for Siletz summer steelhead. For the North Umpqua population, ODFW will assess pHOS annually. Estimates of the abundance of naturally spawning hatchery fish will be derived by subtracting the sum of angler-tag estimates of fin-clipped fish in the North Umpqua upstream of Winchester Dam and fin-clipped fish returning to Rock Creek Hatchery from the census counts of fin-clipped fish at the dam. This estimate will be used in conjunction with the estimate of naturally produced spawners described above for a direct measure of pHOS.

Critical Uncertainties

- Smolt abundance and distinguishing summer from winter steelhead
- Distribution of spawning and rearing
- Annual estimates of age composition of spawners

Coastal Cutthroat

Coastal cutthroat are widespread throughout the Oregon Coastal ESU and exhibit multiple life-history types. Available genetic information suggests that life-history types are not independent. Cutthroat trout are generally known to have some distinguishable population structure within larger stream systems, but the details regarding the relationships among life-history types in individual basins as well as the population structure are uncertain. Although the existing monitoring effort does not facilitate rigorous trend analyses, counts at Winchester Dam (N Umpqua) suggest that the abundance of the larger anadromous life history form has declined in some areas. Presently, there is no established monitoring designed to specifically target coastal cutthroat, but they are widely encountered during the course of sampling for other species. Note that ODFW does not have the ability to systematically monitor cutthroat abundance nor to discern the different life-history types (with exception of above-barrier populations which are assumed to be resident-type). The sea-run component has wide-ranging adult run-timing from July-December, presumably predicated by river flows, so seasonally targeted spawning ground surveys are logistically unfeasible.

Abundance

Although the abundance of coastal cutthroat will not be systematically monitored, ODFW will assess the abundance of anadromous forms in the Siletz and at Winchester Dam (North Umpqua). Anadromous fish will also be assessed through snorkel survey index sampling in the Wilson, Trask, and Nestucca Rivers, as has been done since 1962. Upstream and downstream movement of cutthroat can be monitored to varying degrees at LCMS, but trap designs allow many adult cutthroat to bypass upstream. Documentation of cutthroat during random juvenile surveys in wadeable streams will also provide information on juvenile distribution, density, and abundance.

Productivity

Productivity will not be assessed for coastal cutthroat. There are no available data on all demographic factors needed to assess productivity criteria for this species.

Spatial Structure

ODFW will monitor changes in the distribution of coastal cutthroat based on occurrence during GRTS-based snorkel surveys targeting juvenile coho in wadeable streams. In addition, ODFW's AQI project conducts single-pass electrofishing to look for fish presence at GRTS sites located upstream from anadromous fish distribution. Specific distribution benchmarks will be used in conjunction with presence/density frequency distributions to measure spatial patterns. Fish surveys are also conducted regularly as part of ODFW District or Oregon Department of Forestry required forest activities. These data will be tracked (locally) so they may continue to inform an understanding of cutthroat occurrence and distribution.

Phenotypic Diversity

Specific metrics for phenotypic diversity are not yet developed for coastal cutthroat. However, cutthroat can be collected at ODFW's LCMS.

Proportion of Hatchery Origin Spawners (pHOS)

Coastal cutthroat will not be assessed for pHOS because no hatchery programs exist in the Coastal SMU.

Critical Uncertainties

- Status and trend of the anadromous life history form across populations
- Status and trend of the resident life history form
- Freshwater and estuarine limiting factors

Additional Species Monitoring: Pacific Lamprey[116]

Specific methods to monitor Pacific lamprey in the Oregon Coastal ESU have not been developed. However, Pacific lamprey spawners construct redds that are highly visible, and the timing and spatial distribution of their spawning largely overlaps with that of winter steelhead. This overlap provides a monitoring opportunity as observations of lamprey redds during steelhead surveys can be used for assessment of lamprey abundance, spatial structure and spawn timing. Lamprey juveniles and adults are also commonly captured in downstream migrant traps operated by ODFW's LCM project.

Abundance

ODFW will monitor adult spawners for abundance. The metric for spawner abundance will be cumulative redd counts. Status of spawner abundance will be assessed annually for each stratum. The GRTS-based sampling design currently

[116] This anadromous species has a life history similar to the salmonids addressed in the CMP, so monitoring for this species, concomitant with that for salmonids, is described.

employed by ODFW to monitor spawning winter steelhead will be used to select sample sites, with field methods following those developed by ODFW's OASIS program (http://oregonstate.edu/dept/ODFW/spawn/pdf%20files/reports/STWManual2013_Final.pdf). ODFW will estimate the spawner abundance of adults in the North Umpqua population through video census counts at Winchester Dam.

Productivity

Productivity will not be assessed for Pacific lamprey. Lack of demographic information and estimates on the abundance of seaward migrating macropthalmia prevents estimation of AAS, SAR or AOS.

Spatial Structure

ODFW will assess spatial structure on an annual basis for each stratum based on the occurrence of redds in GRTS-based surveys. Specific distribution benchmarks will be used in conjunction with redd density frequency distributions to evaluate spatial patterns.

Phenotypic Diversity

ODFW will measure diversity on an annual basis through GRTS-based surveys within each respective stratum and at each LCMS. Specific metrics and associated field measurements include:

- Spawn Timing: Date of peak redd counts
- Adult Size Composition: Length frequency at LCMS
- Migration Timing: Juvenile and adult catch frequency versus date at LCMS

ODFW will assess these measures over multi-year periods to account for influences of inter-annual variability in environmental conditions.

Critical Uncertainties

- Precision of redd counts and relationship to spawner abundance
- Macropthalmia abundance
- Annual estimates of age composition of spawners
- Relative influence of freshwater versus marine limiting factors on productivity

Additional Species Monitoring: Amphibians and Freshwater Mussels

Since 2006, ODFW's Aquatic Inventory Project has opportunistically collected information on amphibians in conjunction with habitat surveys in wadeable coastal streams (discussed in greater detail below). This effort contributes to a coarse-scale baseline of amphibian distribution in western Oregon. Similarly, observations of freshwater mussels, including relative abundance, are recorded during snorkel surveys for juvenile coho, steelhead, and cutthroat trout. While these are not comprehensive monitoring programs, they contribute to the knowledge of these species' baseline distribution and abundance by efficiently capitalizing on current efforts to address coastal salmonids.

Management Category Monitoring

To this point, the monitoring plan has outlined current and planned efforts to measure metrics that describe VSP criteria (abundance, productivity, spatial structure, diversity). However, a comprehensive monitoring approach also must address management categories, including hatcheries, harvest, other species (predators), and habitat. Coupled with VSP monitoring, these monitoring efforts (described below) can facilitate assessment of action effectiveness and inform decisions for adaptive management.

Hatchery Fish

ODFW will monitor hatchery program performance through the annual tracking and completion of the Hatchery Program Summary form for each program. This tracking will better enable ODFW to assess program performance and make adjustments to improve contributions to fisheries. As discussed for each SMU, ODFW will monitor pHOS to indicate potential risks to wild populations. Residualism of smolts derived from wild broodstock is also a critical uncertainty that needs investigation.

Additionally, the new Yaquina and Coos spring Chinook hatchery programs will need to be monitored to assess the effectiveness of the program in providing a fishery as well as potential impacts to wild fish populations. Released hatchery fish will need to be identifiable or uniquely marked. Potential impacts to Yaquina and Coos fall-run Chinook spawners, Yaquina chum spawners, and Siletz spring-run Chinook adult migrants will be evaluated through normal monitoring. New work will be needed to assess impacts to Alsea and Coquille spring-run migrants or spawners. If feasible, impacts to juvenile Chinook and chum in the Yaquina and Coos will be assessed. Monitoring will seek to address stray rates, residualism, competition, predator attraction, and contribution to fisheries, among other items from these programs.

Fishing/Harvest

Mandatory tag returns will provide harvest information but ideally should be calibrated with creel surveys. Creel surveys associated with new harvest management monitoring will require new funding or a shift in District priorities and will be conducted as staff is available to do so. Some specific research needs are to investigate harvest rates on spring Chinook in the Umpqua and to seek a better understanding of the harvest of cutthroat since this species is not required to be logged on harvest tags. Ocean harvest information will also be obtained. By-catch and hooking mortality associated with ocean and tributary fisheries, through direct research or a more thorough literature review with application to management decisions, should also be monitored.

Other Species (Predators)

Prey sources for freshwater salmonid life stages will not be tracked. However, carcass placement (conducted to address unidentified limiting factors associated with nutrient availability) will be tracked, as it has traditionally been, through STEP. Disease occurrence is tracked within the hatchery system; any concerns over disease in wild populations will be addressed as they arise.

The tracking of several relatively simple metrics for predators will provide a better understanding of the effects or abundance of these predators through time. Metrics include pinniped injury marks (at hatcheries), cumulative spring maximum daily number of double-crested cormorants, and smallmouth bass abundance. Systematic tracking of these metrics needs to be established and may be dependent on new funding if it does not fit within existing hatchery, program, or District capacities to conduct this work. Additional information about some of these predator species is being collected by ODFW's Avian Predation Program and Marine Mammal Program to document status and address critical uncertainties. Effectiveness monitoring of predator control efforts should also be monitored.

Habitat

The ODFW Aquatic Inventory Project (AQI) conducts an extensive GRTS-based habitat monitoring program in wadeable coastal streams in support of information needed for ESA listing decisions for Oregon Coast Coho. This monitoring effort is being revised slightly to focus some monitoring effort in non-wadeable stream reaches that are used by other salmonid species (principally Chinook and chum) covered in the CMP. This is being accomplished by shifting some effort away from GRTS sites that are above the anadromous fish sampling frames and reducing the number of sites per year that are sampled in the wadeable frame. The latter adjustment will result in annual estimates of coho habitat attributes in wadeable streams at the stratum-level, in order to meet precision targets. Sites above anadromous fish distribution (generally above natural barriers) will be electrofished to check for the presence of cutthroat trout. For non-wadeable and estuarine areas, ODFW will investigate remote sensing technologies (aerial photography, LIDAR, others) for evaluating habitat attributes, particularly to track trends in peripheral/lateral connectivity between stream channels and adjacent floodplain/wetland habitat and functional estuarine acreage. ODFW will also explore the utility of remote sensing applications to infer other habitat metrics. Field measures will be processed through the HabRate model (Burke et al. 2010) in order to evaluate trends pertinent to adult and juvenile Chinook, steelhead, and coho.

In addition to the GRTS-based monitoring described above, ODFW conducts monitoring to assess the effectiveness of individual restoration projects associated with the Western Oregon Stream Restoration Program. This work should continue, especially for projects or methodologies that are not well established and should also focus on assessing whether specific goals for projects have been achieved. These efforts will help to identify successful methods and refine restoration techniques. Other effectiveness monitoring is funded by the Oregon Watershed Enhancement Board (OWEB).

ODFW will encourage other agencies to implement or continue monitoring of metrics associated with their responsibilities that affect salmon and trout. This is consistent with, and assures, implementation of the statewide *Oregon Plan for Salmon and Watersheds* Monitoring Strategy (OWEB 2003).

Funding: Base Monitoring, Critical Uncertainties

The base monitoring identified in this plan is dependent on both existing and new funding. ODFW will prioritize monitoring if funding is reduced or not obtained, and some metrics may not be measured if program capacity is inadequate. Much of the research or investigations into the critical uncertainties identified above will be dependent on new funding sources, advantageous efficiencies identified in on-going work, or funding reallocated from existing or planned efforts.

Research and Development

ODFW recognizes the need for initiatives with respect to research related to management effectiveness, new monitoring methods, more efficient protocols, and additional data analyses to address critical uncertainties and management needs while identifying program efficiencies that will facilitate ongoing and new monitoring in the face of increasing data needs and uncertainty of funding.

Management Effectiveness Research

New research initiatives are required to support more comprehensive assessment of the effectiveness of management actions, strategically fill larger data gaps, better understand management mechanisms, and resolve the critical uncertainties that underlie the management of the CMP species and the fisheries they support. During the CMP development process, many interests called for better data on how management changes would either affect fisheries or wild populations. It is hard for basic status and trend monitoring to answer these specific questions, which require a more focused study design to understand mechanisms related to management actions and specific outcomes. ODFW will make efforts to gain some capacity to conduct this type of research within its current monitoring capacity, as well as through additional funding (see **Implementation: Cost**). This will entail focused data analyses and monitoring initiatives to mechanistically address critical uncertainties, evaluate the effectiveness of specific management actions, and align monitoring results to inform adaptive management decisions. One potential model for these new monitoring initiatives is an “intensively monitored watershed” approach that uses closely coordinated monitoring of adults, juveniles, habitat, and management actions to address specific research or management questions. Higher intensity monitoring in specific basins or sub-basins also may provide a basis for rigorous evaluation of novel monitoring approaches such as those discussed below. This work will also allow for opportunities for new and stronger collaborations with other efforts, agencies, and entities in Oregon. For example, research conducted through the Oregon Hatchery Research Center (OHRC) will play a direct role in informing adaptive management decisions and resolving critical uncertainties regarding hatchery management. This work complements the work described here, and these efforts will ultimately facilitate better informed management actions to maintain and improve fisheries, including many that are important components of rural economies across Oregon. Similarly, coordination among agencies and other entities in an intensively monitored watershed approach has potential to more efficiently focus monitoring resources and expertise to address multiple questions that are of value to Oregonians and relevant to the management and conservation of Oregon’s salmon and steelhead populations.

The exact management questions and locations of research will be decided once resources for this work are available, but they will be consistent with the overarching questions raised during the development of the CMP about the risks of hatchery programs, results of removing hatchery fish, effects of harvest implementation and reduction, and specific impacts on localized wild fish populations (e.g., the effects of hatchery winter steelhead that spawn naturally in places like the Nestucca River, where hatchery programs co-exist with productive wild populations). Other questions may also address the effectiveness of predator management and habitat restoration or protection. The research will also likely take advantage of the actions carried out pursuant to the CMP to conduct hypothesis testing. The overarching objective of this work will be to improve understanding of the mechanisms underlying management actions and facilitate adaptive management with greater certainty of potential outcomes.

New Monitoring Methods

ODFW will make efforts to identify new sampling methods, analytical procedures, and scientific relationships that can improve on existing methods, increase sampling efficiency, or overcome substantial obstacles to monitoring. Concept-level examples of such methods include:

- Remote Monitoring Technologies
    - Split Beam and DIDSON Sonar to estimate spawner abundance in non-wadeable or turbid streams
    - Aerial photography, Light Detection and Ranging (LIDAR), or other remote methods for evaluating habitat attributes
    - Unmanned Aerial Systems (UAS) for spawner/redd surveys in remote areas
- Genetic Techniques
    - Analyses of environmental DNA (eDNA) to detect species presence/site occupancy
    - Genetic-based analyses (e.g., allele frequencies; kinship reconstruction) to estimate effective population size
    - Genetic analyses to evaluate the population structure of Oregon Coastal chum and to differentiate and evaluate live history variants of steelhead and Chinook.

Efforts to evaluate new monitoring methods and incorporate proven methods into field protocols will require new funding sources or reallocation of funds from existing or planned base monitoring.

Efficient Protocols and Coordination

ODFW will continue efforts to identify coordination efficiencies and scientific relationships that allow more information to be gained with the same or reduced amounts of financial or staff resources. Some results of these efforts have already been provided (e.g., incorporation of juvenile and habitat protocols; calibration of mark-recapture abundance to standard index surveys; dual coverage of the wadeable sampling frame for chinook and coho). ODFW will continue to seek similar opportunities for streamlined monitoring that enhance programmatic resilience to fluctuating funding and provide savings that can be redirected to other monitoring needs, evaluation of new methods, or research to address critical uncertainties.

Additional Data Analyses

ODFW will conduct data analyses to improve forecast models in order to best predict run sizes and more closely align optimal fishing opportunity with actual fish availability. Similarly, methods to assess observation error in sampling and to reduce the error around abundance estimates will be conducted (e.g., through the development of a "state-space" model for Chinook spawner estimation in the PCM). Identifying observation error also may help determine if PVA results are due to natural or observation error, possibly eliminating some of the confidence considerations around model results (e.g., divergent model results for Chinook). These analyses should not require that the base data upon which the abundance and productivity assessment was conducted or from which the desired status abundances were determined. Unless there is a critical management need, no analyses which do modify the base data will be implemented or utilized (though they may be investigated) until population re-assessment occurs. This will help ensure that future estimates can be compared to CMP results and goals. If management needs necessitate revision of base data, then revised abundance and productivity results (Table A-II: 11) and abundance goals (Table A-III: 2) will be documented.

Although much of ODFW's current and planned monitoring addresses questions regarding status and trend at various spatial and temporal scales, additional analyses of the extensive datasets derived from these efforts can provide useful information regarding critical uncertainties and the effectiveness of management actions. To capitalize on these existing data, ODFW will make efforts to initiate focused data analyses efforts.

Oregon Hatchery Research Center

The OHRC opened in 2005 as a cooperative effort between ODFW and Oregon State University (OSU) to resolve scientific questions related to native fish recovery and hatchery programs. In 2013, the 77th Oregon Legislative Assembly passed House Bill 3441 (HB 3441), establishing the OHRC Board, with members representing the Oregon Salmon Commission, the Columbia River gillnet salmon fishery, wild fish advocacy organizations, statewide sport angling organizations, the agricultural industry, coastal ports, the forest products industry, the independent scientific community, fish habitat restoration interests, Oregon Indian tribes, ODFW (non-voting), OSU (non-voting), and agencies of the federal government related to fish management (non-voting). Several key responsibilities of the OHRC Board are to establish strategic directions and operational objectives for the OHRC, develop the center's proposed operating budget, recommend research projects and issue requests for research proposals, review and prioritize research proposals submitted to the OHRC, and make recommendations regarding how the research projects at the OHRC may be enhanced to meet the center's strategic directions and operational objectives.

In addition to establishing the OHRC Board, HB 3441 also outlined research areas to be addressed by the OHRC to help achieve large-scale goals of improving fisheries and reducing risks to native fish from hatchery fish. These research activities include:

- Research that assists in the implementation and advancement of native fish population recovery as well as viable fisheries
- Research on methods to minimize the genetic and ecological risks to naturally produced native fish when hatchery produced fish are released in the waters of Oregon for population recovery or consumptive fishery objectives
- Research to determine the genetic and ecological risk to naturally produced native fish when wild native broodstock hatchery produced native fish are released into the waters of Oregon
- Research to determine the effect of hatchery operations on naturally produced native fish and the habitat of naturally produced native fish.

These research areas are well aligned with the goals of the NFCP and the CMP to ensure that the native fishes covered by the plan persist into the future and provide ecological and societal benefits. With this focus, research conducted through the OHRC will play a direct role in meeting the CMP Desired Status goals (e.g., actions identified for Elk River), informing adaptive management decisions and resolving critical uncertainties, such as:

- Efficacy of release and attractant strategies for conservation (e.g., minimizing stray rates, competition, residualism, and predator attraction) and fisheries (e.g., increasing recruitment to fisheries)
- Success of wild vs. domestic brood stock in terms of recruitment to the fishery and other desired fishery characteristics
- Evaluation of the factors influencing productivity of wild and hatchery-reared fish at the population level in coastal basins
- Mechanisms for producing hatchery fish that reduce risks to wild fish

ODFW will remain involved in the operation of the OHRC, and staff will be available to provide input to the Board as it reviews and prioritizes research proposals.

Data Management

Response values and contributing data for Biological (VSP) and Management Metrics will be centralized within ODFW across programs, primarily through annual completion of the *Hatchery Program Summary* (described earlier) and a *Wild Fish Monitoring Summary*. As described previously, revisions to prior-existing datasets resulting from new analytical methods will generally only be made at the time of status re-assessment called for in the CMP. ODFW will make data available to other agencies and the public, ideally through internet-based applications once they are developed (e.g., ODFW's Salmon and Steelhead Recovery Tracker website[117]).

Metric Monitoring Summary

The following tables summarize and identify the monitoring components and locations that will be used to address the metrics identified in Table A-III: 1 and Table A-III: 3 and their associated ODFW programs and methods.

The monitoring program identified here is a large effort, across many ODFW Districts, projects, sections, and programs (Table A-V: 3) to collect and utilize data in order to make management decisions about status, harvest, progress toward goals, and adaptive management within Management Categories. The CMP calls for the institution of several monitoring data management tools (the *Hatchery Program Summary* and the *Wild Fish Monitoring Summary*, which will feed an accessible database) in order to better coordinate data collection and utilization. Overall, this monitoring program will provide better information for future management assessments and decisions.

[117] https://www.odfwrecoverytracker.org

Table A-V: 2. Monitoring components to address metrics identified in Table A-III: 1 and Table A-III: 3. "*" indicates proposed metrics where monitoring or reporting methods require further development by ODFW, in coordination with other agencies in some cases.

		Metric	Monitoring Component
VSP Metrics	Abundance	Spawners	Adult
		Juveniles	Juvenile
	Productivity	Intrinsic (Pre-Harvest Adults/Spawners)	Adult (*+ Harvest below*)
		Outmigrants/Parental Spawners*	Adult, Juvenile
		Returning Spawners/Outmigrants*	Adult, Ocean RunRecon, Juvenile
	Persistence	100-Year Extinction Risk	*from Abundance and Productivity*
	Spatial Structure	Site Occupancy (Spawners)	Adult
		Site Occupancy (Juveniles)	Juvenile
	Diversity	Spawner Age Composition	Adult
		Adult Spawn Timing	Adult
		Adult Migration Timing	Adult
		Outmigrant Timing*	Juvenile
Management Metrics	Hatchery Fish	pHOS	Adult
	Fishing/Harvest	Total Harvest Rate	Harvest, Ocean RunRecon
		# Harvested	Harvest, Ocean RunRecon
	Other Species-Predation	Pinniped Injury Marks	Predator Counts
		Cumulative Spring Maximum Daily DCCO #	Predator Counts
		SMB Abundance/Index	Predator Counts
	Habitat: Water Quality	% Compliant Miles-Temperature*	*work with DEQ*
		Summer Base Temperature (7-day mean max)*	*work with DEQ*
		% Compliant Miles-Toxic Pollutants*	*work with DEQ*
		% Compliant Miles-Sedimentation*	*work with DEQ*
	Habitat: Water Quantity	% Under-Allocated Miles*	*work with OWRD*
		% Miles with Instream Flows*	*work with OWRD*
		Summer Base Flow	*existing data: USGS gauges*
	Habitat: Access	% Miles Accessible	*existing data: Fish Passage Database*
		Estuarine and Mainstem Acreage	Habitat
		Sea-Level Rise in Estuary*	*to be determined*
	Habitat: Physical	HabRate-Chinook	Habitat
		HabRate-Steelhead	Habitat
		HabRate-Coho	Habitat
	Habitat: Restoration/Conservation Expenditures ($)*		*work with OWEB*

Table A-V: 3. Summary of methods and ODFW programs associated with monitoring components identified in Table A-V: 2. Methods are described in further detail in *Appendix V – Monitoring Approach*. Abbreviations for ODFW programs follow the table. Shaded components are also represented in more detail in Table A-V: 4.

Monitoring Component	Methods	ODFW Program
Adult	Random Surveys, Fixed Site Counts, Standard Surveys, Aerial Counts, Mark-Recapture, Census, Scale Analysis	OASIS, LCM, CCRMP, Districts, Scales
Juvenile	Random Surveys, Fixed Site Counts, Estuary Sampling	WORP, LCM, Districts
Ocean RunRecon	Survival Estimates, Age Composition, Models	OSCRP, CWT/Prop, Scales (*+ Adult and Harvest components*)
Harvest	Creel Surveys, Mandatory Tags/Punchcards, Port Sampling	CCRMP, Districts, RecFish, Prop, MRP, anglers
Predator Counts	Hatchery Logs (pinniped), Bird Counts, District Initiative (as able, non-native fish)	Hatcheries, Districts, AvPP, MMP
work with…	---	Implementation Coordinator, Monitoring Coordinator
existing data:	---	Implementation Coordinator
Habitat	Wadeable and Non-Wadeable Streams, Remote Sensing, Electrofishing (cutthroat), Quantitative Models	AQI
R&D	tbd (e.g., sonar)	Monitoring Coordinator with Programs
Data Management	Database, Coordination	Monitoring Coordinator with Programs

- anglers – anglers who return the annual Combined Angling Tag (reporting will be made mandatory)
- AQI – Aquatic Inventories Project
- AvPP – Avian Predation Project
- CCRMP – Coastal Chinook Research and Monitoring Project
- CWT – Coded Wire Tag Project (within Propagation Program)
- Districts – ODFW Fish Districts located in Tillamook, Newport, Roseburg, Charleston, and Gold Beach
- Hatcheries – ODFW and STEP hatcheries on the Coast
- Implementation Coordinator – Coastal Implementation Coordinator
- LCM – Life Cycle Monitoring Project
- MMP – Marine Mammal Program (within Marine Resources Program)
- Monitoring Coordinator – statewide fish and habitat Monitoring Coordinator
- MRP – Marine Resources Program
- OASIS – Oregon Adult Salmonid Inventory and Sampling Project
- OSCRP – Ocean Salmon and Columbia River Program (within Fish Division)
- Prop – Propagation Program (within Fish Division)
- RecFish – Recreational Fisheries Program (within Fish Division)
- Scales – Fish Life History/Scale Analysis Project
- WORP – Western Oregon Rearing Project

Table A-V: 4. Spatial scale and location of base VSP monitoring components conducted within the SMUs which do not require additional funding (at the time of CMP writing). All current monitoring conducted by ODFW Programs and Districts in individual streams is not identified. Randomized survey efforts ("Random") are indicated at a geographic scale where at least a 30% annual precision rate is expected; estimates and information at sub-scales will also be obtained annually.

VSP Monitoring				Coho			Chinook			Spring Chinook		
SMU	Stratum	Population Area	Management Area	Stratum	Population	Mng Area	Stratum	Population	Mng Area	Stratum	Population	Mng Area
Coastal	North Coast Stratum	Necanicum R	Necanicum R	Adults-Random (populations every 3 years) Juveniles-Random			Adults-Random (populations every 5 years)					
		Nehalem R	Nehalem Bay					M-R-Std Rltn, Adults-Std Scales				
			NF Nehalem R									
			Nehalem R									
			Nehalem - Salmonberry R									
		Tillamook	Tillamook Bay					Adults-Std				
			Tillamook - Miami R									
			Tillamook - Kilchis R									
			Tillamook - Wilson R						Scales			
			Tillamook - Trask R									
			Tillamook R									
		Nestucca R	Nestucca Bay					Adults-Std Scales				
			Nestucca R									
			Little Nestucca R									
	Mid-Coast Stratum	Salmon R	Salmon R	Adults-Random (populations every 3 years) Juveniles-Random			Adults-Random (populations every 5 years)	Adults-Std, Creel, Scales				
		Siletz R	Siletz Bay					M-R-Std Rltn, Adults-Std Scales				
			Siletz R									
			Siletz - above Falls			Adults-Fixed			Adults-Fixed			
			Siletz - Drift Crk									
		Yaquina R	Yaquina Bay			LCM (Mill Crk)		Adults-Std				
			Yaquina R									
			Yaquina - Big Elk Crk									
		Alsea R	Alsea Bay					Adults-Std				
			Alsea R									
			Alsea - Drift Crk									
		Yachats Aggregate	Yachats Aggregate									
		Siuslaw R	Siuslaw Bay					M-R-Std Rltn Adults-Std Scales				
			Siuslaw - Lake Crk									
			Siuslaw R									
	Umpqua Stratum	Lower Umpqua R	Umpqua Bay	Adults-Random (populations every 3 years) Juveniles-Random			Adults-Random (populations every 5 years)					
			Umpqua - Smith R									
			Lower Umpqua R									
		Middle Umpqua R	Middle Umpqua R									
		N Umpqua R	N Umpqua R		Adults-Fixed			*Adults-Fixed*			Adults-Fixed	Scales
			N Umpqua - above Rock Crk									
		S Umpqua R	S Umpqua R					Adults-Aerial			Adults-Census	
			S Umpqua R - above Canyonvill									
	Mid-South Stratum	Tenmile Lk/Crk	Tenmile Lk/Crk	Adults-Random (populations every 3 years) Juveniles-Random	Adults-Std w Silt Tank		Adults-Random (populations every 5 years)					
		Coos	Coos Bay Frontal					Adults-Std				
			Coos - EF Millicoma R									
			Coos - WF Millicoma R									
			SF Coos R									
		Coquille R	Coquille Bay					Adults-Std Scales				
			NF Coquille R									
			EF Coquille R									
			Middle Fork Coquille R									
			SF Coquille R									
		Floras/New R	Floras/New R					Adults-Std				
		Sixes R	Sixes R					Adults-Std, Scales				
		Elk R	Elk R					Adults-Std				
	mixed	NADOTs	NADOTs	Adults-Random			Adults-Random					

VSP Monitoring				Chum	Winter Steelhead				Cutthroat Trout		Lamprey
SMU	Stratum	Population Area	Management Area	Population	Stratum	Population	Mng Area	Summer Steelhead	Stratum	Population	Stratum
Coastal	North Coast Stratum	Necanicum R	Necanicum R	Adults-Std	Adults-Random (populations every 5 years) Juveniles-Random				Juveniles-Random		Adults-Random
		Nehalem R	Nehalem Bay	Adults-Std Scales							
			NF Nehalem R								
			Nehalem R								
			Nehalem - Salmonberry R				Adults-Std				
		Tillamook	Tillamook Bay	Adults-Std Scales							
			Tillamook - Miami R								
			Tillamook - Kilchis R								
			Tillamook - Wilson R								
			Tillamook - Trask R								
			Tillamook R								
		Nestucca R	Nestucca Bay	Adults-Std							
			Nestucca R								
			Little Nestucca R								
	Mid-Coast Stratum	Salmon R	Salmon R		Adults-Random (populations every 5 years) Juveniles-Random		Adults-Random		Juveniles-Random		Adults-Random
		Siletz R	Siletz Bay	Adults-Std							
			Siletz R								
			Siletz - above Falls				Adults-Fixed	Adults-Fixed		Adults-Fixed	
			Siletz - Drift Crk								
		Yaquina R	Yaquina Bay	Adults-Std Scales			LCM (Mill Crk); Scales			LCM (Mill Crk)	
			Yaquina R								
			Yaquina - Big Elk Crk				Adults-Random, Std				
		Alsea R	Alsea Bay								
			Alsea R								
			Alsea - Drift Crk								
		Yachats Aggregate	Yachats Aggregate								
		Siuslaw R	Siuslaw Bay								
			Siuslaw - Lake Crk								
			Siuslaw R								
	Umpqua Stratum	Lower Umpqua R	Umpqua Bay		Adults-Random (populations every 5 years) Juveniles-Random				Juveniles-Random		Adults-Random
			Umpqua - Smith R								
			Lower Umpqua R								
		Middle Umpqua R	Middle Umpqua R								
		N Umpqua R	N Umpqua R			Adults-Fixed		Adults-Fixed		Adults-Fixed	
			N Umpqua - above Rock Crk								
		S Umpqua R	S Umpqua R								
			S Umpqua R - above Canyonvill								
	Mid-South Stratum	Tenmile Lk/Crk	Tenmile Lk/Crk		Adults-Random (populations every 5 years) Juveniles-Random				Juveniles-Random		Adults-Random
		Coos	Coos Bay Frontal								
			Coos - EF Millicoma R								
			Coos - WF Millicoma R								
			SF Coos R								
		Coquille R	Coquille Bay								
			NF Coquille R								
			EF Coquille R								
			Middle Fork Coquille R								
			SF Coquille R								
		Floras/New R	Floras/New R								
		Sixes R	Sixes R								
		Elk R	Elk R								
	mixed	NADOTs	NADOTs	Adults-Std (Netarts)	Adults-Random						

Appendix VI – Opinion Survey

This report is provided as a separate document.

Appendix VII – Process Facilitation Report

This report is provided as a separate document.

Appendix VIII – References

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