Note: During final editing of this report the draft report "Part 1: Viability criteria and status assessment of Oregon coastal coho" was presented to the IMST and Stakeholder team. That report included changes to the geographic grouping of coho populations, and used a new methodology to calculate the percent of hatchery fish in naturally spawning coho populations. Due to time constraints this report has not been changed to reflect the new methods used in the viability report.

ODFW Hatchery Management Report

Executive Summary

1. General Conclusion

The implementation of the Oregon Plan for Salmon and Watersheds (OPSW) hatchery measures and other management actions, plans, and policies has substantially changed the management of hatchery programs in the Oregon Coast coho Evolutionarily Significant Unit (ESU). Policy guidance in existing basin and species management plans has been updated and augmented through adoption of the Native Fish Conservation Policy (NFCP), the Fish Hatchery Management Policy (FHMP), and the Fish Health Management Policy. Planning guidance has been clarified and explicitly documented through the development of an Hatchery and Genetic Management Plan (HGMP) for each of the coho hatchery programs in this ESU. Substantial progress has been made in adopting an HGMP for each of the other hatchery programs in this ESU. In addition to these existing policy and planning documents, development of status reviews, conservation plans, and hatchery management plans under the NFCP, will establish explicit and quantifiable goals and guidelines for the hatchery programs in this ESU. This level of documentation in policies and plans will ensure future changes to the hatchery programs in this ESU will require an extensive and public process prior to implementation. Impacts of hatchery facilities are likely minimal and/or have been reduced through compliance with water rights, improved compliance and reporting of hatchery effluents under existing permits, and in some cases improved adult fish passage conditions. Changes in hatchery coho program management have substantially reduced off-station releases and use of non-local broodstocks. Finally, the numbers of hatchery coho juveniles released and adult returns have been reduced to a point that this ESU has shifted:

- ✓ From releases of hatchery coho juveniles in almost all major wild coho populations, to hatchery coho releases in less than half of the major wild coho populations.
- ✓ From releases of over 1,000,000 hatchery coho smolts in some basins, to no more than 200,000 hatchery coho smolts in any basin.
- ✓ From an ESU consisting of 30% to 40% wild coho smolts to an ESU consisting of 90% wild coho smolts.
- ✓ From an ESU with high levels of hatchery fish spawning naturally, to an ESU averaging less than 10% of the naturally spawning population composed of hatchery fish.
- ✓ From an ESU composed of 50% to 60% returning hatchery coho adults, to an ESU composed of 90% wild coho adults.

These actions and their results should significantly reduce genetic, competition, predation, monitoring, and other risks to wild coho attributed to hatchery programs in this ESU. Although not discussed in this report, changes in harvest management and the ODFW fish health program should also reduce harvest and disease risks to wild coho in this ESU. Therefore, we conclude that hatchery programs are likely no longer a significant limit to the sustainability of wild coho in this ESU.

2. Policy for Evaluation of Conservation Efforts Summary

The U.S. Fish and Wildlife Service and National Marine Fisheries Service use the Policy for Evaluation of Conservation Efforts (PECE) as a means for deciding whether a conservation

agreement, will be both implemented and effective in contributing to the elimination or reduction of threats to a species, as identified under the Federal Endangered Species Act (ESA). We reviewed the OPSW hatchery measures in light of the 15 specific questions posed by this policy in Section IV.4. of this report. We conclude that the State of Oregon has demonstrated the legal authority, has provided all the regulatory mechanisms, procedural requirements and authorizations needed, has demonstrated adequate funding and staffing in present and proposed budgets, and has documented and established adequate volunteer participation to provide a high level of certainty that the OPSW hatchery measure will be implemented. Our six plus years of implementation of the OPSW provides a high level of certainty that the OPSW hatchery measure will meet the specific goals established in the measures and other management plans. Demonstrating the elimination or reduction in threats to wild coho in this ESU is difficult, as there is very little evidence of actual impacts. Most of the hatchery issues identified involve risks and the potential for impacts to wild fish. In addition some of these hatchery risks involve complex long-term ecological and genetic processes, so changes in hatchery practices may take years to demonstrate beneficial effects. Given those limitations it is not clear if, or to what extent, the changes in hatchery management have contributed to the recent improvements in abundance, productivity, and distribution of wild coho in this ESU. However, given the magnitude of the changes in hatchery management and changes observed in the wild coho populations, we concluded that the implementation of the OPSW measures, as well as other management actions, have substantially reduced risks to this ESU from hatchery programs.

I. Introduction

The purpose of this report is to present an analysis of hatchery management related to wild coho factors for decline and to describe Oregon Department of Fish and Wildlife (ODFW) regulatory programs and policies related to hatchery management. The report reviews hatchery programs and associated risks to wild coho populations in the Oregon Coast Coho ESU, prior to and after implementation of the OPSW. This document will discuss hatchery risks, impacts and management in general terms, based on the listed risks and the Independent Multidisciplinary Science Team (IMST) recommendations on hatcheries. The discussions will include some information on all ODFW hatchery programs in the Oregon Coast Coho ESU, but will predominately focus on hatchery coho programs at three geographic scales: the entire ESU, the four monitoring areas, and the 19 major wild coho populations. We also review implementation of the OPSW hatchery measures, and the two sets of IMST recommendations on hatcheries.

1. OPSW and Endangered Species Act History

The OPSW is the State of Oregon's plan for managing wild salmon and steelhead and recovering ESA listed salmon and steelhead. The plan was established in 1997, expanded to include steelhead in 1998, and reaffirmed and expanded on by Executive Order of the Governor (EO 99-01). The OPSW was developed concurrent with the National Marine Fishery Service (NMFS, now NOAA Fisheries) review of the Oregon Coast coho ESU for listing under the Federal ESA. The Oregon Coast Coho ESU was listed as a threatened species under the Federal ESA in August 1998 (Federal Register Notice 1998). Since 1998 this ESU has been the subject of legal actions and appeals that have removed and reinstated Federal ESA protections. In 2004, NOAA Fisheries finished their review of 27 salmon and steelhead ESUs, and proposed the Oregon Coast coho ESU for listing as a Threatened

Species under the Federal ESA (Federal Register Notice 2004). In the 6 years between the original listing and the 2004 proposed listing, the State of Oregon has been implementing OPSW measures to improve the status of wild coho and their habitats in this ESU.

2. Hatchery Issues and Risk Factors

At the time of the ESA listing the IMST (IMST 1998), NOAA Fisheries (NMFS 1995) and several review panels (NFHRP 1994, ISG 1996, and NRC 1996) had concluded that hatcheries posed a risk to, and were a contributing factor in, the declines of wild salmon and steelhead populations. Hatchery attributes/factors that are assumed to pose risks and impacts to wild populations include:

Ecological Risks

- ✓ Disease transmission.
- ✓ Predation, both direct predation by hatchery fish and attraction of predators.
- ✓ Competition for food and habitat.
- ✓ Exceeding habitat carrying capacity (freshwater, estuary and ocean).

Genetic Risks

- ✓ Use of non-native stocks and stock transfers between populations.
- ✓ Artificial selection and domestication of hatchery stocks.
- ✓ Altered life-history characteristics (migration timing, spawning timing, smolt and adult size, smolt and adult age, etc.).
- ✓ Stray hatchery fish interbreeding with wild populations.

Operational Risks

- ✓ Water diversions (amounts of water used and screening).
- ✓ Fish passage barriers associated with hatcheries.
- ✓ Water quality of hatchery effluent.
- ✓ Release of excess hatchery fry and fingerling into natural rearing habitats.
- ✓ Difficulty in monitoring wild population due to incomplete marking of hatchery fish.

Management Risks

- ✓ Harvest impacts.
- ✓ Replacing natural habitat with hatcheries.
- ✓ Mitigation with hatcheries as part of the justification for blocking, altering or destroying natural habitats.
- ✓ Inadequate management policies and plans.
- ✓ Inadequate monitoring of hatchery fish outside the hatchery.

Given the above list of risks hatcheries pose to wild salmon and steelhead populations the OPSW identified four factors for decline related to hatcheries. Following is a listing and brief discussion of each factor for decline and the corresponding measure(s) to address it:

Factor V. *Loss of genetic adaptation of wild populations from interbreeding with genetically dissimilar, less fit hatchery fish.*

Biological Objective – Reduce the genetic risk to wild populations by reducing the percentage of hatchery fish to less than 10% of the total population spawning in the wild.

OPSW Measure Number(s) – ODFW-I.D.1, ODFW-II.A.1. ODFW-II.A.2

Biological Objective – To clearly describe the purpose and conduct of all coastal hatchery programs.
OPSW Measure Number(s) – ODFW-II.A.3

Biological Objective – To facilitate differentiation of hatchery fish from wild fish on spawning grounds.
OPSW Measure Number(s) – ODFW-II.A.4

Factor VI. *Competition with hatchery reared fish.*

Biological Objective – Reduce the potential for competition between juvenile hatchery and wild coho by decreasing the number of hatchery fish released.
OPSW Measure Number(s) – ODFW-II.A.2, ODFW-II.A.3

Factor VII. *Low-density reproductive failure of wild populations.*

Biological Objective – Evaluate the potential and effectiveness of using hatchery production to rebuild or restore critically depressed wild populations of coastal coho salmon.
OPSW Measure Number(s) – ODFW-I.D.1, ODFW-II.B.1

Factor VIII. *Reduced nutrients (carcass nutrient cycle) from depressed runs.*

Biological Objective – Increase the growth and survival of juvenile coho salmon in a set of streams where spawner abundance is depressed by increasing the abundance of adult salmon carcasses in spawning areas during and shortly after the spawning season.
OPSW Measure Number(s) – ODFW-I.D.1, ODFW-II.B.4

In the ESA listing determination for the Southern Oregon/Northern California Coast coho ESU (Federal Register Notice 1997), NOAA Fisheries reviewed the impacts of hatchery coho programs on wild coho. They also examined the OPSW (at that time known as the Oregon Coastal Salmon Restoration Initiative, or OCSRI) and how its proposed measures might effect the impacts of hatchery coho programs on wild coho populations. The hatchery coho program factors that NOAA Fisheries determined to pose high threats to wild coho included: genetic impacts from interbreeding of hatchery and wild fish, use of non-native coho in hatchery broodstocks, impacts to the adult run timing of wild coho from interbreeding of hatchery and wild coho, competition between hatchery and wild fish, disease impacts, attraction of predators by large releases of hatchery fish, and difficulty in monitoring wild coho because of the inability to identify stray hatchery fish. At that time the NOAA Fisheries biological review team concluded that implementation of the OCSRI hatchery and harvest measures would have a positive effect on wild coho and might substantially reduce short-term extinction risks (Federal Register Notice 1997).

All of the hatchery risk issues noted above, by the IMST and NOAA Fisheries and in the OPSW, will be discussed directly or indirectly in the following report, with two exceptions. Harvest issues and fish health issues are the subjects of other reports in this OPSW review of the Oregon Coastal Coho ESU, Part 4(C) ODFW (2) Harvest Report and Part 4(C) ODFW (6) Disease Report. Thus, harvest and fish health issues will not be discussed in this report.

3. Hatchery Measures under the OPSW

The OPSW includes a prescriptive set of measures for recovering threatened and endangered salmon and steelhead, and meeting federal water quality standards. These include six measures (see Section V.1. below) linked to the hatchery production of coho salmon in the Oregon Coast Coho ESU. The OPSW addresses risk factors for wild coho through hatchery measures including reduced numbers of hatchery coho released, development of hatchery management plans, mass marking of hatchery coho, implementation of management strategies to protect wild fish, assessing use of hatcheries in rebuilding wild populations, and stream nutrient enrichment using carcasses of hatchery salmon and steelhead. The measures are a mix of specific actions with quantifiable goals and specific timelines, and conceptual/experimental actions to be pursued, including needed research, monitoring and evaluation.

II. Data Sources and Methods

The hatchery data used in this report is available from the Oregon Plan Review Data Site web page (https://nrimp.dfw.state.or.us/metadatawarehouse/default.aspx). Along with each data file is a metadata file which describes the data source and means of data summarization, defines data fields, discusses uses and limitations for the data, and identifies potential future improvements to the data set. Following is a discussion of the data sources for this report.

1. Hatchery Management Information System

The data for this report includes summaries of hatchery coho juvenile releases and adult coho returns in the Oregon Coast Coho ESU for the period 1990 through 2003. The data is reported by release year (juveniles) and return year (adults), and is summarized at three geographic levels: by population, by monitoring area, and total for the ESU. Definitions of the coho population areas are those described on the Oregon Plan Review Data Site web page. Release and return data for ODFW hatcheries, and Salmon Trout Enhancement Program (STEP) projects were obtained from the Hatchery Management Information System (HMIS) database located at the ODFW headquarters in Salem, Oregon. Where release data was missing or incomplete in HMIS, the missing information was added from other sources (district records, hatchery records, or transfer records in HMIS). The private hatchery coho release data was obtained from the Pacific States Marine Fisheries Commission online database (http://www.rmis.org/).

Juvenile releases are grouped into three size classes; unfed fry, fry/fingerlings, and smolts. Releases of "excess" fish in lakes and reservoirs are included in the data, but are noted as such in the data file. These fish are not intended to produce smolts, but to enhance "trout" fisheries. Release numbers are estimates, based on either a water displacement measurement, or on an inventory minus mortality method. Aspects of these methods have been reviewed by ODFW (Buchanan 1992, Ewing et.al. 1994, Lewis et.al 1994, and Ewing et.al 1998). The data presented is the best available information regarding hatchery coho releases in the Oregon Coast Coho ESU. This data is a summary of the information available in the HMIS system. Un-summarized data, including specific date, size and location of release, is available by contacting ODFW fish propagation staff located at the Salem headquarters.

Adult returns are reported as jacks (age 2) or adults (age 3+), and where and when hatchery fish are mass-marked as either hatchery origin fish (marked) or natural origin fish (un-marked). Return numbers are actual counts of fish, not estimates. Although hatchery returns are well sampled, factors such as hatchery location within the basin, type of hatchery barrier, and water flows create differences between hatcheries and across years as to the proportion of returning coho adults that enter the various hatchery traps. The data presented is the best available information to represent returns of coho to hatcheries and associated fish traps in the Oregon Coast Coho ESU. This data is a summary of the information available in the HMIS system. Un-summarized data, including specific date, size and location of release, is available by contacting ODFW fish propagation staff located at the Salem headquarters.

2. Marine Survival

Three different methods were used to calculate a generalized hatchery coho marine survival: (percent of hatchery coho that survive from smolt release to adult catch or escapement). Two methods are specific to hatchery coho released in the Oregon Coast Coho ESU, and the third is for hatchery coho released in the Oregon Production Index (OPI) area. The OPI area includes the Pacific Ocean from Leadbetter Point Washington to the U.S./Mexico border, as well as the river basins that enter this section of the Pacific Ocean. All three methods give generally similar results and all have strengths and weaknesses. Although all three methods are available on the Oregon Plan Review Data Site web page, ODFW staff felt that the OPI method had the fewest weaknesses and used this method for this assessment. Survivals are calculated for the 1981 through 2000 brood years, which correspond to the 1984 through 2003 adult catch/return years. Only the OPI method will be used here, although the other two methodologies are explained in the metadata available on the Oregon Plan Review Data Site web page.

The OPI method of calculating survival rates uses total OPI hatchery coho smolts released and adults produced to estimate an OPI wide hatchery coho survival rate. Total hatchery coho adults produced is estimated by reducing total OPI abundance by the number of Oregon Coast Natural (OCN) spawners, plus catch of OCN coho based on exploitation rates. Survival is calculated by dividing the total number of hatchery adults each year by the total number of hatchery smolts released in the prior year. The data for this method uses total OPI hatchery coho smolts released (Table B-1) and adults produced (Table III-2) from PFMC (2004). The report is prepared annually for the Pacific Fisheries Management Council (PFMC) by the Salmon Technical Team. Data for the current year was updated by the 2004 annual report.

3. Spawning Ground Data

Estimates of the number of hatchery coho in natural spawning populations was obtained from the Oregon Plan Review Data Site web page. A discussion of the monitoring program and methods used to generate these numbers is reported in Jacobs, et.al. (2002).

4. Wild Coho Population Data

Information on wild coho populations in the Oregon Coast ESU was obtained from ODFW's monitoring programs under the OPSW. The data and methods used in these monitoring programs will not be reported here, but is included in other chapters of the OPSW

Coastal Coho Assessment and in ODFW annual reports. Information on the abundance of wild coho juveniles and adults, size and migration timing of wild coho, and estimated abundance and distribution of spawning and rearing habitat was obtained from both published and unpublished sources (personnel communication Tom Nickelson, Salmonid Inventory Project Reach file database, Jacobs, et.al. 2002, and Solazzi et.al. 2003).

III. Results and Discussion (Pre-OPSW vs. Post-OPSW)

Results and discussions will be presented at three geographic scales: the entire ESU, the four monitoring areas, and the 19 major wild coho populations. The result will compare hatchery programs and associated risks to wild coho in pre-OPSW and post-OPSW periods. The pre-OPSW period for juvenile releases is from the 1990 through 1997 release years, and the post-OPSW period is from the 1998 through 2003 release years. Coho smolts released in the spring generally return as adults in fall of the following year. Therefore, the pre- and post-OPSW adult time period is shifted one year latter than the juvenile pre- and post-OPSW time period. Thus, for adult returns the pre-OPSW period is from the 1990 through 1998 return year, and the post-OPSW period is from the 1999 through 2003 return year. In order to minimize redundancy most of the discussion will occur in the ESU wide section (Section III.1.). The sections on each monitoring area and wild population, will present results for those areas based on the discussions and citations in the ESU wide section.

1. ESU Wide

- *Hatchery Facilities and Programs*

Within the Oregon Coast coho ESU, ODFW currently operates seven hatcheries, and five satellite facilities (Figure 1 and Table 1). In addition, STEP operates fish rearing facilities in cooperation with ODFW (Figure 1). Finally, there are two recently decommissioned ODFW hatcheries located within the Oregon Coast coho ESU, Fall Creek Hatchery and Siletz Hatchery. The Siletz Hatchery was decommissioned as an ODFW hatchery in 1987. Since then it has been used by ODFW as a smolt acclimation and adult recapture site. In the late 1990's the Confederated Tribes of Siletz Indians created an off-channel earthen pond at the old Siletz Hatchery site. The earthen pond has been used for natural rearing of coho from eggs and fingerlings to smolts, as well as acclimation and release of the 42,000 conventionally reared smolts from Salmon River Hatchery. Fall Creek Hatchery was decommissioned in 1998, and since then has been operated as a satellite of Alsea Hatchery for rearing rainbow trout and steelhead. The last releases of fish from the Fall Creek Hatchery were; chinook and coho in 1998, steelhead in 2000, and rainbow trout in 2004. The Fall Creek facility is currently undergoing conversion to a hatchery research center. In addition, during the 1970's and 1980's there were three private hatcheries releasing coho within the Oregon Coast coho ESU. These programs released coho in the Coos, Siuslaw and Yaquina basins. The last private hatchery coho release in this ESU was in 1990.

In their 1995 status review of coho salmon ESUs, NOAA Fisheries identified widespread hatchery coho production as one of the factors in their conclusion that the ESU was likely to become endangered in the future (NMFS 1995). The review concluded most coho populations in major rivers had heavy hatchery influence including juvenile releases in most basins, use of out-of-basin stocks in many basins, and high levels of hatchery-origin adults in

the natural spawning populations in many basins. In the pre-OPSW juvenile release period (1990 – 1998) there were releases of hatchery coho juveniles in 17 of the 19 major populations, and many of these involved mixed or out-of-basin stocks. Only the Beaver Creek and Sixes River coho populations had no hatchery coho releases. In the post-OPSW period the use of out-of-basin stocks has been eliminated in all but the Salmon River population. Although, the hatchery coho stocks released in the Nehalem, Tillamook, and Siletz basins, historically had some mixing with non-local stocks. Also, the number of basins with hatchery coho releases has been reduced to 7 of the 19 major populations (Table 2). In 2004 the Confederated Tribes of Siletz Indians (Tribe) requested a change in management of Siletz Basin coho. Until recently, hatchery coho for the Siletz Basin were reared to smolts at Salmon River hatchery, and were then transported and released in the Siletz Basin. In the last 2 summers ODFW has been transferring 42,000 hatchery coho fingerlings from Salmon River hatchery to the Tribe's facilities at the site of the old Siletz hatchery. These fish were reared in an earthen pond under "natural" conditions until they migrated the following spring as smolts. The Tribe has requested that for the next 5 years ODFW suspend the transfers of hatchery coho fingerlings, and use the funds for habitat restoration efforts in the Rock Creek basin. This will eliminate releases of hatchery coho in the Siletz Basin. During the 5 year period the Tribe will finalize the management plan for their Rock Creek property. In response ODFW has agreed to suspend the fingerling transfers beginning with the 2004 brood year (2006 release year), and will no longer de-emphasis habitat projects in the Rock Creek Basin. The ODFW will also work to develop and pursue funding for, habitat restoration project(s) in the Rock Creek basin.

- *Adult Fish Passage at Hatchery Barriers*

The following discussion will only address adult fish passage at ODFW hatchery facilities (Due to time constraints similar information has not been compiled for STEP facilities). Adult salmon and steelhead passage barriers at ODFW facilities in this ESU are described in Table 3. The type of barrier, their distribution across the ESU, and the amount and proportion of coho spawning habitat above the barriers is presented in Table 4. Approximately 152 miles of coho spawning habitat in the Oregon Coast coho ESU is above some sort of hatchery barrier (Table 4). While this accounts for 3.4% of the miles of coho spawning habitat in the ESU, 151 of the 152 miles are above limited or selective barriers that likely have minimal or no impact on wild coho salmon. There is a general declining trend in the number of miles and the severity of blockage from North to South in the ESU (Table 4). There have been improvements to adult fish passage since implementation of the OPSW. These include work done on the Alsea hatchery barrier, and proposed work on the Fall Creek and Rock Creek hatchery barriers. The work done generally involved modifying the barrier to convert complete barriers to selective barriers, operated to remove hatchery fish and pass naturally produced fish above the barriers. These risks were not the main focus of the OPSW or the IMST recommendations on hatcheries however, and reductions in these risks are mainly the result of general improvements in hatchery programs and not necessarily tied to implementation of the OPSW.

- *Hatchery Coho Juvenile Releases*

In their review of the scientific basis for hatcheries, the IMST concluded that interactions between hatchery and wild fish (such as disease, predation, competition, and exceeding

habitat carrying capacity) do impact wild fish. Therefore, the assumption that releases of juvenile hatchery fish do not adversely affect wild populations is not uniformly valid (IMST 2001). The IMST also pointed out that carrying capacity is not easily monitored and changes over time, and that there are sometimes conflicting recommendations as to how to manage the ecological consequences of hatchery releases (IMST 2001). This report acknowledges: 1) there are risks and impacts to wild populations from releasing hatchery fish; 2) that we have some idea of the general kinds of risks but that documenting and monitoring actual impacts is difficult and costly; 3) that there is some level of scientific uncertainty on the best method(s) of managing these risks; and 4) that there is little understanding of how management strategies to reduce one kind of risk may interact with other areas of risks and strategies to manage them. Therefore, the following review of hatchery coho release programs will proceed from these assumptions.

That, all other things being equal,

- reducing the number of hatchery fish released reduces risks.
- reducing spatial overlap between hatchery and wild fish reduces risks.
- reducing temporal overlap between hatchery and wild fish reduces risks.
- reducing phenotypic differences between hatchery and wild fish reduces risks.
- reducing genetic differences between hatchery and wild fish reduces risks.

During the period from 1980 through 2003 releases of hatchery coho in the Oregon Coast coho ESU have declined from a peak of 34.5 million in 1981 to 1.4 million in 2003 (Figure 2 and Table 5). This 96% reduction in releases of juvenile hatchery coho occurred in several stages and for a variety of reasons. During the period private hatcheries were operating (1980 to 1990) this ESU had an average annual hatchery coho juvenile release of 20 million fish. This declined to an average of 7.1 million hatchery coho per year for the first 4 years (1991 to 1994) following closure of the private hatcheries. In 1994, ODFW reviewed its hatchery program for compliance with the Wild Fish Management Policy. This review found several of the hatchery coho programs in this ESU to be out of compliance with the policy. Implementation of the recommendations of that policy review resulted in a gradual decline in releases of hatchery coho during the next 3 years, 1995 to 1997. In 1997 the OPSW was established, and ODFW began implementing the hatchery measures identified in the plan. The OPSW established a goal of reducing Oregon coastal hatchery coho smolt releases to 2.3 million by 1998. This goal included an annual release of 200,000 coho smolts in the Rogue River, part of the Southern Oregon Northern California Coast (SONCC) coho ESU. Coho smolt releases in the Oregon Coast coho ESU declined to 1.5 million by 1998 and continued to decline to the current release level of about 0.76 million (Figure 3, Tables 2 and 5). This level is well below the goal set in the OPSW and reflects budget cuts, prioritization of hatchery programs, program reductions to meet effluent water quality standards, and reduced opportunities for harvest of hatchery coho. In addition to the reductions in hatchery coho smolt releases, there have been large reductions in coho unfed fry, fed fry, and fingerling releases (Table 5).

Estimates of wild coho smolt production by year for the period 1992 through 2004 were obtained by modeling (personnel communication Tom Nickelson). The model was based on estimated wild coho spawner abundance, estimated amount and quality of coho habitat, and estimated egg to smolt survivals. The intent was to put the hatchery coho smolt production, and reductions in hatchery coho smolts, in the context of overall coho smolt production for

the ESU. Estimates of total coho smolt production for the ESU ranged from about 3 million to over 7 million between 1992 and 2004 (Figure 4). However, the proportion of each years smolt production that was composed of hatchery fish has steadily declined. The result is that the ESU has shifted from a production of about 7 million coho smolts with about 60% to 70% hatchery fish in the early 1990's to about 7 million coho smolts with about 10% hatchery fish in 2004 (Figure 4). This shift is at least partly the result of reductions in hatchery coho smolt production through implementation of the OPSW.

Planned releases of 2003 brood year hatchery coho juveniles, smolt releases in spring 2005, are listed in Table 2. Proposed coho smolt releases total 762,500 and are spread fairly evenly across the four monitoring areas, ranging from 142,500 to 250,000 per monitoring area. Basins with higher numbers of hatchery coho smolts released were found to be negatively correlated with basin wide wild coho productivity in this ESU (Nickelson 2003). Although not analyzed separately by Nickelson (2003), in basins with average annual hatchery coho releases of 200,000 or less there does not appear to be any correlation. The negative correlation appears to begin somewhere between average annual releases of 200,000 and 300,000 hatchery coho smolts per basin. All of the current hatchery coho programs in this ESU, are managed to release no more than 200,000 smolts in any basin. Beginning in 2006, releases of hatchery coho in the Siletz River will be suspend for at least 5 years. This will reduce ESU-wide hatchery coho releases by 50,000 smolts per year. There is only one proposed hatchery coho fingerling release, 20,000 fish at 250 fish/lb in a tributary of Depoe Bay. Depoe Bay is located in the central coast about 13 miles north of the Yaquina River. The Depoe Bay coho population is categorized as a dependent population, with an estimated 3 miles of coho spawning habitat. Proposed coho unfed fry releases for the 2003 brood (2004 release year) total 605,000 and will all be released in the Mid-South Coast Monitoring Area (75,000) and in the Umpqua Monitoring Area (530,000). The unfed fry releases in the Umpqua Monitoring Area include releases associated with two research projects. First, is a releases of 400,000 unfed fry as part of a hatchery supplementation research project on Calapooya Creek. Second, is "planting" of 80,000 wild coho eggs in Rock Creek as part of an evaluation of Slide Creek Dam mitigation habitat restoration requirements. The 2003 brood year is the last release group for the Calapooya Creek study. Starting with the 2004 brood year (2005 release year), the proposed total unfed fry releases in the Oregon Coast coho ESU will be reduced to 255,000.

Hatchery release locations and strategies are used to minimize spatial and temporal overlap between hatchery coho and wild coho. We estimated the amount of wild coho rearing habitat below hatchery coho release sites using estimated amounts and distribution of coho rearing habitat, obtained from an ODFW database (Salmonid Inventory Project Reach file database), and known hatchery release locations. The intent was to put the hatchery coho programs in more of a landscape perspective, by placing the hatchery coho smolt release sites within the geographic context of rearing habitat for local wild coho populations. The amount of coho habitat downstream of the hatchery release site was based on the assumption that the released hatchery smolts do not swim upstream from the release site and do not swim up tributaries they pass on the way to the ocean. We have very limited information for this assumption, but the data we do have suggest that the hatchery coho smolts in this ESU generally do migrate fairly quickly to the ocean (Cornwell et.al 2001 and Stahl et.al 2000). Overall hatchery coho smolts pass through about 5% of the ESU-wide coho rearing habitat (Table 9). About half of the smolts released pass through less than 5% of the local coho

population's rearing habitat. Of the three hatchery programs whose smolts pass through more than 10% of the local coho population's rearing habitat, two release small numbers of fish (50,000 in the Siletz and 15,000 in the South Umpqua). The third is a large release at Salmon River hatchery, which is located at the head of tide in the Salmon River basin. However this is a very small basin, which results in over 10% of the basin wide coho rearing habitat being below the hatchery. There were no OPSW measures on hatchery release locations and these have not changed, other than through reduction or elimination of releases, through implementation of the OPSW.

Based on sampling at ODFW life-cycle monitoring sites from 1998 through 2002, the typical peak in wild coho smolt migration occurs from mid-April to mid-May (Solazzi et. al. 2003). Peak occurrence of wild coho juveniles in estuary seining is from mid-May to mid-June (personnel communication Bob Buckman). Approximately 2/3 of the hatchery coho smolt releases in this ESU occur from early March to mid-April (Table 2), prior to the peak in migration of the wild coho smolts. This may not necessarily reflect temporal overlap, as hatchery release sites and life-cycle monitoring sites are often located in different parts of a basin. In the Nehalem Basin the hatchery and life-cycle monitoring site are approximately 2 miles apart, adjacent to the North Fork Nehalem River. At the North Fork Nehalem River life-cycle site the typical peak in wild coho smolt migration is in the last week in April (Solazzi et.al. 2003). Whereas, Nehalem hatchery coho smolt releases occur in two stages, the first in early March and the second in early April (Table 2). Typically hatchery coho smolt lengths are between 130 mm and 170 mm. Average length of wild coho smolts is in the range of 100 mm to 120 mm (Solazzi et.al. 2003). These lengths equate to fish weights of 11 to 17 gm for wild fish (personnel communication Bob Buckman) and 30 to 45 gm for hatchery fish (HMIS database). These types of phenotypic differences between hatchery and wild fish are not uncommon. Research has documented phenotypic differences between hatchery and wild salmonids. For a review, see (NFHRP 1994, ISG 1996, NRC 1996, and IMST 2001).

The coho hatchery programs in this ESU have not changed release times or reduced the size of hatchery smolts to more closely match the size of wild smolts. Recent research with steelhead in the Hood River documented differences in phenotypes and in smolt to adult survival of traditional hatchery fish, new wild broodstock hatchery fish, and wild fish and concluded this might provide a mechanism for genetic divergence (Kostow 2004). One of the assumptions for this review is that, all other things being equal, reducing phenotypic differences between hatchery and wild fish reduces risks. Releasing hatchery smolts that are larger than wild smolts is thought to increase competition impacts to wild fish. However, releasing hatchery fish at the same time as the wild fish are migrating may increase temporal overlap, thus increasing competition and carrying capacity issues in the migration corridor. It is also unclear if smaller hatchery fish would migrate as quickly. If smaller hatchery fish migrate more slowly, they might increase the duration of competitive and carrying capacity interactions between hatchery and wild fish. While we do not have programs monitoring the duration or intensity of such interactions, there is some information that the current hatchery coho smolts migrate to the ocean relatively quickly. Preliminary studies using radio tagging indicate Nehalem hatchery coho smolts appear to leave the Nehalem basin, either entering saltwater or being taken by predators, in less than 10 days (Stahl et.al. 2000). Sampling in Salmon River estuary indicated that hatchery coho smolts released from Salmon River hatchery were present in the estuary shortly after release, were only in the estuary a short

time, and rarely entered the marsh channels (Cornwell et.al. 2001). Seining during the late 1990's in Alsea, Siletz, and Yaquina estuaries indicated that hatchery coho smolts released in those basins likely migrated fairly quickly through the basins (personnel communication Bob Buckman). This aspect of hatchery operations needs further research. The extensive post release monitoring network planned for ODFW's new hatchery research center in the Alsea Basin would provide the infrastructure needed for such research.

Since the OPSW, hatchery coho programs have implemented other changes in release strategies that should decrease potential risks to wild coho populations. Off-station releases, locations remote from where the fish are reared or acclimated, have been greatly reduced (Lewis 2004). All major hatchery coho smolt releases are either on-site or at acclimation sites, and almost all are volitional releases (Table 2). While we still force out the coho that do not leave during the volitional period, spreading out the release times over several days to weeks should help to reduce carrying capacity and competition concerns, and may reduce the likelihood of hatchery smolts attracting higher than normal concentrations of predators. This has been a concern in some of Oregon's coastal estuaries (personnel communication Bob Buckman, and Nickelson (2003)). Prior to the OPSW, hatcheries in this ESU routinely released fry and fingerling, in excess of production needs, into natural rearing areas. Since 1998 any excess coho fry or fingerlings are either destroyed or placed in standing water bodies. Finally, prior to the OPSW only a small proportion of hatchery coho were marked. Since the 1995 brood year, smolts released in 1997, all ODFW hatchery coho smolts released in the Oregon Coast coho ESU have been mass marked. While mass marking is not perfect, the estimated percent of hatchery coho smolts released each year with a mark and/or tag has averaged 98.7% and ranged from 97.3% to 99.4% (1995 through 2000 brood years).

- *Hatchery coho adults on spawning grounds.*

Hatchery coho returns in the Oregon Coast coho ESU are reported in Table 6. Data for chinook and steelhead returns is reported in Lewis (2004). Table 6 also reports the number of coho collected in the wild and brought to the hatchery for inclusion in brood stocks, and the number of unmarked "wild" coho collected at hatcheries since the beginning of returns of mass marked hatchery coho (1998 run year). Returns of adult coho salmon to hatcheries in the Oregon Coast coho ESU averaged over 20,000 per year for the 1990 through 1998 run years (Table 6). Since implementation of the OPSW, adult coho returns have averaged about 16,000 of which about 750 per year are unmarked (Table 6). To put these hatchery return numbers in an ESU wide context, we calculated the total number of hatchery and wild coho returning to hatcheries and spawning grounds in this ESU. Even though the number of hatchery adults declined very little, from about 20,000 to 16,000 in the pre- and post-OPSW periods, the proportion of hatchery fish in the ESU as a whole declined from about 50% to 60% in the early 1990's to about 10% in 2003 (Figure 5). The reduction in hatchery returns is expected given the large reductions in hatchery coho smolts released (Table 5). However, the small size of the reduction, about 4,000 adult coho per year, reflects generally increased marine survivals. Survival of hatchery coho in the OPI area was very low for coho adults returning in the 1992 through 1999 run years, but has increased since then (Figure 6). The recent improvement in coho marine survivals, to about 4%, are still well below the 6% to 12% observed in the mid 1960's through mid 1970's (State of Oregon 2004).

Returning hatchery coho adults can impact wild coho populations through genetic impacts and by creating difficulty in monitoring wild abundance if the hatchery fish cannot

be identified. As noted under the juvenile release section above, the OPSW included a measure calling for mass marking of hatchery coho smolts and this measure has been implemented, starting with the 1995 brood year smolts (1997 release year). In their review of the scientific basis for hatcheries in the recovery of wild salmon and steelhead, the IMST noted the genetic concerns raised in recent scientific reviews of hatchery programs (IMST 2001). Actual measurement of genetic impacts of hatchery fish on wild populations can be difficult and costly. Two recent papers by ODFW staff used similar methods to evaluate impacts of hatchery coho salmon (Nickelson 2003) and hatchery steelhead (Chilcote 2003) on con-specific wild populations. They found a negative correlation between the productivity of naturally spawning steelhead populations and the proportion of hatchery steelhead in those spawning population, but no such correlation for coho. As the actual measurement of impacts are difficult and generally not available for specific populations in this ESU, we will assume that lowering the proportion of hatchery fish in the natural spawning population lowers the risk of genetic impacts. What constitutes an acceptable proportion of hatchery strays is still a subject for research. The ODFW Wild Fish Management Policy (WFMP) used a 10% to 50% limit depending on the type of hatchery stock, higher rates for more "wild" type stocks. The new NFCP uses no more than 10% hatchery fish as an interim criteria pending completion of conservation plans. Research on coho straying in British Columbia found both wild fish and production hatchery fish stray rates averaged less than 5% (Labelle 1992). This and other information has led to suggestions that 10% is too high and 5% should be the goal. However, Berejikian et.al (2001) found reduced breeding success in a natural environment for hatchery reared males in comparison to wild males. This in conjunction with potential differences in the spatial (ODFW 2001a) and temporal (based on spawning timing) distributions of hatchery and wild fish on natural spawning grounds suggests that the simple numeric proportion of hatchery fish in a natural population may not reflect the actual level of interbreeding and genetic impacts. Given, the policy use and general acknowledgement of the 10% limit, difficulty in measuring actual genetic impacts and scientific uncertainty, this review used 10% or less hatchery fish on natural spawning grounds as the management goal, pending further research.

The proportion of naturally spawning coho of hatchery origin was obtained from the Oregon Plan Review Data Site web page. Prior to implementation of the OPSW the ESU averaged 17.3% hatchery fish in the natural spawning coho population (Table 7). In addition, three of the four monitoring areas and 7 of the 16 wild coho populations, for which we have basin specific stray data, had over 10% of their naturally spawning populations composed of hatchery fish (Table 7). There was also a geographic trend toward higher proportions of hatchery fish in the more northern populations. In the 5 years since the OPSW, the ESU wide proportion of hatchery fish has averaged 8.9% (Figure 7 and Table 7). Only the Umpqua monitoring area and two coho populations, Salmon River and Upper Umpqua still average over 10% hatchery fish on the spawning grounds (Table 7). There is no longer any geographic trend in hatchery stray rates, and the average proportion of hatchery fish on spawning grounds in 11 of the 16 populations was equal to or less than the 4.7% average proportion of stray fish reported in Labelle (1992).

2. By the Four Monitoring Areas

- *North Coast Monitoring Area*

There are five ODFW and two main STEP hatchery facilities located within the geographic boundaries of this monitoring area. ODFW hatchery facilities impact adult passage to a total of 61.4 miles of coho spawning in this monitoring area (Table 4). This equates to 6.0% of the total coho spawning habitat for the monitoring area. Complete blockages of adult passage impact 1.2 miles, or 0.1% of the total coho spawning habitat in this monitoring area (Table 4). The remaining hatchery barriers are either operated to selectively pass wild fish, or only limit adult passage during periods of low water flows. This monitoring area has the highest level of ODFW hatchery impacts on adult passage of the four monitoring areas. However, the amount of coho habitat blocked and the level of impacts are still relatively low.

The hatchery coho programs in this monitoring area use three stocks, Fishhawk Lake (stock 99), North Fork Nehalem (stock 32), and Trask (stock 34). All three stocks would be classified as an isolated, harvest augmentation programs. In their proposed listing determination (Federal Register Notice 2004) NOAA Fisheries included North Fork Nehalem stock in the ESU and excluded Fishhawk Lake and Trask stocks from the ESU. The hatchery coho programs in this monitoring area are more traditional hatchery programs, releasing smolts for harvest augmentation and managing for isolation of the hatchery and wild populations. Both North Nehalem and Trask stocks are long-term domesticated stocks, with some historic mixing of non-local fish in the broodstocks. The Fishhawk Lake stock was more recently founded from upper Nehalem Basin wild coho and has not had any mixing of non-local fish in the broodstock. None of these stocks have included wild fish in the broodstock for several generations.

Hatchery coho releases in this monitoring area have included unfed fry, fingerlings, and smolts. There have been no unfed fry releases since 2000, and since 1991 all unfed fry and fingerling releases have been excess fish released in lakes. Smolt releases have been reduced from an average of about 1,600,000 in the pre-OPSW era (1980 – 1997) to about 200,000 in 2003 (Table 5). Under the current draft HGMPs for these programs, hatchery coho juvenile releases are capped at 400,000 smolts or less. The programs may also release excess fry and fingerlings in lakes. In the pre-OPSW era some releases were off-station and un-acclimated. The current program calls for all smolts to be either reared and released on-site or acclimated prior to release. We estimate about 2% of the total wild coho rearing habitat for this monitoring area is in the migration corridor below hatchery coho release sites (Table 9). The proportion of hatchery fish in the natural spawning population averaged over 36% for the 1990 through 1998 run years (Table 7). This has been reduced to an average of 3.0% in the post-OPSW period (1999 – 2003), and has been below 10% in all 5 years (Table 7).

In the period prior to the OPSW the hatchery coho programs in this monitoring area likely had high risks and impact to the wild coho populations. Based on our review of the current hatchery coho programs, we conclude these programs are likely no longer a significant limit to the sustainability of wild coho in this monitoring area. This conclusion is based on elimination of unfed fry and fingerling releases, elimination of off station and un-acclimated releases, elimination of hatchery coho releases in two of the

four wild coho populations, limited adult passage issues at hatcheries, limited spatial and temporal overlap of hatchery and wild coho in freshwater, an almost 90% reduction in smolt releases, and an over 90% reduction in the proportion of hatchery fish in the natural spawning population, to an average of less than 10%.

- *Mid-Coast Monitoring Area*

  There are one Tribal, one main STEP, and three ODFW hatchery facilities located within the geographic boundaries of this monitoring area. ODFW hatchery facilities impact adult passage to a total of 63 miles of coho spawning habitat in this monitoring area (Table 4). This equates to 4.9% of the total coho spawning habitat for the monitoring area. All of the hatchery barriers are either operated to selectively pass wild fish, or only limit adult passage during periods of low water flows. Hatchery barriers in this monitoring area impact adult passage to a high number of miles of coho spawning habitat. However, the types of impacts (limited and selective) are minimal, thus the overall effect on wild coho populations are likely relatively low.

  Historically, a variety of ODFW hatchery, private hatchery, and wild-type coho broodstocks have been used in this monitoring area. At present there is only one coho stock still in use, Siletz River (stock 33). This hatchery coho program would be classified as an isolated, harvest augmentation program. In their proposed listing determination (Federal Register Notice 2004) NOAA Fisheries excluded Siletz River stock from the ESU. This hatchery coho program is a more traditional hatchery program, releasing smolts for harvest augmentation and managing for isolation of the hatchery and wild populations. Siletz River stock is a long-term domesticated stock, with some historic mixing of non-local fish in the broodstock. Wild fish have not been included in the broodstock for several generations.

  Hatchery coho releases in this monitoring area have included unfed fry, fingerlings, and smolts. While the private hatcheries were in operation, hatchery coho juvenile releases peaked at over 25 million in this monitoring area (Table 5). There have been no private hatchery releases since 1990, no unfed fry releases since 2001, and the only remaining fingerling release is about 20,000 fish per year in Depoe Bay Creek. This review is focused on a comparison of pre- and post-OPSW periods, however, not all of the changes are directly attributable to implementation of the OPSW. In 1997 the Oregon Fish and Wildlife Commission approved the Mid-Coast Basin Fish Management Plan. This is a set of six sub-basin plans for large and small basins in the Mid-Coast monitoring area. These plans guide management of wild and hatchery fish in these basins, and were developed by ODFW district and region staff, as well as public steering committees. Development of these management plans occurred concurrently with development of the OPSW, and they were reviewed for consistency with the OPSW. Smolt releases have been reduced from an average of about 7,200,000 in the pre-OPSW era (1980 – 1997) to an average of about 250,000 in the post-OPSW era (1998 – 2003). Under the current draft HGMPs for hatchery coho programs in this monitoring area, hatchery coho juvenile releases are capped at 1,900 unfed fry, 18,000 fingerling, and 250,000 smolts or less. In the pre-OPSW era some releases were off-station and un-acclimated. Current plans call for all smolts to be either reared and released on-site or acclimated prior to release. We estimate about 3% of the total wild coho rearing habitat for this monitoring area is in the

migration corridor below hatchery coho release sites (Table 9). The proportion of hatchery fish in the natural spawning population averaged about 19% for the 1990 through 1998 run years (Table 7). This has been reduced to an average of 5.6% in the post-OPSW period (1999 – 2003), and has been below 10% in all 5 years (Table 7).

Historically, the hatchery coho programs in this monitoring area likely had high risks and impacts to the wild coho populations. Based on our review of the current hatchery coho programs, we conclude these programs are likely no longer a significant limit to the sustainability of wild coho in this monitoring area. This conclusion is based on elimination of almost all unfed fry and fingerling releases, elimination of off-station and un-acclimated smolt releases, elimination of private hatchery releases, current hatchery coho releases in only two of the six wild coho populations, limited adult passage issues at hatcheries, limited spatial and temporal overlap of hatchery and wild coho in freshwater, over 95% reduction in smolt releases, and a 70% reduction in the proportion of hatchery fish in the natural spawning population to an average of less than 10%.

- *Mid-South Coast Monitoring Area*

There are four major STEP facilities and one ODFW hatchery facility located within the geographic boundaries of this monitoring area. Only the ODFW hatchery facility was assessed and it impacts adult passage to a total of 3 miles of coho spawning habitat (Table 4). This equates to 0.4% of the total coho spawning habitat for the monitoring area. This hatchery barrier is operated to selectively pass wild fish. Given the very low number of miles of coho spawning habitat impacted, and the minimal type of impact (selective passage) the overall effects on wild coho populations are likely negligible.

Historically, a variety of ODFW hatchery, private hatchery, and wild-type coho broodstocks have been used in this monitoring area. At present there are only two coho stocks still in use, Coos River (stock 37) and Coquille River (stock 44). These hatchery coho programs would be classified as integrated broodstocks, and are used for both conservation and harvest augmentation programs. In their proposed listing determination (Federal Register Notice 2004) NOAA Fisheries included both stocks in the ESU. These hatchery coho programs tend to incorporate many of the newer hatchery management techniques: 1) hatchery broodstock founded on local wild coho; 2) active collection and integrating significant (25% to 30%) wild coho into the broodstock each year; 3) releasing moderate numbers of smolts for harvest augmentation; 4) releasing hatchery smolts in areas spatially separated from most of the wild coho rearing areas; 5) on-site acclimation and volitional smolt releases; 6) releasing unfed fry for a limited time in areas associated with habitat improvement projects for re-introduction and/or supplementation of wild coho production; and 7) managing for isolation of hatchery fish used for harvest augmentation from the naturally spawning coho populations.

Hatchery coho releases in this monitoring area have included unfed fry, fingerlings, and smolts. While the private hatcheries were in operation, hatchery coho juvenile releases peaked at about 12 million in this monitoring area (Table 5). There have been no private hatchery releases since 1989 and no fingerling releases since 1997. Unfed fry releases averaged over 600,000 in the pre-OPSW era (1980 – 1997) and have been reduced to an average of about 100,000 in the post-OPSW era (1998 – 2003). Smolt releases have been reduced from an average of about 2,200,000 in the pre-OPSW era

(1980 – 1997) to an average of about 170,000 in the post-OPSW era (1998 – 2003). Under the current draft HGMPs for hatchery coho programs in this monitoring area, hatchery coho juvenile releases are capped at 85,000 unfed fry and 170,000 smolts or less. Off-station and un-acclimated releases have been reduced but not eliminated in this monitoring area. We estimate about 2% of the total wild coho rearing habitat for this monitoring area is in the migration corridor below hatchery coho release sites (Table 9). The proportion of hatchery fish in the natural spawning population has been consistently low, averaging less than 1% in both the pre-OPSW and post-OPSW periods (1999 – 2003), and has been below 10% in each of the last 14 years (Table 7).

In the period prior to the OPSW the hatchery coho programs in this monitoring area likely had moderate risks and impacts to the wild coho populations. Based on our review of the current hatchery coho programs, we conclude these programs are likely no longer a significant limit to the sustainability of wild coho in this monitoring area. This conclusion is based on elimination of private hatchery releases, elimination of fingerling releases, an over 80% reduction in unfed fry releases, an over 90% reduction in smolt releases, current hatchery coho releases in only two of the seven wild coho populations, limited adult passage issues at hatcheries, limited spatial and temporal overlap of hatchery and wild coho in freshwater, and a very low proportion of hatchery fish in the natural spawning population, an average of less than 10%.

- *Umpqua Monitoring Area*

There are two ODFW facilities and one STEP hatchery facility located within the geographic boundaries of this monitoring area. Only the ODFW hatchery facilities were assessed and they impact adult passage to a total of 25 miles of coho spawning habitat (Table 4). This equates to 1.7% of the total coho spawning habitat for the monitoring area. This hatchery barrier only limits adult passage during periods of low water flow. Given the relatively low number of miles of coho spawning habitat impacted, and the minimal type of impacts, the overall effects on wild coho populations are likely minimal.

Hatchery coho programs in this monitoring area use two coho stocks, Cow Creek (stock 18) and Umpqua River (stock 55). A third stock, based on wild coho, was used for 3 years as part of a research project in Calapooya Creek. These hatchery coho programs would be classified as integrated broodstocks, and are used for both conservation and harvest augmentation programs. In their proposed listing determination (Federal Register Notice 2004) NOAA Fisheries included both Cow Creek and Umpqua stocks in the ESU, but did not review the third wild stock. These hatchery coho programs incorporate many of the newer hatchery management techniques: 1) hatchery broodstock founded on Umpqua Basin wild coho; 2) actively collecting and integrating significant (30% to 50%) wild coho into the broodstock each year; 3) releasing moderate numbers of smolts for harvest augmentation; 4) on-site acclimation and volitional smolt releases; and 5) releasing unfed fry for a limited time in areas associated with habitat improvement projects for re-introduction and/or supplementation of wild coho production.

Hatchery coho releases in this monitoring area have included unfed fry, fingerlings, and smolts (Table 5). Unfed fry releases have been highly variable, but have similar and relatively high average annual releases in both the pre-OPSW (530,000 unfed fry) and post-OPSW (480,000 unfed fry) periods (Table 5). Unfed fry releases will decline after

2004 as releases for the Calapooya Creek research study are now complete. Current fingerling releases are intermittent and are excess fish released into Galesville Reservoir. Smolt releases have been reduced from an average of about 360,000 in the pre-OPSW era (1980 – 1997) to an average of about 190,000 in the post-OPSW era (1998 – 2003). Under the current draft HGMPs for hatchery coho programs in this monitoring area, hatchery coho juvenile releases are capped at 410,000 unfed fry and 212,500 smolts or less. In the pre-OPSW era some releases were off-station and un-acclimated. The current program calls for all smolts to be either reared and released on-site or acclimated prior to release. We estimate about 12% of the total wild coho rearing habitat for this monitoring area is in the migration corridor below hatchery coho release sites (Table 9). The proportion of hatchery fish in the natural spawning population averaged about 34% for the 1990 through 1998 run years and about 29% in the post-OPSW period (1999 – 2003), and has been above 10% in each of the last 14 years (Table 7). Most of the hatchery coho smolt releases in this monitoring area occur in the North Umpqua sub-basin. Consequently most of the hatchery coho strays are observed in the North Umpqua sub-basin. In the pre-OPSW period over 70% of the hatchery coho strays were in the North Umpqua sub-basin, and this increased to about 90% in the post-OPSW period (Figure 8). Relatively few hatchery coho are observed on spawning grounds out side the North Umpqua sub-basin. The percent hatchery fish on spawning grounds in the Lower Umpqua wild coho population has averaged less than 5% since 1990 (Table 7). This result is in line with what has occurred in the rest of the ESU, and shows that the high proportion of hatchery fish in the monitoring area as a whole is driven by results in the North Umpqua sub-basin.

In the period prior to the OPSW the hatchery coho programs in this monitoring area likely had high risks and impacts to the wild coho populations. Changes in hatchery management in this monitoring area have resulted in: 1) a small reduction in unfed fry releases; 2) an almost 50% reduction in smolt releases; 3) elimination of un-acclimated smolt releases; 4) a low proportion of hatchery fish on natural spawning grounds outside the North Umpqua sub-basin; and 5) improved genetic management of the hatchery coho broodstocks. These results should reduce risks to wild coho in the monitoring area. However, the amount of coho rearing habitat below hatchery releases sites is about three times the amount in any of the other monitoring areas, the number of hatchery coho unfed fry released is still high and is about three times the number in any of the other monitoring areas, and the percent of hatchery fish in the North Umpqua sub-basin is still high. Therefore, while there has likely been some reduction in risks and impact to the wild coho overall in this monitoring area, hatchery risks and impacts are likely still fairly high, at least in the North Umpqua sub-basin.

3. By the 19 Major Populations

- *Necanicum Population*

  Monitoring Area: North Coast
  Population Classification: Potentially Independent

  There are no ODFW or STEP hatchery facilities located within the geographic boundaries of this wild coho population. In the pre-OPSW release period (1990 to 1997) there were releases of hatchery coho unfed fry in this population. These releases were

relatively large, but were discontinued after 1991 (Table III.3.1). The only other releases of hatchery coho in this population have been occasional releases of excess fingerlings in Sunset Lake. This has occurred three times in the last 14 years for a total release of about 150,000 coho fry in Sunset Lake (Table III.3.1). The proportion of hatchery fish in the natural spawning population has averaged less than 2% in both the pre-OPSW and post-OPSW years (Table 7). The pre-OPSW period (1990 – 1998) actually averaged 0% hatchery fish on the spawning grounds. This is partly a result of inadequate sample sizes in many years, as scale analysis did identify hatchery fish in this spawning population, e.g. see Borgerson and Bowden (1999).

Table III.3.1. Releases of juvenile hatchery coho salmon within the Necanicum wild coho population.

Release Year	Unfed Fry	Fry and Fingerling*	Smolts
1990	70,944	0	0
1991	87,565	0	0
1992	0	53,913	0
1993	0	0	0
1994	0	0	0
1995	0	0	0
1996	0	0	0
1997	0	0	0
1998	0	24,725	0
1999	0	0	0
2000	0	0	0
2001	0	0	0
2002	0	78,782	0
2003	0	0	0
Average			
Pre-OPSW	19,814	6,739	0
Post-OPSW	0	17,251	0

* = All released in Sunset Lake.

Due to the very low percentage of hatchery fish in the natural spawning population, lack of a hatchery facility, and very limited hatchery coho releases, we conclude the Oregon coast hatchery coho programs are likely not a significant limit to the sustainability of this wild coho population.

- *Nehalem Population*

  Monitoring Area: North Coast
  Population Classification: Independent

Nehalem hatchery is located 10 miles northeast of the town of Nehalem, adjacent to the North Fork Nehalem River at river mile (RM) 10.3. This is the only hatchery facility in this wild coho population. The hatchery began operation in 1966 and is 100% state funded with an approved staffing of four FTE. Elevation at the hatchery is 141 feet above sea level. The concrete footing of an old hatchery barrier spans the North Fork Nehalem River adjacent to the hatchery. This was classified as a limited barrier (Tables 3 and 4) as it may create a barrier to adult salmon passage during periods of very low water flow. The barrier has not been assessed for juvenile salmonid or other fish passage. There are an estimated 30 miles of coho spawning habitat above the barrier. This

constitutes about 6% of the coho spawning habitat for this population (Table 4). There is also a OPSW life-cycle monitoring site about 1 mile upstream of Nehalem hatchery (Solazzi, et.al. 2003).

The Nehalem hatchery coho program uses two hatchery stocks, Fishhawk Lake (stock 99) and North Fork Nehalem (stock 32) and would be classified as an isolated, harvest augmentation program. In their proposed listing determination (Federal Register Notice 2004) NOAA Fisheries included North Fork Nehalem stock in the ESU and excluded Fishhawk Lake stock from the ESU. This hatchery coho program is a more traditional hatchery program, releasing smolts for harvest augmentation and managing for isolation of the hatchery and wild populations. The North Nehalem stock is a long-term domesticated stock, with some historic mixing of non-local fish in the broodstock. The Fishhawk Lake stock was more recently founded from upper Nehalem Basin wild coho and has not had any mixing of non-local fish in the broodstock. Neither stock has included wild fish in the broodstock for several generations.

Table III.3.2. Releases of juvenile hatchery coho salmon within the Nehalem wild coho population.

Release Year	Unfed Fry	Fry and Fingerling	Smolts
1990	212,896	117,264	830,852
1991	257,185	0	735,845
1992	0	0	832,351
1993	0	0	760,261
1994	0	0	839,514
1995	175	0	789,984
1996	0	0	636,519
1997	0	0	629,007
1998	0	0	192,645
1999	0	0	214,556
2000	0	0	209,652
2001	0	0	204,648
2002	0	0	204,534
2003	0	0	101,704
Average Pre-OPSW	58,782	14,658	756,792
Post-OPSW	0	0	187,957

Hatchery coho releases in this wild coho population have included unfed fry, fingerlings, and smolts. Unfed fry and fingerling releases have been eliminated and smolt releases have been reduced from an average of about 800,000 in the pre-OPSW era (1990 – 1997) to about 100,000 in 2003 (Table III.3.2). Under the current draft HGMP for this program, smolt releases are capped at 200,000 or less. Beginning in 2003, the production goal was reduced from 200,000 to 100,000 smolts. In the pre-OPSW era some releases were off-station and un-acclimated. The current program calls for all smolts to be reared and released at Nehalem hatchery. We estimate about 1% of the wild coho rearing habitat for this population is in the migration corridor below this release site (Table 9). The proportion of hatchery fish in the Nehalem Basin natural spawning population averaged over 49% for the 1990 through 1998 run years (Table 7). This has been reduced to an average of 6.5% in the post-OPSW period (1999 – 2003), and has been below 10% in 4 of the 5 years (Table 7). Concentration of hatchery activities in the

North Fork Nehalem River may reduce risks and impacts to the population as a whole, but may increase risks and impacts to wild coho in the local area.

In the period prior to the OPSW this program likely had high risks and impacts to the Nehalem wild coho population. Review of the current program documented elimination of unfed fry and fingerling releases, elimination of off-station and un-acclimated releases, limited adult passage issues, an almost 90% reduction in smolt releases, and an almost 90% reduction in the proportion of hatchery fish in the natural spawning population to an average of less than 10%. Therefore, we conclude this hatchery coho program is likely no longer a significant limit to the sustainability of this wild coho population.

- *Tillamook Population*

  Monitoring Area: North Coast
  Population Classification: Independent

Trask hatchery is located 8 miles east of Tillamook, adjacent to Trask River at about RM 10. The hatchery began operation in 1914 and is 100% state funded (including lottery funds), with an approved staffing of 3.75 FTE. Elevation at the hatchery is 40 feet above sea level. There are two satellite rearing ponds. East Fork Trask Pond is located 17 miles east of Tillamook, adjacent to the East Fork of South Fork Trask River at RM 0.5, a tributary of the South Fork Trask River, which enters the Trask River at about RM 19. The facility began operation in 1969 with funding and staffing included under Trask hatchery. Tuffy Creek pond is a cooperative project between ODFW, Oregon Department of Corrections, and Oregon Department of Forestry, built on the site of a state prison camp. It is located 30 miles northeast of Tillamook, adjacent to the South Fork Wilson River at about RM 1, a tributary of the Wilson River at about RM 33. The facility began operation in 1989. Funding is included in the Trask hatchery budget with daily operations handled by the inmates. There are limited adult passage barriers at both satellite facilities which limit passage to 4.5% (East Fork Pond) and 1.6% (Tuffy Creek Pond) of the coho spawning habitat for this wild coho population (Tables 3 and 4). Trask hatchery has a complete barrier across Gold Creek, which blocks adult passage to 0.5% of the coho spawning habitat for this population (Tables 3 and 4).

The Trask hatchery coho program uses Trask River stock (stock 34), and would be classified as an isolated, harvest augmentation program. All hatchery coho releases in this population have been at Trask hatchery since the 1995 release year. In their proposed listing determination (Federal Register Notice 2004) NOAA Fisheries excluded this stock from the ESU. This hatchery coho program is a more traditional hatchery program, releasing smolts for harvest augmentation and managing for isolation of the hatchery and wild populations. Trask stock is a long-term domesticated stock, with some historic mixing of non-local fish in the broodstock, and has not intentionally included wild fish in the broodstock for many generations.

Hatchery coho releases in this wild coho population have included unfed fry and smolts. Unfed fry releases have been eliminated and smolt releases have been reduced from over 1,000,000 in the pre-OPSW era (1990 – 1997) to about 100,000 in 2003 (Table III.3.3). Under the current draft HGMP for this program, smolt releases are capped at 200,000 or less. Beginning in 2003, the production goal was reduced from 200,000 to 100,000 smolts. In the pre-OPSW era some releases were off-station and un-acclimated.

The current program calls for the smolts to be reared at Nehalem hatchery, then acclimated and released at Trask hatchery. We estimate about 5% of the wild coho rearing habitat for this population is in the migration corridor below this release site (Table 9). The proportion of hatchery fish in the natural spawning population averaged over 18% for the 1990 through 1998 run years (Table 7). There were 3 years, 1990 through 1992, listed as 0%, which is at least partly a result of inadequate sample sizes. Substantial reduction in hatchery stray rates began in 1996, after the smolt releases were reduced in 1995. The 1993 through 1995 return years average 48% hatchery fish in the natural spawning population, which is likely a more accurate reflection of historic hatchery straying. This has been reduced to an average of 6.9% in the post-OPSW period (1999 – 2003), and has been below 10% in 3 of the 5 years (Table 7).

Table III.3.3. Releases of juvenile hatchery coho salmon within the Tillamook wild coho population.

Release Year	Unfed Fry	Fry and Fingerling	Smolts
1990	196,528	0	1,011,339
1991	152,262	0	1,066,566
1992	0	0	1,281,713
1993	81,384	0	1,091,351
1994	0	0	1,251,713
1995	0	0	216,801
1996	0	0	201,098
1997	0	0	144,533
1998	0	0	212,525
1999	0	0	189,230
2000	0	0	196,385
2001	0	0	194,634
2002	0	0	201,749
2003	0	0	97,355
Average			
Pre-OPSW	53,772	0	783,139
Post-OPSW	0	0	181,980

In the period prior to the OPSW this program likely had high risks and impact to the Tillamook wild coho population. Review of the current program documented elimination of unfed fry releases, limited adult passage issues, an over 90% reduction in smolt releases, and a substantial reduction in the proportion of hatchery fish in the natural spawning population to an average of less than 10%. Therefore, we conclude this hatchery coho program is likely no longer a significant limit to the sustainability of this wild coho population.

- *Nestucca Population*

  Monitoring Area: North Coast

  Population Classification: Independent

  Cedar Creek hatchery is located 1.5 miles east of the town of Hebo, adjacent to Three Rivers at RM 2, a tributary of Nestucca River at about RM 10. The hatchery began operation in 1924 and is 100% state funded, with a approved staffing of three FTE. Elevation at the hatchery is 120 feet above sea level. A satellite facility, Rhoades Pond, is located 4 miles east of the hatchery and is currently being used by STEP volunteers for

a fall chinook rearing program. The main hatchery barrier is on Three Rivers and is a selective barrier used to remove hatchery fish and pass wild fish upstream. About 9% of the population-wide coho spawning habitat is above this barrier. There is also a complete barrier across Cedar Creek. However, the 3.1 miles of habitat above the barrier is not coho spawning or rearing habitat (Tables 3 and 4).

Historically Trask River stock hatchery coho were released from Cedar Creek hatchery. This program was relatively small, about 45,000 smolts per year. There have been no hatchery coho releases in this population since 1992 (Table III.3.4). There is currently no draft or proposed HGMP for a hatchery coho program in this population. The proportion of hatchery fish in the natural spawning population has averaged less than 2% in both the pre-OPSW and post-OPSW years (Table 7). The pre-OPSW period (1990 – 1998) actually averaged 0% hatchery fish on the spawning grounds. However, this is partly a result of inadequate sample sizes in many years, as scale analysis has identified hatchery coho in this spawning population.

Table III.3.4. Releases of juvenile hatchery coho salmon within the Nestucca wild coho population.

Release Year	Unfed Fry	Fry and Fingerling	Smolts
1990	38,858	0	45,459
1991	0	0	44,660
1992	0	0	42,824
1993	0	0	0
1994	0	0	0
1995	0	0	0
1996	0	0	0
1997	0	0	0
1998	0	0	0
1999	0	0	0
2000	0	0	0
2001	0	0	0
2002	0	0	0
2003	0	0	0
Average Pre-OPSW	4,857	0	16,618
Post-OPSW	0	0	0

Due to the very low percentage of hatchery fish in the natural spawning population, very limited historic hatchery coho releases, and the elimination of all hatchery coho releases 11 years ago, we conclude the Oregon coast hatchery coho programs are likely not a significant limit to the sustainability of this wild coho population.

- *Salmon Population*

  Monitoring Area: Mid-Coast

  Population Classification: Potentially Independent

Salmon River hatchery is located 4 miles northeast of Lincoln City, adjacent to Salmon River at about RM 5. The hatchery began operation in 1976 and is 100% state funded (including lottery funds), with an approved staffing of four FTE. Elevation at the hatchery is 24 feet above sea level. The Salmon River hatchery has a wooden deck

which spans the Salmon River adjacent to the hatchery. This was classified as a limited barrier (Tables 3 and 4) as it may create impact adult salmon passage during periods of very low water flow. The barrier has not been assessed for juvenile salmonid or other fish passage. There are an estimated 30 miles of coho spawning habitat above the barrier. This constitutes about 73% of the coho spawning habitat for this population (Table 4).

The Salmon River hatchery coho program uses Siletz River stock (stock 33), and would be classified as an isolated, harvest augmentation program. In their proposed listing determination (Federal Register Notice 2004) NOAA Fisheries excluded this stock from the ESU. This hatchery coho program is a more traditional hatchery program, releasing smolts for harvest augmentation and managing for isolation of the hatchery and wild populations. Siletz River stock is a long-term, domesticated stock, with some historic mixing of fish from several basins in the broodstock. This stock is not based on Salmon River coho and has not intentionally included wild fish in the broodstock for many generations.

Table III.3.5. Releases of juvenile hatchery coho salmon within the Salmon River wild coho population.

Release Year	Unfed Fry	Fry and Fingerling	Smolts
1990	99,158	39,694	301,080
1991	0	0	505,175
1992	95,970	0	255,933
1993	265,565	0	405,164
1994	9,919	0	403,118
1995	0	0	316,281
1996	0	0	322,200
1997	0	0	200,206
1998	0	0	342,200
1999	0	0	111,052
2000	0	0	20,450
2001	0	0	198,107
2002	0	0	192,945
2003	0	0	196,291
Average Pre-OPSW	58,827	4,962	338,645
Post-OPSW	0	0	176,841

Hatchery coho releases in this wild coho population have included unfed fry, fingerlings, and smolts. Unfed fry and fingerling releases have been eliminated and smolt releases have been reduced as high as 500,000 in the pre-OPSW era (1990 – 1997) to about 200,000 in 2003 (Table III.3.5). Under the current draft HGMP for this program, smolt releases are capped at 200,000 or less. The current program calls for the smolts to be reared and released at Salmon River hatchery. We estimate about 11% of the wild coho rearing habitat for this population is in the migration corridor below this release site (Table 9). The proportion of hatchery fish in the natural spawning population averaged over 55% for the 1990 through 1998 run years (Table 7). The proportion of hatchery fish in the natural spawning population has actually increased in recent years and has averaged 65% in the post-OPSW period (1999 – 2003) (Table 7).

In the period prior to the OPSW this program likely had high risks and impact to the Salmon River wild coho population. Although the hatchery barrier is likely a limited impediment to adult salmon and steelhead passage, it impacts over 70% of the coho spawning habitat in this population. In spite of a 60% reduction in hatchery coho smolts released, the proportion of hatchery fish in the natural spawning population has actually increased, and is at very high levels. The risks of this high level of straying are compounded by the use of a non-local, long-term hatchery stock. Therefore, we conclude this hatchery coho program is likely a significant limit to the existence and sustainability of wild coho production for this population. In 1997 the Oregon Fish and Wildlife Commission approved the Mid-Coast Basin Fish Management Plan. This set of six sub-basin plans included a review of the management of hatchery and wild coho for the entire mid-coast area. In aggregate the plans reviewed options for recovering wild coho populations, while maintaining some hatchery coho production for fisheries augmentation and monitoring goals. Within this broader geographic context the Salmon River basin was selected for continued hatchery coho production. Hatchery coho programs were greatly reduced or eliminated in all other wild coho populations within the Mid-Coast Monitoring Area. Thus, when viewed in isolation, this hatchery management strategy likely results high risks to wild coho in the Salmon River population. However, risks to wild coho in the monitoring area as a whole are likely reduced. Options for reducing risks to Salmon River wild coho were discussed in the 1997 management plans and will continue to be reviewed by ODFW.

- *Siletz Population*

  Monitoring Area: Mid-Coast
  Population Classification: Independent

  There are currently no ODFW hatcheries in the Siletz Basin. The Siletz hatchery was an ODFW facility that operated until 1986, when it was closed and production of the Siletz Basin coho program was moved to Salmon River hatchery. The old Siletz hatchery site is now owned by the Confederated Tribes of Siletz Indians (Tribe). The Tribe has used this facility to rear coho from eggs to smolts in an earthen pond, and to acclimate and release smolts reared at Salmon River hatchery. In the last 2 years the coho from Salmon River hatchery have come in as fingerlings in the summer. The fish are then reared to the following spring in the earthen pond. This is no longer an ODFW hatchery facility so it was not included in the adult passage analysis (Tables 3 and 4).

  The Siletz hatchery coho program uses Siletz River stock (stock 33), and would be classified as an isolated, harvest augmentation program. In their proposed listing determination (Federal Register Notice 2004) NOAA Fisheries excluded this stock from the ESU. Siletz River stock is a long-term, domesticated stock, with some historic mixing of fish from several basins in the broodstock. This stock has not intentionally included wild fish in the broodstock for many generations. Historically, this was a traditional hatchery program, releasing smolts for tribal and non-tribal harvest augmentation and managing for isolation of the hatchery and wild populations. The program has gone through extensive changes since the early 1990's. The intent of these changes has been to reduce risks to Siletz wild coho. Although many of these changes pre-date the OPSW the intent and results are consistent with the OPSW.

Hatchery coho releases in this wild coho population have included unfed fry, fingerlings, and smolts. Unfed fry and fingerling releases have been at very low levels since 1994, and were eliminated after 2001 (Table III.3.6). Historically, half the hatchery coho smolts released in the Siletz basin were at the Siletz hatchery site, and the other half were released in the mainstem and other off-site areas. Mainstem releases were eliminated after 1993, and since 1999 all hatchery smolt releases have been in Rock Creek at the site of the old Siletz Hatchery. Smolt releases have been reduced incrementally from about 1,000,000 in 1990 to about 50,000 in 2003 (Table III.3.6). Under the current draft HGMP for this program, smolt releases are capped at 50,000. In 2004 the Tribe requested a change in management of Siletz Basin coho. Until recently, hatchery coho for the Siletz Basin were reared to smolts at Salmon River hatchery, and were then transported and released in the Siletz Basin. In the last 2 summers ODFW has been transferring 42,000 hatchery coho fingerlings from Salmon River hatchery to the Tribe's facilities at the site of the old Siletz hatchery. These fish were reared in an earthen pond under "natural" conditions until they migrated the following spring as smolts. The Tribe has requested that for the next 5 years ODFW suspend the transfers of hatchery coho fingerlings, and use the funds for habitat restoration efforts in the Rock Creek basin. This will eliminate releases of hatchery coho in the Siletz Basin. During the 5 year period the Tribe will finalize the management plan for their Rock Creek property. In response ODFW has agreed to suspend the fingerling transfers beginning with the 2004 brood year (2006 release year), and will no longer de-emphasis habitat projects in the Rock Creek Basin. The ODFW will also work to develop, and pursue funding for habitat restoration project(s) in the Rock Creek basin.

Table III.3.6. Releases of juvenile hatchery coho salmon within the Siletz wild coho population.

Release Year	Unfed Fry	Fry and Fingerling	Smolts
1990	86,910	394,635	1,043,894
1991	0	0	987,091
1992	29,890	77,069	776,502
1993	100	0	745,206
1994	32,028	203,214	821,622
1995	1,375	0	312,747
1996	2,225	0	50,649
1997	3,790	0	50,176
1998	0	0	50,821
1999	1,822	0	34,986
2000	1,260	0	425
2001	1,532	0	48,911
2002	0	0	42,661
2003	0	0	44,737
Average			
Pre-OPSW	19,540	84,365	598,486
Post-OPSW	769	0	37,090

We estimate about 18% of the wild coho rearing habitat for this population is in the migration corridor below the Rock Creek release site (Table 9). The proportion of hatchery fish in the natural spawning population averaged about 11% for the 1990 through 1998 run years, but ranged from 0% to 71% (Table 7). However, many of the

years in this period had an inadequate number of coho sampled to make an estimate of the proportion of hatchery fish. In the post-OPSW period the average percent hatchery fish was been reduced to 6.6%, and has been below 10% in 4 of the 5 years (Table 7).

Prior to program changes discussed above this program likely had high risks and impact to the Siletz wild coho population. Due to elimination of unfed fry and fingerling releases, elimination of off-station and un-acclimated releases, an almost 95% reduction in smolt releases, and a likely very large reduction in the proportion of hatchery fish in the natural spawning population to an average of less than 10%, we conclude this hatchery coho program is likely no longer a significant limit to the sustainability of this wild coho population.

- *Yaquina Population*

  Monitoring Area: Mid-Coast
  Population Classification: Independent

There are no ODFW or STEP hatchery facilities located within the geographic boundaries of this wild coho population. There was a private hatchery facility in Yaquina Bay, but this did not have any associated barriers and it was not included in the adult passage analysis (Tables 3 and 4).

A private hatchery released coho smolts in this wild coho population until the 1990 release year. Although most of these releases pre-date the pre-OPSW period used in this analysis, this was a major program that released up to 20 million hatchery coho smolts per year. There have been no private hatchery coho releases since 1990 (Table III.3.7). In comparison the ODFW hatchery coho releases in this wild coho population have been more moderate, including up to 40,000 unfed fry, and 500,000 smolts. There has been no release of hatchery coho juveniles in this wild population since 1997 (Table III.3.7).

Table III.3.7. Releases of juvenile hatchery coho salmon within the Yaquina wild coho population.

Release Year	Unfed Fry	Fry and Fingerling	Smolts
1990	27,070	0	2,833,986
1991	0	0	0
1992	36,931	0	0
1993	372	0	0
1994	11,203	0	0
1995	0	0	306,402
1996	90	0	489,332
1997	0	0	360,367
1998	0	0	0
1999	0	0	0
2000	0	0	0
2001	0	0	0
2002	0	0	0
2003	0	0	0
Average Pre-OPSW	9,458	0	498,761
Post-OPSW	0	0	0

There is currently no draft or proposed HGMP for a hatchery coho program in this population. The proportion of hatchery fish in the natural spawning population averaged about 13% for the 1990 through 1998 run years (Table 7). However, 5 years are reported as 0% and the other 4 years are between 20% and 40% (Table 7). It is likely many of the years listed as 0% in this period had an inadequate number of coho sampled to make an estimate of the proportion of hatchery fish. In the post-OPSW period the average percent hatchery fish has been reduced to 1.0%, and has been below 10% in all 5 years (Table 7).

In the period prior to the OPSW the private and ODFW hatchery coho programs likely had high risks and impacts to the Yaquina wild coho population. Due to elimination of all hatchery coho releases, no facility adult passage issues, and a substantial reduction in the proportion of hatchery fish in the natural spawning population to an average of less than 10%, we conclude coastal hatchery coho programs are likely no longer a significant limit to the sustainability of this wild coho population.

- *Beaver Population*

  Monitoring Area: Mid-Coast
  Population Classification: Potentially Independent

  There are no ODFW or STEP hatchery facilities located within the geographic boundaries of this wild coho population. There have been no hatchery coho releases in this population in either the pre-OPSW (1990 to 1997) or post-OPSW (1998 to 2003) release period (Table III.3.8). There is currently no draft or proposed HGMP for a hatchery coho program in this population. We have very little information on the proportion of hatchery fish spawning in this wild population. The Oregon Plan Review

Table III.3.8. Releases of juvenile hatchery coho salmon within the Beaver Creek wild coho population.

Release Year	Unfed Fry	Fry and Fingerling	Smolts
1990	0	0	0
1991	0	0	0
1992	0	0	0
1993	0	0	0
1994	0	0	0
1995	0	0	0
1996	0	0	0
1997	0	0	0
1998	0	0	0
1999	0	0	0
2000	0	0	0
2001	0	0	0
2002	0	0	0
2003	0	0	0
Average			
Pre-OPSW	0	0	0
Post-OPSW	0	0	0

Data Site web page reports estimates of hatchery strays in this population as not available. Scale analysis has found hatchery fish on the spawning grounds in this population, e.g. see Borgerson and Bowden (1999). Given the small size of the Beaver

Creek basin and its location between two basins with historically large hatchery coho releases (Yaquina to the north and Alsea to the south) it has likely received stray hatchery coho. The stray hatchery coho in Beaver Creek are reported to be predominately from releases in the Yaquina River (personnel communication Bob Buckman). Since 1998 there have been no hatchery coho releases in either the Yaquina or Alsea basins. This should greatly reduce the chances of hatchery coho spawning in the Beaver Creek wild coho population.

Due to the currently low potential for hatchery fish in the natural spawning population, lack of a hatchery facility, and lack of hatchery coho releases, we conclude the Oregon coast hatchery coho programs are likely not a significant limit to the sustainability of this wild coho population.

- *Alsea Population*

  Monitoring Area: Mid-Coast
  Population Classification: Independent

  There were two ODFW hatcheries located within the geographic boundaries of this wild coho population. Alsea hatchery is located at about RM 5 on the North Fork of the Alsea River off Highway 34, near the town of Alsea, 15 miles west of Philomath. The hatchery site occupies about 25 acres at 380 feet above sea level. Fall Creek hatchery was located 17 miles west of the town of Alsea, adjacent to Fall Creek at RM 3.1, a tributary of the Alsea River at about RM 27. Elevation at the site is 230 feet above sea level. The hatchery began operation in 1952, was decommissioned in 1998, and operated as a satellite of Alsea Hatchery until 2004 when it began conversion to a hatchery research center. The hatchery research center is scheduled to open in summer 2005. The barriers at both Alsea and Fall Creek have been recently remodeled to allow for operational removal of adult hatchery fish and passage of adult wild fish. There is about 17 and 16 miles of coho spawning habitat above the Alsea and Fall Creek barriers, respectively. In total this accounts for 13.8% of the coho spawning habitat for this wild coho population (Tables 3 and 4).

  Hatchery coho releases in this wild coho population have included unfed fry, fingerlings, and smolts. Releases in the pre-OPSW averaged about 1.1 million coho smolts (Table III.3.9). There have been no releases of hatchery coho juveniles in this wild coho population since 1998. There is currently no draft or proposed HGMP for a hatchery coho program in the Alsea Basin. The proportion of hatchery fish in the natural spawning population averaged about 15% for the 1990 through 1998 run years (Table 7). However, 5 years are reported as 0% and the other 4 years are between about 20% and 90% (Table 7). It is likely many of the years listed as 0% in this period had an inadequate number of coho sampled to make an estimate of the proportion of hatchery fish. In the post-OPSW period the average percent hatchery fish was been reduced to 3.2%, and has been below 10% in 4 of the 5 years (Table 7).

  In the period prior to the OPSW the Alsea hatchery coho program likely had high risks and impacts to the Alsea wild coho population. Due to elimination of all hatchery coho releases, limited facility adult passage issues, and a substantial reduction in the proportion of hatchery fish in the natural spawning population to an average of less than

10%, we conclude coastal hatchery coho programs are likely no longer a significant limit to the sustainability of this wild coho population.

Table III.3.9. Releases of juvenile hatchery coho salmon within the Alsea wild coho population.

Release Year	Unfed Fry	Fry and Fingerling	Smolts
1990	511,118	179,227	1,121,342
1991	124,675	373,595	1,088,872
1992	376,258	306,271	1,498,461
1993	254,730	125,512	949,502
1994	9,660	0	1,022,074
1995	0	0	1,046,283
1996	133	0	1,010,036
1997	0	0	1,003,069
1998	0	0	206,241
1999	0	0	0
2000	0	0	0
2001	0	0	0
2002	0	0	0
2003	0	0	0
Average Pre-OPSW	159,572	123,076	1,092,455
Post-OPSW	0	0	34,374

- *Siuslaw Population*

  Monitoring Area: Mid-Coast
  Population Classification: Independent

  There are no ODFW hatchery facilities located within the geographic boundaries of this wild coho population, although there are facilities associated with the STEP program. These are small facilities and were not included in the review of adult passage analysis (Tables 3 and 4). In the pre-OPSW release period (1990 to 1997) the average annual releases of hatchery coho juveniles in this wild population were about 60,000 unfed fry, 40,000 fingerlings, and 60,000 smolts (Table III.3.10). There have been no releases of hatchery coho juveniles in this wild coho population since 1999. There is currently no draft or proposed HGMP for a hatchery coho program in this population. The proportion of hatchery fish in the natural spawning population averaged about 9% for the 1990 through 1998 run years (Table 7). However, 5 years are reported as 0% and the other 4 years are between about 5% and 40% (Table 7). It is likely many of the years listed as 0% in this period had an inadequate number of coho sampled to make an estimate of the proportion of hatchery fish. In the post-OPSW period the average percent hatchery fish has been reduced to 1.4%, and has been below 10% in all 5 years (Table 7).

  Given the relatively small releases and generally low proportion of hatchery fish spawning naturally in the period prior to the OPSW, the Siuslaw hatchery coho program likely had moderate risks and impacts to the Siuslaw wild coho population. Due to elimination of all hatchery coho releases, and a substantial reduction in the proportion of hatchery fish in the natural spawning population to an average of less than 10%, we conclude coastal hatchery coho programs are likely no longer a significant limit to the sustainability of this wild coho population.

Table III.3.10. Releases of juvenile hatchery coho salmon within the Siuslaw wild coho population.

Release Year	Unfed Fry	Fry and Fingerling	Smolts
1990	112,560	0	64,713
1991	269,005	7,115	23,390
1992	0	0	125,325
1993	1,500	52,678	50,942
1994	0	42,120	65,558
1995	0	8,862	54,407
1996	46,600	46,108	48,758
1997	49,086	150,794	45,670
1998	0	66,186	0
1999	0	0	5,628
2000	0	0	0
2001	0	0	0
2002	0	0	0
2003	0	0	0
Average			
Pre-OPSW	59,844	38,460	59,845
Post-OPSW	0	11,031	938

- *Siltcoos Population*

  Monitoring Area: Mid-South Coast

  Population Classification: Potentially Independent

There are no ODFW or STEP hatchery facilities located within the geographic boundaries of this wild coho population. There have been almost no hatchery coho juvenile releases in this population in either the pre-OPSW (1990 to 1997) or post-OPSW (1998 to 2003) release period (Table III.3.11). There is currently no draft or

Table III.3.11. Releases of juvenile hatchery coho salmon within the Siltcoos wild coho population.

Release Year	Unfed Fry	Fry and Fingerling	Smolts
1990	0	0	0
1991	0	0	0
1992	0	0	0
1993	0	0	0
1994	0	0	0
1995	0	0	0
1996	0	0	0
1997	0	1,500	0
1998	0	0	0
1999	0	0	0
2000	0	0	0
2001	0	0	0
2002	0	0	0
2003	0	0	0
Average			
Pre-OPSW	0	188	0
Post-OPSW	0	0	0

proposed HGMP for a hatchery coho program in this population. The proportion of hatchery fish in the natural spawning population has averaged 0% in both the pre-OPSW and post-OPSW years (Table 7).

Due to the lack of a hatchery facility, the very limited hatchery coho releases, and the essential lack of hatchery fish in the natural spawning population, we conclude the Oregon coast hatchery coho programs are likely not a significant limit to the sustainability of this wild coho population.

- *Tahkenitch Population*

  Monitoring Area: Mid-South Coast

  Population Classification: Potentially Independent

  There are no ODFW or STEP hatchery facilities located within the geographic boundaries of this wild coho population. There have been almost no hatchery coho juvenile releases in this population in either the pre-OPSW (1990 to 1997) or post-OPSW (1998 to 2003) release period (Table III.3.12). There is currently no draft or proposed HGMP for a hatchery coho program in this population. The proportion of hatchery fish in the natural spawning population has averaged 0% in both the pre-OPSW and post-OPSW years (Table 7).

  Due to the lack of a hatchery facility, the very limited hatchery coho releases, and the essential lack of hatchery fish in the natural spawning population, we conclude the Oregon coast hatchery coho programs are likely not a significant limit to the sustainability of this wild coho population.

Table III.3.12. Releases of juvenile hatchery coho salmon within the Tahkenitch wild coho population.

Release Year	Unfed Fry	Fry and Fingerling	Smolts
1990	0	0	0
1991	0	0	0
1992	0	0	0
1993	0	0	2,013
1994	0	0	2,000
1995	0	0	0
1996	0	0	0
1997	0	0	0
1998	0	0	0
1999	0	0	0
2000	0	0	0
2001	0	0	0
2002	0	0	0
2003	0	0	0
Average			
Pre-OPSW	0	0	502
Post-OPSW	0	0	0

- *Lower Umpqua Population*

  Monitoring Area: Umpqua
  Population Classification: Independent

  There are no ODFW hatchery facilities located within the geographic boundaries of this wild coho population, although there are facilities associated with the STEP program. These are small facilities and were not included in the review of adult passage analysis (Tables 3 and 4). In the pre-OPSW release period (1990 to 1997) the average annual releases of hatchery coho juveniles in this wild population were about 60,000 unfed fry, and 12,000 smolts (Table III.3.13). There have been no releases of hatchery coho juveniles in this wild coho population since 2000. The proportion of hatchery fish in the natural spawning population averaged about 4% in both the pre-OPSW and post-OPSW periods (Table 7).

  Given the relatively small releases and generally low proportion of hatchery fish spawning naturally in the period prior to the OPSW, the Umpqua hatchery coho programs likely had moderate risks and impacts to the Lower Umpqua wild coho population. Due to elimination of all hatchery coho releases, and a maintenance of a low proportion of hatchery fish in the natural spawning population at an average of less than 10%, we conclude coastal hatchery coho programs are likely no longer a significant limit to the sustainability of this wild coho population.

  Table III.3.13. Releases of juvenile hatchery coho salmon within the Lower Umpqua wild coho population.

Release Year	Unfed Fry	Fry and Fingerling	Smolts
1990	22,055	0	7,975
1991	40,612	0	0
1992	8,454	0	29,342
1993	14,500	0	12,201
1994	106,823	0	5,515
1995	189,858	0	14,915
1996	92,301	0	10,438
1997	195	0	12,674
1998	0	0	0
1999	74,160	0	9,201
2000	13,865	0	6,942
2001	0	0	0
2002	0	0	0
2003	0	0	0
Average			
Pre-OPSW	59,350	0	11,633
Post-OPSW	14,671	0	2,691

- *Upper Umpqua Population*

  Monitoring Area: Umpqua
  Population Classification: Independent

  Rock Creek hatchery is located 5 miles east of the town of Glide, adjacent to Rock Creek at RM 0.2, a tributary of the North Umpqua River at about RM 36. The hatchery

began operation in 1921 and is 100% state funded, with an approved staffing of five FTE. Elevation at the hatchery is 800 feet above sea level. The concrete diversion dam and ladder across Rock Creek was classified as a limited barrier (Tables 3 and 4) as it may create a barrier to adult salmon passage during periods of low water flow. The barrier has not been assessed for juvenile salmonid or other fish passage. There are an estimated 25 miles of coho spawning habitat above the barrier. This constitutes about 2% of the coho spawning habitat for this population (Table 4).

The Umpqua hatchery coho program uses two broodstocks, Cow Creek (stock 18) and North Umpqua (stock 55). There has been some mixing of fish between the two broodstocks, and the North Umpqua stock was originally founded with Smith River wild coho. However, both stocks regularly collect and incorporate wild fish in the broodstock, with a goal of 1/3 to 1/2 of the broodstock composed of wild fish. The programs have both harvest augmentation and conservation goals. In conjunction with STEP volunteers the programs release unfed fry in re-introduction and/or supplementation projects. In their proposed listing determination (Federal Register Notice 2004) NOAA Fisheries included both stocks in the ESU.

Table III.3.14. Releases of juvenile hatchery coho salmon within the Upper Umpqua wild coho population.

Release Year	Unfed Fry	Fry and Fingerling	Smolts
1990	18,139	0	425,260
1991	0	0	426,633
1992	351,326	0	289,065
1993	494,746	21,140	285,832
1994	482,557	0	278,393
1995	378,183	18,208	262,646
1996	429,219	0	277,185
1997	46,853	0	265,083
1998	35,843	0	309,678
1999	476,979	10,440	209,846
2000	643,406	100,800	207,979
2001	719,367	24,960	116,700
2002	416,755	0	115,178
2003	491,644	0	146,170
Average			
Pre-OPSW	275,128	4,919	313,308
Post-OPSW	463,999	22,700	184,259

Hatchery coho releases in this wild coho population have included unfed fry, fingerlings, and smolts (Table III.3.14). The fingerling are releases of excess fish in Galesville Reservoir, which have been intermittent. Unfed fry releases are re-introduction and/or supplementation projects with STEP volunteers. There is an ongoing supplementation research project on Calapooya Creek, within this wild coho population. During the 2001 to 2003 brood years (2003 to 2005 release years) the research project has and will release 400,000 unfed fry and 20,000 smolts each year in Calapooya Creek, half from a hatchery brood stock and half from wild fish (ODFW 2001b). Beginning with the 2004 brood year (releases of unfed fry in 2005 and smolt in 2006) the releases in Calapooya Creek will end and total coho releases in this wild coho population will decline by 400,000 unfed fry and 20,000 smolts (Table 2).

Annual releases of hatchery coho juveniles in the pre-OPSW era (1990 – 1997) averaged 275,000 unfed fry, 5,000 fingerlings, and 310,000 smolts (Table III.3.14). There has been a reduction in smolt releases, but an increase in unfed fry and fingerling releases in the post-OPSW period. Under the current draft HGMP for this program, smolt releases are capped at 212,500 and unfed fry releases at 410,000 or less. In the pre-OPSW era, some releases were off-station and un-acclimated. Beginning with the 2004 brood year (2006 release year) the program calls for all smolts to be reared and/or acclimated prior to release at either Rock Creek hatchery or at the acclimation site at the base of Galesville Dam. We estimate about 7% and 10% of the wild coho rearing habitat for this population is in the migration corridor below these release sites, respectively (Table 9). The proportion of hatchery fish in the natural spawning population averaged about 40% for the 1990 through 1998 run years, and 41% in the post-OPSW period (1999 – 2003) (Table 7). Estimates of the number of naturally spawning hatchery fish in this wild coho population are obtained from two sources. In areas other than the North Umpqua River, we use examination of coho carcasses on spawning ground surveys, and for the North Umpqua River we use Winchester Dam counts, adjusted for hatchery coho that were caught above the dam or returned to Rock Creek hatchery. In the pre-OPSW period over 70% of the Umpqua Basin hatchery coho strays were in the North Umpqua sub-basin, and this increased to about 90% in the post-OPSW period (Figure 8). Relatively few hatchery coho are observed on spawning grounds out side the North Umpqua sub-basin. Umpqua Basin smolt releases have been switched from approximately an equal split between the North and South Umpqua rivers, to predominantly in the North Umpqua River at Rock Creek hatchery. This concentration of hatchery smolt releases in the North Umpqua River may reduce risks and impact to the population as a whole, but may increase risks and impacts to wild coho in the local area.

In the period prior to the OPSW this program likely had high risks and impacts to the Upper Umpqua wild coho population. Due to changes in hatchery smolt release locations, improved integration of wild fish in the hatchery broodstock, and a low proportion of hatchery fish in the natural spawning population outside the North Umpqua sub-basin, there is some evidence of reduced impacts to this wild coho population. However, compared to other hatchery programs in the ESU these hatchery release sites are relatively high in the basin, overall hatchery coho juvenile releases have changed very little, and the proportion of hatchery fish in the naturally spawning population as a whole has remained high. Therefore, we conclude this hatchery coho program likely continues to pose risks and have impacts on the sustainability of this wild coho population, although the risks are likely concentrated in the North Umpqua sub-basin.

- *Tenmile Population*

  Monitoring Area: Mid-South Coast
  Population Classification: Potentially Independent

  There are no ODFW or STEP hatchery facilities located within the geographic boundaries of this wild coho population. While in operation during the period reviewed (1990 to 1994) the average annual releases of hatchery coho juveniles in this wild population were about 65,000 unfed fry, 410,000 fingerlings, and 105,000 smolts (Table III.3.15). There have been no releases of hatchery coho juveniles in this wild coho population since 1994. There is currently no draft or proposed HGMP for a hatchery

coho program in this population. The proportion of hatchery fish in the natural spawning population averaged 0% in both the pre-OPSW and post-OPSW periods (Table 7).

Table III.3.15. Releases of juvenile hatchery coho salmon within the Tenmile wild coho population.

Release Year	Unfed Fry	Fry and Fingerling	Smolts
1990	6,836	567,941	91,365
1991	78,090	550,206	103,363
1992	134,141	283,462	86,095
1993	38,052	245,012	120,978
1994	0	0	122,785
1995	0	0	0
1996	0	0	0
1997	0	0	0
1998	0	0	0
1999	0	0	0
2000	0	0	0
2001	0	0	0
2002	0	0	0
2003	0	0	0
Average Pre-OPSW	32,140	205,828	65,573
Post-OPSW	0	0	0

Due to the lack of a hatchery facility, the lack of hatchery coho releases since 1994, and the essential lack of hatchery fish in the natural spawning population, we conclude the Oregon coast hatchery coho programs are likely not a significant limit to the sustainability of this wild coho population.

- *Coos Population*

  Monitoring Area: Mid-South Coast
  Population Classification: Potentially Independent

  There are no ODFW hatchery facilities located within the geographic boundaries of this wild coho population, although there are facilities associated with the STEP program. These facilities were not included in the review of adult passage (Tables 3 and 4).

  The Coos hatchery coho program uses Coos stock (stock 37). This stock was fairly recently founded with Coos River wild coho, and regularly collects and incorporates wild fish in the broodstock, with a goal of 30% of the broodstock composed of wild fish. The program has both harvest augmentation and conservation goals. In conjunction with STEP volunteers the program release unfed fry in re-introduction and/or supplementation projects. In their proposed listing determination (Federal Register Notice 2004) NOAA Fisheries included Coos stock in the ESU.

  A private hatchery released coho smolts in this wild coho population until the 1989 release year. Although these releases pre-date the pre-OPSW period used in this analysis, this was a major program that released up to 12 million hatchery coho smolts per year. There have been no private hatchery coho releases since 1989. In comparison, the ODFW hatchery coho releases in this wild coho population have been more moderate. In the pre-OPSW release period (1990 to 1997) the average annual releases of hatchery

coho juveniles in this wild population were about 270,000 unfed fry, 3,000 fingerlings, and 90,000 smolts (Table III.3.16). Fingerling releases have been eliminated, and unfed fry releases have been reduced to an annual average of 26,000 in the post-OPSW period (1998 to 2003). Smolt releases have actually increased slightly to an average annual release of about 120,000 (Table III.3.16). Under the current draft HGMP for this program, smolt releases are capped at 120,000 and unfed fry releases at 45,000 or less. We estimate about 3% of the wild coho rearing habitat for this population is in the migration corridor below this release site (Table 9). The proportion of hatchery fish in the natural spawning population averaged 1.5% for run years 1990 to 1998 (Table 7). In the post-OPSW period the average percent hatchery fish was reduced to 0.6%, and has been below 10% in all 5 years (Table 7).

Table III.3.16. Releases of juvenile hatchery coho salmon within the Coos wild coho population.

Release Year	Unfed Fry	Fry and Fingerling	Smolts
1990	444,876	4,004	118,199
1991	190,545	0	62,249
1992	262,788	0	108,903
1993	151,204	0	104,546
1994	293,265	0	99,293
1995	376,636	16,250	70,871
1996	323,497	0	65,298
1997	129,482	0	70,540
1998	0	0	79,135
1999	14,674	0	124,322
2000	16,013	0	122,350
2001	12,179	0	123,951
2002	24,831	0	134,177
2003	90,030	0	115,563
Average			
Pre-OPSW	271,537	2,532	87,487
Post-OPSW	26,288	0	116,583

In the period prior to the OPSW the private and ODFW hatchery coho programs combined likely had high risks and impacts to the Coos wild coho population. Due to elimination of all private hatchery coho releases, the moderate size of current hatchery coho releases, and a very low proportion of hatchery fish in the natural spawning population (an average of less than 10%), we conclude the Coos hatchery coho program is likely no longer a significant limit to the sustainability of this wild coho population.

- *Coquille Population*

  Monitoring Area: Mid-South Coast
  Population Classification: Independent

Bandon hatchery is located 1 mile east of the town of Bandon, adjacent to Ferry Creek about 2 miles above its confluence with the Coquille River, at about RM 1. The hatchery began operation about 1927 and is 100% state funded with an approved staffing of three FTE. Elevation at the hatchery is 98 feet above sea level. In addition there are small STEP hatchery facilities located within the geographic boundaries of this wild coho population. These facilities were not included in the review of adult passage analysis

(Tables 3 and 4). Bandon hatchery has barrier across Ferry Creek, which is operated to selectively pass wild coho adults to 2.5 miles of coho spawning habitat, about 0.9% of the total for this population (Tables 3 and 4).

The Coquille hatchery coho program uses Coquille stock (stock 44). This stock was founded with Coquille River wild coho, and regularly collects and incorporates wild fish in the broodstock, with a goal of 30% of the broodstock composed of wild fish. The program has both harvest augmentation and conservation goals. In conjunction with STEP volunteers the program release unfed fry in re-introduction and/or supplementation projects. In their proposed listing determination (Federal Register Notice 2004) NOAA Fisheries included Coquille stock in the ESU.

In the pre-OPSW release period (1990 to 1997) the average annual releases of hatchery coho juveniles in this wild population were about 230,000 unfed fry, 20,000 fingerlings, and 85,000 smolts (Table III.3.17). Fingerling releases have been eliminated, unfed fry releases have been reduced to an annual average of 63,000, and smolt release to an annual average of 54,000 in the post-OPSW period (1998 to 2003). Under the current draft HGMP for this program, smolt releases are capped at 50,000 and unfed fry releases at 40,000 or less. We estimate about 1% to 2% of the wild coho rearing habitat for this population is in the migration corridor below these release sites (Table 9). The proportion of hatchery fish in the natural spawning population averaged less than 10% in both the pre-OPSW and post-OPSW periods (Table 7). In the post-OPSW period the percent hatchery fish averaged 2.5%, and was below 10% in 4 of the 5 years (Table 7).

Table III.3.17. Releases of juvenile hatchery coho salmon within the Coquille wild coho population.

Release Year	Unfed Fry	Fry and Fingerling	Smolts
1990	733,451	0	99,477
1991	217,404	32,946	95,498
1992	280,421	9,840	120,039
1993	97,353	15,028	43,930
1994	110,243	50,745	49,153
1995	10,214	0	190,531
1996	2,480	0	45,195
1997	379,622	30,906	26,299
1998	52,344	0	57,731
1999	41,039	0	58,099
2000	150,618	0	53,882
2001	38,224	0	48,618
2002	53,362	0	57,030
2003	43,592	0	47,468
Average			
Pre-OPSW	228,899	17,433	83,765
Post-OPSW	63,197	0	53,805

In the period prior to the OPSW this program likely had moderate risks and impacts to the Coquille wild coho population. Due to reductions in hatchery coho releases, the moderate size of current hatchery coho releases, limited adult passage issues, and a very low proportion of hatchery fish in the natural spawning population (an average of less

than 10%), we conclude the Coquille hatchery coho program is likely no longer a significant limit to the sustainability of this wild coho population.

- *Floras Population*

  Monitoring Area: Mid-South Coast
  Population Classification: Potentially Independent

  There are no ODFW or STEP hatchery facilities located within the geographic boundaries of this wild coho population. There have been no hatchery coho fingerling or smolt releases in this population in either the pre-OPSW (1990 to 1997) or post- OPSW (1998 to 2003) release period (Table III.3.18). There was a supplementation program using unfed fry from local wild coho. This program averaged releases of 25,000 unfed fry in the pre-OPSW period (1990 to 1997), but there have been none released since 1999 (Table III.3.18). There is currently no draft or proposed HGMP for a hatchery coho program in this population. We have very little information on the proportion of hatchery fish spawning in this wild population, but what we have suggests it is low. The Oregon Plan Review Data Site web page reports estimates of hatchery strays in this population as not available. Given that the Floras Creek basin is not located near any basins with large hatchery coho releases, it is likely it has received few stray hatchery coho. However, this is a small basin with a relatively small wild coho population. Therefore, even a few hatchery strays could result in a high proportion of hatchery fish in the naturally spawning population.

Table III.3.18. Releases of juvenile hatchery coho salmon within the Floras wild coho population.

Release Year	Unfed Fry	Fry and Fingerling	Smolts
1990	36,568	0	0
1991	62,320	0	0
1992	51,517	0	0
1993	0	0	0
1994	34,000	0	0
1995	0	0	0
1996	0	0	0
1997	16,170	0	0
1998	18,612	0	0
1999	35,955	0	0
2000	0	0	0
2001	0	0	0
2002	0	0	0
2003	0	0	0
Average			
Pre-OPSW	25,072	0	0
Post-OPSW	9,095	0	0

Due to the likely low potential for hatchery fish in the natural spawning population, lack of a hatchery facility, and lack of hatchery coho releases since 1999, we conclude the Oregon coast hatchery coho programs are likely not a significant limit to the sustainability of this wild coho population.

- *Sixes Population*

  Monitoring Area: Mid-South Coast
  Population Classification: Potentially Independent

  There are no ODFW or STEP hatchery facilities located within the geographic boundaries of this wild coho population. There have been no hatchery coho releases in this population in either the pre-OPSW (1990 to 1997) or post- OPSW (1998 to 2003) release period (Table III.3.19). There is currently no draft or proposed HGMP for a hatchery coho program in this population. We have very little information on the proportion of hatchery fish spawning in this wild population, but what we have suggests it is low. The Oregon Plan Review Data Site web page reports estimates of hatchery strays in this population as not available. Given that the Sixes River basin is not located near any basins with large hatchery coho releases, it is likely it has received few stray hatchery coho. However, this is a small basin with a relatively small wild coho population. Therefore, even a few hatchery strays could result in a high proportion of hatchery fish in the naturally spawning population.

Table III.3.19. Releases of juvenile hatchery coho salmon within the Sixes wild coho population.

Release Year	Unfed Fry	Fry and Fingerling	Smolts
1990	0	0	0
1991	0	0	0
1992	0	0	0
1993	0	0	0
1994	0	0	0
1995	0	0	0
1996	0	0	0
1997	0	0	0
1998	0	0	0
1999	0	0	0
2000	0	0	0
2001	0	0	0
2002	0	0	0
2003	0	0	0
Average			
Pre-OPSW	0	0	0
Post-OPSW	0	0	0

Due to the likely low potential for hatchery fish in the natural spawning population, lack of a hatchery facility, and lack of hatchery coho releases, we conclude the Oregon coast hatchery coho programs are likely not a significant limit to the sustainability of this wild coho population.

4. DEQ Compliance and Water Diversions

Water diversions at ODFW facilities are covered under existing water rights. The amounts of water used are reported annually to the Oregon Water Resources Department. Water effluent quality from ODFW hatchery facilities in this ESU is regulated under a general 300J NPDES permit as required by the Oregon Department of Environmental Quality. In the past there have been problems with permit compliance at some of the

hatchery facilities in this ESU. Violations included both exceeding limits in the permit and reporting errors. Improvements in hatchery programs and operations as well as improved training of hatchery personnel has resulted in no violations for at least the last 4 quarterly reporting periods. There have been some reductions in these risks since implementation of the OPSW. However, these risks were not the main focus of the OPSW or the IMST recommendations on hatcheries, and reductions in these risks are mainly the result of general improvements in hatchery programs and not necessarily tied to implementation of the OPSW.

5. Stream Enrichment Program.

Salmon carcass have been shown to be an important source of nutrients to freshwater ecosystems (Bilby et.al 1996, Bilby et.al 1998, Johnston et.al. 2004, Kline et.al 1990, and Richey et.al 1975). Nutrients from coho carcasses composed, on average, from 11% to 40% of the nutrients of various stream biota in coho spawning streams (Bilby et.al 1996). Salmon carcasses have been correlated with elevated levels of primary production (Johnston et.al. 2004 and Richey et.al 1975) and fish growth rates (Bilby et.al 1996). Addition of salmon carcasses from a local hatchery increased rearing densities, fish weight, and condition factor of naturally rearing coho and steelhead juveniles, in comparison to control streams (Bilby et.al 1998). These and other results have led to the hypothesis that reduced spawning escapements can become a negative feed-back loop (Bilby et.al 1996, and Larkin and Slaney 1997). Reduced escapements, resulting in fewer marine derived nutrients, resulting in reduced productivity of freshwater ecosystems, resulting in reduced productivity of salmonid populations, and thus lower escapements. At the time the OPSW was developed, this was becoming a major issue in the management of wild salmonid populations. In response the OPSW included a measure to develop an experimental stream enrichment program utilizing the carcasses of hatchery salmon and steelhead.

The OPSW stream enrichment program began in this ESU in the winter of 1997-98 and uses hatchery coho, chinook, and steelhead carcasses in Oregon coastal basins. The program goal is to provide increased marine derived nutrients in coastal watersheds, to assist in replacing the loss of nutrients from reduced runs of wild salmonids in those basins. The program is managed by ODFW with the help of volunteers, and is operated under and regulated by a Memorandum of Agreement (MOA) between ODFW and ODEQ. This program is also regulated by rules established in Oregon's Fish Health Management Policy (635-007-1000). The MOA establishes operational rules and guidelines. The current MOA is available from the ODFW headquarters office in Salem, Oregon. Following is a list of some of the key rules and guidelines for the program:

- ✓ Maximum of 2,500 lbs of carcasses per stream mile.
- ✓ Carcasses only used within historic range of salmonid spawning in the basin.
- ✓ Carcasses distributed in a semi-natural manner, i.e. not dumped in piles.
- ✓ Carcasses only used in pre-established list of streams.
- ✓ Carcasses will be placed only when or where they will not adversely impact water quality limitations described in the 303(d) Water Quality Limited Streams list.
- ✓ Strict monitoring to prevent spread of disease.
- ✓ Limits on use of carcasses in geographic areas outside where they were collected.

- ✓ Establishes monitoring requirements for the program.

Data for the stream enrichment program are reported on ODFW's Natural Resources Information Management Program web page (http://rainbow.dfw.state.or.us/nrimp/) and are summarized in Table 10. The program built slowly during the first 4 years. Although there are some differences between monitoring areas, the program as a whole has averaged about 21,000 carcasses, 230,000 pounds, and 280 stream miles treated for the ESU as a whole over the last 3 years (Table 10). This equates to an average of over 800 lbs/mile in treated streams over the last 3 years (Table 10). The MOA also established monitoring requirements for the program. In 1999, water quality tests were done on streams "super loaded" with carcasses. The tests were conducted in the Wilson River with carcasses distributed at 3,000 lbs/mile. Results indicated that water quality was not compromised at these loading levels. As a result, the MOA established a maximum loading rate of 2,500 lbs/mile, and no longer requires water quality testing for the program. Although research has shown nutrients from salmon carcasses to be an important component of freshwater ecosystems, there has not been a comprehensive study to evaluate this as a factor in the status of wild coho in the Oregon Coast coho ESU. Therefore, whether or not, and to what extent this stream enrichment program can assist in improving the status of wild coho in this ESU is unknown. To evaluate program effectiveness, ODFW will use a research methodology that compares individual stream before and after treatment, as well as compares results between treated and untreated streams (pre / post, treatment / control methodology). The evaluation will involve 48 coastal coho spawning streams. Abundance of coho spawners has been monitored in these 48 streams for the last 15 years, and will continue indefinitely. Up to 16 of the streams will be treated with 2,500 lbs/mile of hatchery carcasses and the remaining 32 will be untreated controls. Details of this monitoring program are available in the MOA.

6. Survival, Harvest and Economic Issues

Harvest of coho salmon in eastern Pacific Ocean marine fisheries is documented in several reports issued annually by the Pacific Marine Fisheries Commission (PFMC). The PFMC reports are available on their web page at (http://www.pcouncil.org/index.html). In addition, Part 4(C) ODFW (2) Harvest Report of the Oregon coastal coho assessment specifically addresses harvest and harvest issues. Coded-wire tag (CWT) technology is used to monitor post-release survival, catch, and contribution of specific groups of hatchery salmon. Release and recovery data for groups of CWT hatchery coho released in this ESU is reported on the Regional Mark Information System web site (http://www.rmis.org/). This information, along with other hatchery data is summarized in an OPSW annual report (Lewis 2004).

The economics of hatchery production in this ESU has been the subject of several reports over the last 15 years. In 1990 ODFW conducted a analysis of benefits and costs for all ODFW hatchery programs (ODFW 1990). This analysis, used a variety of data sources to estimate hatchery production benefits, and actual hatchery operational budgets to estimate hatchery costs. This analysis was updated in 1999 for State-operated facilities, which includes all the ODFW hatcheries in this ESU (ODFW 1999). This analysis used similar data sources to estimate adult salmon and steelhead produced and caught. However, the ODFW staff economist provided a more rigorous economic analysis of the economic benefits and costs of hatchery production. Hatchery costs included both operational costs and

estimated capital costs. Oregon Trout commissioned a study of the economics of the State of Oregon's hatchery programs in 1999 (Radtke and Davis 1997). This report and ODFW (1999) use similar data sources to estimate adult salmon and steelhead produced and caught, and value of harvested fish. Although both reports included both operational and capital costs, they use different means to calculate capitol costs. Finally, the Oregon Secretary of State Audits Division conducted an audit of the ODFW state funded hatchery programs (State of Oregon 2002). Again this report used similar data sources to estimate adult salmon and steelhead produced and caught, and value of harvested fish. However, costs included hatchery operational costs, deferred maintenance costs, and pro-rated agency administrative costs.

Production, survival, harvest, and economic issues related to salmonid hatcheries are all important considerations in a complete review of Oregon's hatchery program. However, the goal of this report is an evaluation of the effects of the OPSW on hatchery impacts to wild coho production in the Oregon Coast coho ESU. As the production, survival, harvest, and economic issues are not directly related to the goal of this report, and they are the subject of already existing reports {Part 4(C) ODFW (2) Harvest Report}, they will not be discussed further here.

7. Other Hatchery Programs

- Columbia Basin hatchery coho releases.

This report has been focused on the impacts to wild coho populations from hatchery coho programs within the Oregon Coast coho ESU. These are the hatchery coho programs most likely to directly impact wild coho in this ESU, based on geographic overlap. These are also the only hatchery coho programs directly referred to in the OPSW hatchery measures. However, other OPI hatchery coho programs, predominately Columbia Basin programs, could also impact wild coho from this ESU through ecological impacts in the shared ocean environment. These hatchery coho programs are not included in the OPSW hatchery measures, and ODFW has management authority over only about 30% of the Columbia Basin hatchery coho smolt releases (PFMC 2004).

The number of hatchery coho released each year in the OPI area was obtained from the PFMC web page (http://www.pcouncil.org/index.html). The release data is displayed in Figure 9, and was compiled from two reports in a preseason report series (PFMC 1995, and PFMC 2004). Columbia Basin hatchery coho smolt releases averaged 30 million from 1969 through 1993 (Figure 9). There has been a slight reduction in Columbia Basin hatchery coho smolt releases since 1993, with releases averaging about 24 million in the last 3 release years (2001 – 2003). Releases of hatchery coho smolts in the entire OPI area peaked at over 60 million in 1981, and have declined to about 26 million in the last 3 years (Figure 9).

In the 1960's increases in hatchery coho smolts released in the OPI area corresponded to increased abundances of coho adults (McGie 1981). However, adult coho production in the OPI area declined in the 1970's in spite of continued increases in OPI area coho smolt releases. McGie (1981) found ambiguous results in tests of this data for density dependence, but concluded this was a likely possible explanation of the trends observed. Ambiguous results for OPI area coho have continued, with studies concluding density dependence has occurred (McCarl and Rettig 1983, and Emlen et.al. 1990), and others concluding marine

survival of OPI area coho has been density independent (Peterman 1981, Clark and McCarl 1983, and Nickelson 1986). In a general review of salmon ocean ecology, Pearcy (1992) reviewed the case for density dependence in OPI area coho and concluded the issue is not yet settled. Two of the above studies also estimated smolt releases that would result in maximum adult production in the OPI area. Stock recruitment curves showed adult coho production peaked at about 31 million OPI area smolts and declined at smolt releases greater than 37 million (McGie 1981). Optimum adult coho production in the OPI area was estimated to occur at smolt releases of between 25 and 35 million (McGie 1981). Clark and McCarl (1983) concluded that the data was insufficient to determine optimum smolt release numbers, but that maximum adult production likely occurred at smolt releases from 32 million to 180 million, based on five different equations. However, the equations showed limited increases in adult production for smolt releases over 40 to 45 million smolts (Clark and McCarl 1983).

A variety of ocean conditions have been shown to correlate with marine survival and or growth of OPI coho and these ocean conditions vary over time (Nickelson 1986, Fisher and Pearcy 1988, Pearcy 1992, Koslow et.al. 2002, and Logerwell et.al. 2003). Survival of hatchery coho to jack returns is routinely used to estimate overall marine survival of OPI coho (PFMC 2004). This method is based on a strong correlation between marine survival in the first 6 months at sea (jack returns) and ultimate marine survival to adults. Catch of juvenile coho in June of their first month at sea was positively correlated to survival to jack returns (Fisher and Pearcy 1988). Thus, the first month in the ocean appears to be the critical period in determining overall marine survival of OPI coho (Fisher and Pearcy 1988, and Pearcy 1992). Assuming that ocean conditions in the first month at sea are a major factor in determining marine survival and that ocean conditions vary, we would conclude that whether or not density dependent factors will affect marine survival at any specific OPI coho smolt abundance likely varies with ocean conditions in the year of smolt migration.

In conclusion, we cannot determine whether or not, and if so to what extent, the current level of hatchery coho smolt releases in the Columbia Basin (about 24 million) is affecting marine survival of wild coho from the Oregon Coasts ESU. It is also unclear if the current level of total hatchery coho releases in the OPI area (about 26 million), in conjunction with wild coho smolts, reaches a level at which density dependent effects on marine survival may be occurring. However, the reduction in OPI area hatchery smolt releases from over 60 million in 1982 to the current 26 million, should reduce the probability of impacts to wild coho marine survival. It is also encouraging to note that for the last 3 years, 2001 to 2003, the average total OPI smolt abundance, OPI hatchery smolts (Figure 9) plus wild smolts for the Oregon Coast ESU (Figure 4) equals about 30 million total smolts. This is essentially the same total abundance of OPI area coho smolts as the 1960 to 1969 average of 29 million reported by Nickelson (1986). Clearly more research into marine interactions and carrying capacity of the OPI area is needed. We also need more information on stock specific differences in fish size, as well as spatial and temporal distributions, in the marine environment and how this influences interactions between the various components of OPI area coho salmon.

- Coastal hatchery releases of other species.

The ODFW hatcheries in this ESU rear and release coho, fall chinook, spring chinook, summer steelhead, winter steelhead and rainbow trout. The various species and stocks released are listed geographically by coho population in Table 1. Rainbow trout are not listed in Table 1, as all the hatchery rainbow trout released in the Oregon Coast coho ESU are released in lakes, ponds, and reservoirs. These trout are reared at hatcheries within and outside this ESU. The ODFW hatcheries within this ESU that rear trout are Alsea, Bandon, Nehalem and Rock Creek. A few of the trout release locations also contain wild coho. A draft HGMP for hatchery rainbow trout released in Eckman, Devils, Mercer, Sutton, Woahink, and Siltcoos lakes is posted on the ODFW web page, and is available for public comment. Particular concern has been raised over impacts to wild coho salmon, from hatchery rainbow trout released in Devils Lake. Potential impacts include; competition, predation, and incidental harvest of coho smolts in the trout fishery. Management of the Devils Lake hatchery trout program includes; mass marking (adipose fish clip) and selective harvest, to minimize harvest impacts on wild coho smolts. Analysis of scales from Devils Lake adult coho sampled in 2001, 2002 and 2004 indicated good growth rates and extensive use of the lake for juvenile rearing (personnel communication Lisa Borgerson). Electro-fishing in spring 2005, also showed good numbers and sizes of juvenile coho in Devils Lake (personnel communication Bob Buckman). Together, these results suggest competition in the lake is not likely a severe limitation to Devils Lake wild coho at this time. The electro-fishing in spring 2005 showed hatchery rainbow trout to be a small component of the overall fish community in Devils Lake (personnel communication Bob Buckman). In addition, predation by this stock of hatchery rainbow trout at these release sizes in not thought to be a significant concern. There is undoubtedly some level of hatchery rainbow trout over-wintering in the lake. However, based on fish size, the four hatchery rainbow trout observed in the electro-fishing in spring 2005 were all fish stocked in spring 2005 (personnel communication Bob Buckman). These results and management of hatchery trout programs, suggests risks to wild coho are likely minimal. Monitoring and evaluation of hatchery trout stocking in lakes containing wild coho will continue and ODFW will look at modifying or eliminating programs should results suggest that risks to wild coho are at unacceptable levels.

Hatchery cutthroat trout have also been reared and released in this ESU. The cutthroat trout program consisted of two components, fish released in lakes for trout fisheries and fish released in flowing waters for a sea-run cutthroat fishery. Although, the number of hatchery sea-run cutthroat trout released in this ESU was relatively small, the fish were released in the spring at a very large size, between 100 to 200 gm per fish. These fish could have had negative ecological impacts on wild coho salmon smolts in this ESU. Releases of hatchery sea-run cutthroat trout in flowing waters of the Oregon Coast coho ESU declined from about 200,000 in 1990 to about 50,000 in 1996. There have been no releases since 1996, and there are no plans for future releases of hatchery sea-run cutthroat trout in the Oregon Coast coho ESU. During the period 1990 to 2003, releases occurred in all the North Coast and Mid-Coast monitoring area major wild coho populations, except Yaquina River and Beaver Creek. There were also releases in the Lower Umpqua wild coho population, but none were released in the Mid-South Coast monitoring area. Releases per basin ranged from less than 5,000 to 70,000. Large releases, over 20,000 per basin, occurred only in the Nestucca, Siletz, Alsea, and Siuslaw wild coho populations. Releases in the Lower Umpqua wild coho population were about 16,000 per year.

Releases of juvenile hatchery chinook and steelhead in this ESU are reported in Table 11, and Figures 10 and 11. These releases are summarized by release year, and by three fish size/age categories (unfed fry, fry and fingerlings, smolts). Location of release is reported through three groupings, total releases, off station releases, and out of basin releases. Off station releases are characterized by lack of rearing, acclimation, or adult re-capture at the release site. Fish released in a basin other than that stock's basin of origin are reported as out of basin releases. Fish released in a closed water body (one from which they are assumed not to migrate to the ocean) are not included in the table or figures.

The bulk of this report discusses risks to wild coho populations in this ESU from hatchery coho releases in this ESU. These are the hatchery programs most likely to directly impact wild coho in this ESU. These are also the only hatchery coho programs directly referred to in the OPSW hatchery measures. However, the other hatchery programs in this ESU also pose potential risks and impacts to wild coho in this ESU. These other hatchery programs are not included in the OPSW hatchery measures. Generally, the types of risks and impacts are the same as those listed in the introduction section (Section I.2.). The specific risks to wild coho, from non-coho hatchery programs in this ESU, will depend on a variety of considerations, including; spatial and temporal overlap, abundance, fish size, behavior, and habitat usage of the hatchery fish and the wild coho. We will not conduct an analysis of interspecies interactions between wild coho and hatchery salmon and steelhead in this ESU. We will provide some general ideas on which hatchery programs are most like to impact wild coho, what are the most likely areas of impacts, which hatchery practices might be affecting the level of impacts, and some observations on trends in the hatchery programs.

Historically, releases of juvenile hatchery chinook in this ESU have included large numbers of unfed fry, fingerlings and smolts (Figure 10 and Table 11). Almost all releases of juvenile chinook in this ESU occur as sub-yearlings, between early spring (unfed fry) and fall (smolts). Over the last 14 years total hatchery chinook releases in this ESU have fluctuated between 3 and 5 million, but there is no increasing or decreasing trend (Figure 10 and Table 11). There is substantial fluctuation in total non-smolt hatchery chinook releases, unfed fry to fingerlings, with a trend toward releases of more fingerlings and less unfed fry (Figure 10 and Table 11). Between 1990 and 2003 non-smolt hatchery chinook releases in this ESU averaged about 3 million fish, and on average accounted for 75% of the off station releases (Table 11). Releases of hatchery fish not yet ready to migrate and releases in areas remote from the hatchery are likely to increase the possibility for ecological impacts to wild fish. A high level of spatial overlap was observed in Sixes River, Oregon, between wild coho and chinook juveniles in the spring, shortly after emergence (Stein et.al. 1972). However, by summer there was substantial spatial separation of the two species, and when in a common environment the coho grew faster and exhibited social dominance over the chinook (Stein et.al. 1972). Coho and chinook juveniles in the South Umpqua River showed similar differences in freshwater habitat use (Scarnecchia and Roper 2000). Hatchery chinook fingerlings released in April and May in the Coos Basin took about 1 month to migrate to the bay, and reared in the bay for 1 to 2 months (Fisher and Pearcy 1989). Substantial diet overlap was observed in the Columbia Estuary for juvenile coho and chinook (McCabe et.al. 1983). Sub-yearling coho are known to disperse in freshwater and may move down to mainstem and estuary habitats, but these are not considered their primary freshwater rearing habitats (Sandercock 1991). Juvenile coho have been observed rearing in estuary

marsh habitat in Salmon River Oregon, but only a relatively small (11% to 18%) proportion of the returning adult coho exhibited this juvenile estuary rearing (Cornwell et.al 2001). Given the social dominance of juvenile coho, and the limited degree of spatial and temporal overlap of wild coho juveniles and hatchery chinook fingerlings it is unlikely that the releases of hatchery chinook unfed fry or fingerlings is having a significant impact to the sustainability of wild coho in the Oregon Coast coho ESU. It is interesting to note that for the period 1990 through 2003, non-smolt hatchery chinook releases in the Coos Basin accounted for 64% of the total and 27% of the off-station releases of non-smolt hatchery chinook in the entire Oregon Coast coho ESU (ODFW hatchery release database). During this same time period the Coos Basin has had one of the largest and most productive wild coho populations in the ESU.

Hatchery chinook smolts are almost all released in the fall, mostly at hatcheries, and mostly in large tributary or mainstem habitats. Wild coho smolts will use these same areas as migration corridors, but not at this time of year. Hatchery chinook smolts might interact with wild coho fingerlings in the fall, however, there is generally only moderate amounts of coho rearing habitat below the hatchery releases sites (Table 9). Therefore, hatchery chinook smolt releases are not likely to have significant impacts to wild coho in freshwater due to very limited spatial and temporal overlap. The difference in timing of ocean entry, fall for hatchery chinook and spring for wild coho, should limit any ecological impacts to wild coho populations, competition and predator attraction, in the estuaries and near shore ocean environment. As noted above, in the discussion of Columbia Basin hatchery coho releases, the first month in the ocean appears to be a critical period in determining marine survival of coho salmon. Ocean distribution and diet of juvenile coho and chinook overlap (Brodeur and Pearcy 1990, Orsi and Wertheimer 1995, and Schabetsberger et.al 2002). However, there is evidence of spatial segregation by depth, with chinook inhabiting deeper water (Orsi and Wertheimer 1995), and significant differences in diet (Schabetsberger et.al 2003).

It has been suggested that wild coho populations that failed the viability analysis (Part 2 of the Oregon Coastal Coho Assessment) generally had hatchery chinook releases, and wild coho populations that passed didn't, or only had STEP program releases. We don't have any evidence that STEP program releases of chinook have any more or less impact to wild coho than ODFW hatchery chinook releases. In fact the Coos Basin STEP chinook program releases over 2 million juveniles a year (unfed fry to smolts) which is more that twice the number of any other chinook program in the Oregon Coast Coho ESU. Over the last 2 coho generations or 6 release year (1998 to 2003) three of the five wild coho populations that failed the viability analysis had hatchery chinook releases. The average annual release of hatchery chinook in these populations was about 315,000 fish. A fourth wild coho population (Alsea) had chinook hatchery juvenile releases prior to the 1997 release year. Of the five wild coho populations that ranked as pass in the viability analysis three had hatchery chinook releases, and those releases averaged about 114,000 fish per year. Of the seven wild coho populations that were ranked pass plus in the viability analysis three had hatchery chinook juvenile releases, and those releases averaged about 327,000 fish per year. Thus, for each ranking in the viability analysis roughly half the populations had hatchery chinook releases, and there was no apparent trend in numbers of fish released. Of the nine wild coho populations that had hatchery chinook releases, eight also had hatchery coho releases. Thus, any analysis of a correlation between hatchery chinook releases and the status of wild coho populations is compounded by hatchery coho releases.

Historically, releases of juvenile hatchery steelhead in this ESU have included large numbers of unfed fry and smolts (Figure 11 and Table 11). Releases of fingerling hatchery steelhead in this ESU have been very rare since 1992 (Table 11). Releases of hatchery steelhead unfed fry in this ESU have decreased from about 3 million in 1990, to between 100,000 and 300,000 since 1994 (Table 11). Releases of hatchery steelhead unfed fry in the Coos and Coquille basins have averaged 70% since 1994, and 90% for the last 3 years (2001 to 2003), of all hatchery steelhead unfed fry released in the ESU (ODFW hatchery release database). The presence and density of juvenile steelhead negatively affected growth but not survival of juvenile coho in freshwater streams (Harvey and Nakamoto 1996). However, that study examined affects within fenced sections of streams, and under natural conditions juvenile steelhead and coho show a high degree of habitat segregation within freshwater habitats (Scarnecchia and Roper 2000). Given the large reductions in non-smolt hatchery steelhead releases it is likely that any impacts to wild coho in this ESU are greatly reduced from historic levels. We conclude that the likely spatial separation between hatchery steelhead and wild coho juveniles in freshwater, the small size of the non-smolt hatchery steelhead releases and their concentration in two basins (Coos and Coquille), prevent these hatchery programs from having a significant impact on the sustainability of wild coho in the Oregon Coast coho ESU. Any impacts are likely limited to the Coos and Coquille basins, which in recent years are areas with some of the largest and most productive wild coho populations in the ESU.

Releases of hatchery steelhead smolts averaged about 1.8 million from 1990 through 1994 (Figure 11 and Table 11). Releases have been reduced to an average of about 1.3 million for the last seven years, 1997 through 2003 (Figure 11 and Table 11). Hatchery steelhead smolt releases occur in the spring, and thus overlap temporally with wild coho fry emergence timing (Sandercock 1991) and smolt migration timing (Solazzi et.al. 2003). Although the data for this ESU is limited, it appears hatchery steelhead smolts move fairly quickly to the ocean. Peak catches of hatchery steelhead smolts in the Alsea and Siletz estuaries occurred within 1 week of release, although some fish remained in the basin for an extended time (Buckman 1999). Thus, hatchery steelhead smolts are most likely to interact with wild coho during the relatively short time the hatchery steelhead smolts are in the migration corridor below the release site. As noted above, for fish releases at a hatchery there are generally only moderate amounts of coho rearing habitat below the hatchery releases sites in this ESU (Table 9). Off-station releases could increase the likelihood of interactions, if the off-site release occurs in or above wild coho rearing areas. Although not analyzed in this report, it appears most off-station releases are in mainstem or larger tributary areas. These types of habitat are not generally considered the primary freshwater rearing habitats for wild coho (Sandercock 1991). Thus, most interactions are likely between hatchery steelhead smolts and wild coho smolts.

Average annual releases of hatchery steelhead smolts in individual basins, between 1997 and 2003, ranged from about 20,000 in the Yaquina and Tenmile Lakes basins to about 200,000 in the Tillamook and Umpqua basins (ODFW hatchery release database). At release, hatchery steelhead smolts in this ESU average about 190 mm FL, and over 90% are between 160 and 230 mm FL (ODFW unpublished data). This is substantially larger than the average length of wild coho smolts in this ESU, range of 100 mm to 120 mm (Solazzi et.al. 2003). Differences in weight are even greater, with hatchery steelhead smolts typically between 70 gm and 90 gm, where as wild coho smolts are 11 to 17 gm (personnel

communication Bob Buckman). The larger size of hatchery steelhead smolts provides at least two potential areas for ecological interactions with wild coho: competition and predation. As noted earlier, release location, the relatively rapid migration of hatchery steelhead smolts, the reduction in numbers of hatchery steelhead smolts released, and the relatively low to moderate numbers released in each basin should decrease and minimize the potential for competition between hatchery steelhead smolts and wild coho. In a review of published literature on feeding habitat of salmonid fishes, Keeley and Grant (2001) noted that in streams, insects were the dominant prey class and that fish were rare in the diets of salmonid fishes below 250 mm in length. The average size when half the salmonid fish in streams contained some fish in their stomachs was 270 mm (Keeley and Grant 2001). Steelhead smolts in the Columbia estuary predominately preyed on invertebrates (McCabe et.al. 1983). Steelhead did consume fish, but although juvenile chinook and coho were present in the Columbia Estuary none were observed in steelhead stomachs (McCabe et.al. 1983). Based on stomach contents analysis of rainbow trout in the size range of steelhead smolts, consumption of fish is rare in lakes (Efford and Tsumura 1973, Schneidervin and Hubert 1987, and Hubert et.al. 1994) and streams (Bisson 1978, and Angradi and Griffith 1990). When piscivory was observed, it occurred with rainbow trout at sizes larger that the typical size of hatchery steelhead smolts, over 250 mm (Efford and Tsumura 1973) and over 300 mm (Hubert et.al. 1994). Thus, given the limited spatial and temporal overlap noted earlier, and the indication that *Oncorhynchus mykiss* in the size range of hatchery steelhead smolts are not highly piscivorous, it is unlikely that hatchery steelhead smolts are responsible for any significant predation on wild coho in this ESU.

IV. Policy and Planning

In both their 1998 and 2001 reviews of hatchery issues the IMST has called for a comprehensive policy for hatchery management and specific management plans for individual hatchery programs (IMST 1998 and 2001). In 2002 the Oregon Fish and Wildlife Commission adopted a new policy governing management of wild fish, the NFCP. In 2003 Oregon Fish and Wildlife Commission adopted two new policies governing management of hatchery fish, the FHMP and Fish Health Management Policy. These three policies establish the overarching framework for hatchery management called for by the IMST. Specific management plans for each hatchery program are a requirement of the FHMP, of the OPSW, and of the 4(d) rule(s) implemented for species listed under the Federal ESA. Following are discussions of these policies and their implementation.

1. Native Fish Conservation Policy

In 2002 the Oregon Fish and Wildlife Commission adopted the Native Fish Conservation Policy (OAR 635-007-0502 through 635-007-0509). The purpose of the NFCP is to ensure conservation and recovery of Oregon's native fish species. The policy is focused on naturally produced native fish, but also provides context and guidance for hatchery programs. The intent of the policy is to "…provide a basis for managing hatcheries, fisheries, habitat, predators, competitors, and pathogens in balance with sustainable production of naturally produced native fish." The new NFCP establishes three policy goals, which are 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.
(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.

The policy will be implemented through conservation plans, developed with input and collaboration from management partners (Tribal, State, and Federal), university programs, and the public. In addition ODFW will seek independent scientific peer review of conservation plans. Conservation plans shall be based on the concept that locally adapted populations provide the best foundation for maintaining and restoring sustainable naturally produced native fish. The NFCP establishes the Species Management Unit (SMU) as the grouping for management on naturally produced native fish. An SMU is a collection of populations from a common geographic region that share similar genetic & ecological characteristics. A conservation plan will be developed for each SMU. Conservation plans shall illustrate a range of options for recovery strategies, fisheries and the responsible use of hatchery produced fish. Conservation plans will address the following elements:

1. Identification of the SMU and the constituent populations.
2. Description of the desired biological status.
3. Description of the current status.
4. Assessment of the primary factors causing the gap between current and desired status.
5. Short- and long-term management strategies to address the limiting factors.
6. Description of monitoring, evaluation & research necessary to gauge the success.
7. Process for modifying strategies based on monitoring, evaluation and research results.
8. Measurable criteria indicating significant deterioration in status.
9. Annual and long-term reporting requirements, in a format available to the public.
10. Description of potential impacts to other native fish species

Conservation plans developed under this policy will be presented to the Oregon Fish and Wildlife Commission for adoption. The policy establishes priorities for development of conservation plans (OAR 635-007-0505(3)). Pending completion of conservation plans existing rules and plans, and/or the NFCP interim criteria (OAR 635-007-0507) will guide management of each SMU. Currently, ODFW is reviewing a draft status report of native fish in Oregon that describes each SMU and its status.

2. Fish Hatchery Management Policy

In 2003 the Oregon Fish and Wildlife Commission adopted the Fish Hatchery Management Policy (OAR 635-007-0542 through 635-007-0548) and the companion Fish Health Management Policy (OAR 635-007-0960 through 635-007-1000). These policies, in conjunction with the NFCP and other existing policies and plans, create a foundation for the management, reform, and operation of ODFW hatchery programs. These plans and policies also apply to STEP and cooperative hatchery programs. The purpose of the FHMP is to

describe the hatchery tool and its uses, with the intent of maintaining genetic resources and helping to ensure conservation of both naturally produced and hatchery produced native fish. The new HFMP establishes four policy goals:

(1) Foster and sustain opportunities for sport, commercial and tribal fishers consistent with the conservation of naturally produced native fish.
(2) Contribute toward the sustainability of naturally produced native fish populations through the responsible use of hatcheries and hatchery-produced fish.
(3) Maintain genetic resources of native fish populations spawned or reared in captivity.
(4) Minimize adverse ecological impacts to watersheds caused by hatchery facilities and operations.

The policy will be implemented through a two tiered process including an NFCP conservation plan for the SMU, and a Hatchery Program Management Plan (HPMP) for the individual hatchery program. The conservation plan will establish the context and specific uses for each hatchery program within the SMU as a whole, and within the specific basin where the hatchery program operates. The HPMP will describe the specific goals, performance standards, management, operation, and monitoring of the hatchery program to comply with the context and uses established in the conservation plan. The HPMP for each hatchery program will be consistent with and support the conservation plan developed through the NFCP for that species in that area. The FHMP specifies the use of the "best available scientific information", monitoring and evaluation adequate to assess compliance with management goals, and adaptive management, as the tools needed to achieve consistency with and support of the native fish conservation plan.

The FHMP establishes a list of specific topics and guidelines to be addressed in a HPMP. These include descriptions of the program's objectives, fish culture operations, facilities operations, and monitoring and evaluation. The policy also provides guidance on the development of an HPMP, including consultation and cooperation with management partners (Tribal, State, and Federal), university programs, and the public. The FHMP provides specific guidance on the elements of an HPMP including program objectives, program types, fish culture operations, facility operations, fish health (through the Fish Health Management Policy), record keeping, data management and reporting, personnel training, and monitoring and evaluation of the hatchery program.

Fish Division staff of ODFW will be responsible for the review, modification (if needed), and approval of each HPMP. Existing hatchery programs will continue to operate under existing statutes, rules and plans, pending completion of a HPMP for that program. An existing hatchery management plan, including an HGMP, Lower Snake River Compensation Plan annual operating plan, or other management document that meets the guidelines in the FHMP can serve as a HPMP.

3. Hatchery and Genetic Management Plan development

Under prior ODFW policy, OPSW measure ODFW-II.A.3, and as part of Federal ESA 4(d) rule requirements, an HGMP is to be developed for each hatchery program in the Oregon Coast Coho ESU. Development of HGMPs for hatchery programs in this ESU began in 1997, but has not yet been completed. There are a total of 33 hatchery salmon and steelhead programs in this ESU, and the status of the HGMP for each is reported in Table 8.

Workloads and shifting priorities have resulted in this process taking far longer than anticipated. We have a draft HGMP for every salmon and steelhead hatchery program in this ESU, except for one winter steelhead program. A draft HGMP for this program is being developed under a contract with an outside consultant. To date all of the seven coho, 4 of 15 steelhead, and 1 of 11 chinook HGMPs have been submitted to NOAA Fisheries. None of the submitted HGMPs has yet been reviewed and approved by NOAA Fisheries.

The intention to develop management objectives and operational guidelines for each ODFW hatchery program was established in 1992 under Oregon Administrative Rule (OAR), as the Hatchery Fish Gene Resource Management Policy (HFGRMP. OAR 635-007-0540 through 635-007-0541). Although some progress did occur under this policy it was never fully implemented, and was replaced in 2003 by the Fish Hatchery Management Policy (OAR 635-007-0542 through 635-007-0548). In 1997 ODFW began work on a management plan for the Nehalem hatchery coho program that would fulfill both OPSW measure (ODFW-II.A.3) and the HFGRMP. Although, a plan was finished in 1998, the format was superceded that same year by adoption of a hatchery management plan for the Cole Rivers hatchery coho program (ODFW 1998), that implemented both the OPSW and HFGRMP needs, and was submitted to and approved by NOAA Fisheries as the management plan required under the Federal ESA 4(d) rule governing the listing of the Southern Oregon/Northern California Coast coho ESU. After the 1998 listing of the Oregon Coast coho ESU, ODFW began compiling and summarizing the basic information for all the coastal hatchery coho programs. This information was used to begin compiling a draft HGMP for the Nehalem Hatchery coho program (ODFW 2001a) using the format of the Cole Rivers coho HGMP. However, in December 1999 NOAA Fisheries developed a template for HGMPs submitted under the Federal ESA 4(d) rule(s) then in existence. Between 1999 and 2001 ODFW committed a great deal of agency resources and staff time to development of HGMPs for the hatchery programs is this ESU. The 2001 ruling by Judge Hogan in *Alsea Valley Alliance v. Evans*, essentially de-listed the Oregon Coast coho ESU. Due to the legal uncertainty created by this ruling and its appeal, ODFW staff either returned to their normal duties, or switched over to developing HGMPs for the hatchery programs in the Willamette basin. With development of draft HGMPs for Willamette Basin hatchery programs now essentially done, and the 2004 proposed threatened listing of the Oregon Coast coho ESU by NOAA Fisheries (Federal Register Notice 2004), work on HGMPs in this ESU has resumed.

Through the process of developing HGMPs for Columbia Basin hatchery programs the NOAA Fisheries HGMP template has undergone some modifications. While these changes do not represent a major change in the content of an HGMP, they do require more in-depth development of a few sections of the HGMP. Although we have at least a draft HGMP for all but one hatchery program in this ESU, eight of those drafts are still in the "Old" HGMP format (Table 8). These drafts will need to be revised to meet the "New" HGMP format. They will also need to be updated to reflect information and changes that have accrued between 2001 and 2004.

4. NMFS Policy for Evaluation of Conservation Efforts

In March of 2003 the U.S. Fish and Wildlife Service and National Marine Fisheries Service adopted a policy on the evaluation of conservation efforts when making listing decisions under the federal Endangered Species Act (Federal Register Notice 2003). This

policy establishes 15 criteria for evaluating whether a conservation agreement, not yet implemented and/or not yet demonstrating results, will be both implemented and effective in contributing to the elimination or reduction of threats to the species as identified under section 4(a)(1) of the Federal ESA.

In their 1995 status review of coho salmon ESUs, NOAA Fisheries identified widespread hatchery coho production as one of the factors in their conclusion that the ESU was likely to become endangered in the future (NMFS 1995). The review identified the hatchery related threats to the ESU as high levels of hatchery coho in the natural spawning populations, juvenile hatchery coho releases in most major basins, use of out-of basin-stocks in many basins, and difficulty in monitoring wild coho due to incomplete marking of hatchery fish. In the status review update (NMFS 2003) and their Federal Register notice proposing a threatened listing for the Oregon Coast Coho ESU (Federal Register Notice 2004) NOAA Fisheries noted that the changes in hatchery programs since implementation of the OPSW have reduced risks to wild coho in this ESU. However, they noted it may take time for these benefits to become apparent and a concern over the possibility of future public pressures to increase hatchery production in this ESU (NMFS 2003). Following are specific responses to each of the 15 PECE criteria as they relate to the above hatchery risks and to the hatchery measures identified under the OPSW:

A. The certainty that the conservation effort will be implemented:

1. The conservation effort, the party(ies) to the agreement or plan that will implement the effort, and the staffing, funding level, funding source, and other resources necessary to implement the effort are identified.

Sections III. and V.1., discuss implementation of the OPSW measures and results of that implementation in this ESU. The OPSW have either been or are being implemented and most have been for the last 6 plus years. Most hatchery measures were determined to not require additional funding or staffing, beyond what is identified in the ODFW fish propagation base budget. Funding for construction of the Hatchery Research Center (HRC) is included in the current budget, and operation cost are built into the proposed FY 2005-06 budget.

2. The legal authority of the party(ies) to the agreement or plan to implement the formalized conservation effort, and the commitment to proceed with the conservation effort are described.

The ODFW has both authority to operate and manage hatchery operations under Oregon Revised Statutes (ORS). The agency has established policies and rules for such actions under Oregon Administrative Rules (OAR). The OPSW was established under Executive Order 99-01 by authority of the Governor of the State of Oregon. The OPSW has been operational for the last 6 plus years, and is the Statewide policy for management of salmon, steelhead and their habitats in the State of Oregon.

3. The legal procedural requirements (e.g. environmental review) necessary to implement the effort are described, and information is provided indicating that fulfillment of these requirements does not preclude commitment to the effort.

As described in question 2 above the State of Oregon has the legal authority, and has exercised such authority in establishing and implementing the OPSW. Hatchery water withdrawals are authorized and regulated under establish water rights through the legal authority of the Oregon Water Resources Department (OWRD). Hatchery effluent is regulated through the legal authority of the Oregon Department of Environmental Quality

(ODEQ) under an existing permit process. Use of hatchery carcasses in stream enrichment activities is authorized and managed under the legal authority of the Oregon Department of Environmental Quality through a Memorandum of Agreement between ODEQ and ODFW.

4. Authorizations (e.g., permits, landowner permission) necessary to implement the conservation effort are identified, and a high level of certainty is provided that the party(ies) to the agreement or plan that will implement the effort will obtain these authorizations.

The ODFW fish propagation program has been in operation for decades, under the necessary and pertinent permits and authorizations. The changes in operations and OPSW measures will generally not require any additional permits or authorizations. Exceptions include the stream enrichment activities, which are authorized through a Memorandum of Agreement between ODEQ and ODFW, and construction at the HRC. All applicable local, state, and federal permits and authorizations for this construction are or will be obtained and are available from ODFW headquarters in Salem Oregon.

5. The type and level of voluntary participation (e.g., number of landowners allowing entry to their land, or number of participants agreeing to change timber management practices and acreage involved) necessary to implement the conservation effort is identified, and a high level of certainty is provided that the party(ies) to the agreement or plan that will implement the conservation effort will obtain that level of voluntary participation (e.g., an explanation of how incentives to be provided will result in the necessary level of voluntary participation).

Most hatchery measures do not involve volunteers. Those that do are generally involved with the STEP program which has been in operation since the early 1980's. STEP activities and levels of participation can be obtained from the STEP annual report, online at http://www.dfw.state.or.us/STEP/main.html.

6. Regulatory mechanisms (e.g., laws, regulations, ordinances) necessary to implement the conservation effort are in place.

See the answers to questions 2 through 4 above.

7. A high level of certainty is provided that the party(ies) to the agreement or plan that will implement the conservation effort will obtain the necessary funding.

Funding for government programs is always subject to the annual or biennial budgeting process. However, the OPSW has been funded and implemented for the last 6 plus years. In addition, most hatchery measures were determined to not require additional funding or staffing, beyond what is identified in the ODFW fish propagation base budget.

8. An implementation schedule (including incremental completion dates) for the conservation effort is provided.

Most of the hatchery measures under the OPSW have specific timelines for implementation, which are discussed under Section V.1. of this report. A complete set of timelines and implementation schedules for the OPSW are outlined in the plan itself. Available on the web at: http://www.oregon-plan.org/.

9. The conservation agreement or plan that includes the conservation effort is approved by all parties to the agreement or plan.

The OPSW was established through Executive Order 99-01 by the Governor of the State of Oregon. The OPSW has been in existence and been implemented for the last 6 plus years.

B. The certainty that the conservation effort will be effective:

1. The nature and extent of threats being addressed by the conservation effort are described, and how the conservation effort reduces the threats is described.

Hatchery risks and impacts are summarized in Section I.2. above. This summary is based on the factors for decline as described in the OPSW, NOAA Fisheries status reviews (NMFS 1995 and NMFS 2003), and in reviews by the independent science panel with oversight for the OPSW (IMST 1998 and IMST 2001).

2. Explicit incremental objectives for the conservation effort and dates for achieving them are stated.

Specific objectives for OPSW measures are identified, and their implementation discussed in SectionV.1. of this report. A complete set of objectives and timelines for the OPSW are outlined in the plan itself, available on the web at: http://www.oregon-plan.org/. Hatchery program objectives and timelines are established in the HGMP for each hatchery program. Specific conservation objectives for wild fish populations in Oregon are being established through stock status reports developed through implementation of ODFW's NFCP.

3. The steps necessary to implement the conservation effort are identified in detail.

The hatchery measures and their implementation status are discussed in Section V.1. of this report. Actual implementation and results at various geographic scales are discussed in Section III. of this report. Specific management plans for each hatchery program are discussed in detail in that program's HGMP. Descriptions of how each hatchery program corresponds to the conservation and management of wild fish are described in existing ODFW species and basin management plans, and the 1994 ODFW review of WFMP compliance. As part of the implementation of the new NFCP and FHMP, the status and management of wild fish populations, including hatchery fish and their management, will be reviewed and discussed as stock status reports and conservation plans are developed.

4. Quantifiable, scientifically valid parameters that will demonstrate achievement of objectives, and standards for these parameters by which progress will be measured, are identified.

Specific objectives and quantifiable metrics are established in two of the OPSW hatchery measures, reduction of smolt releases to 2.3 million, and marking all hatchery smolts released. A third OPSW hatchery measure calls for implementing the specific and quantifiable actions developed in the 1994 WFMP review. Another OPSW measure calls for the development a management plan (HGMP), including specific goals, objectives and standards for each hatchery program. The last two measures call for research and monitoring of means to use hatcheries and programs to assist in the rebuilding of wild coho populations. The measure on using hatchery fish in a study of stream enrichment is governed by an Memorandum of Agreement between ODEQ and ODFW, that is available on the web at: http://www.dfw.state.or.us/ODFWhtml/InfoCntrFish/PDFs/carcassmoa.pdf. The OPSW hatchery measures, their likely impacts to wild fish, and their scientific validity were review by NOAA Fisheries and/or IMST (IMST 1998 and NMFS 1995).

5. Provisions for monitoring and reporting progress on implementation (based on compliance with the implementation schedule) and effectiveness (based on evaluation of quantifiable parameters) of the conservation effort are provided.

The OPSW established or built on existing ODFW monitoring programs in this ESU. The information from these programs is available in ODFW databases and annual reports including: Hatchery operations, juvenile releases, adult returns and post release survival, (HMIS database, Lewis (2004), and ODFW (2003)); Hatchery fish on natural spawning grounds (Jacobs et.al 2002); OPSW life-cycle monitoring sites (Solazzi et.al 2003). Finally, the IMST holds periodic monitoring reviews and other workshops to review actions and results of the OPSW.

6. Principles of adaptive management are incorporated.

Two of the six OPSW hatchery measures (ODFW-II.B.1 and ODFW-IV.B.4) are research and monitoring actions to provide the information needed to improve management of hatchery programs and assist in recovery of wild populations. A third measure (ODFW-II.A.4) implements a management tool to allow for improved monitoring of both hatchery and wild fish to assist in adaptive management. In each HGMP there are sections describing alternatives to the current hatchery program, how the program will be monitored, and actions that can be used if the program is not meeting the program standards, goals and objectives. Basin plans and, when developed, conservation plans under the NFCP will provide further guidance on program alternatives, monitoring and adaptive management of hatchery programs and the wild populations within which they exist. Finally, the IMST reviews programs and plans developed under the OPSW, and holds periodic monitoring reviews and other workshops to review actions and results of the OPSW as well as new research findings.

V. Implementation of OPSW Measures and IMST Recommendations

1. OPSW Measures

The 1997 Oregon Plan identified six measures specific to the ODFW hatchery program. The following list provides a brief description and the implementation status of each measure:

ODFW-II.A.1 – Implement Coho Wild Fish Management Policy Strategies.

Description: The measure refers to a set of strategies approved by the Oregon Fish and Wildlife Commission in 1994, and specifically identifies three objectives. 1) Reducing releases of hatchery smolts; 2) Removing hatchery origin fish as much as possible from natural spawning areas with traps at hatcheries or fish ladders; and 3) Implementing other WFMP strategies.

Status: The 1994 WFMP review identified 16 specific strategies involving six hatchery coho programs in this ESU. Each of those strategies is discussed below.

Nehalem Hatchery Coho Program

Strategy 1). Maintain existing broodstock. The two hatchery broodstocks used by this program are still in use and genetic management is described in the relevant HGMP.

Strategy 2). Remove returning hatchery fish at N.F. Nehalem fish ladder. This strategy was implemented for 4 years, 1998 to 2001, and was then discontinued for a variety of reasons including logistical and safety issues, a high percentage of the

hatchery fish passed above the falls without going through the fish ladder, and a reduction in hatchery smolt releases to levels much lower than proposed in 1994.

Strategy 3). Reduce annual hatchery smolt release number from 800,000 to 605,000 per year. Hatchery smolt releases were reduced to 630,000 in 1996, to 200,000 in 1998, and to 100,000 in 2003.

Trask Hatchery Coho Program

Strategy 1). Reduce number of hatchery coho released from 1.2 million smolts to 200,000 smolts. Mark all releases from Trask hatchery. Trask Hatchery smolt releases were reduced to 200,000 in 1995, and to 100,000 in 2003.

Salmon River Hatchery Coho Program

Strategy 1). Eliminate hatchery coho releases in Salmon River. Smolt releases were reduced to 200,000 in 1997, but have not been eliminated.

Strategy 2). Rear Columbia River hatchery coho stock for release in Youngs Bay. This option was discussed in 2004, but has not been implemented.

Strategy 3). Monitor N. Coast streams for hatchery strays from program. Documenting straying of hatchery coho in Oregon coastal basins is an ongoing OPSW monitoring activity.

Siletz River Hatchery Coho Program

Strategy 1). Eliminate hatchery coho releases into Siletz River. Smolt releases were reduced to 50,000 in 1996, and will be eliminated for 5 years beginning in 2006.

Strategy 2). Rear Columbia River hatchery coho stock for release in Youngs Bay. This option was discussed in 2004, but has not been implemented.

Strategy 3). Monitor N. Coast streams for hatchery strays from program. Documenting straying of hatchery coho in Oregon coastal basins is an ongoing OPSW monitoring activity.

N. F. Umpqua River Hatchery Coho Program

Strategy 1). Maintain existing hatchery broodstock. This hatchery broodstock is still in use, and genetic management is described in the relevant HGMP.

Strategy 2). Maintain existing hatchery smolt release number – 140,000 per year. The 140,000 release target was maintained through 2000, but has been reduced to 62,500 since then.

Strategy 3). Enhance adult attraction and trapping facilities at Rock Creek Hatchery. The Rock Creek adult trapping facilities are currently undergoing review for modification and improvements.

S. F. Umpqua River Hatchery Coho Program

Strategy 1). Develop hatchery broodstock from wild S.F. Umpqua fish. Returns of 100% marked hatchery coho adults began in 1998, which aided implementation of this strategy. In recent years the broodstock has been 100% wild South Umpqua coho, with a goal of at least 33% fish in the broodstock each year.

Strategy 2). Maintain existing hatchery smolt release number – 125,000 per year, and rear at Butte Falls Hatchery. The 125,000 release target was maintained through 1998, but has been reduced to 60,000 since then. Rearing was maintained at Butte Falls, but will switch to Rock Creek Hatchery beginning with the 2004 brood year, release in 2006.

Strategy 3). Expand acclimation release sites in the S.F. Umpqua basin. Acclimation facilities for 60,000 smolts were developed at the base of Galesville Dam, and have been in use since 1999.

ODFW-II.A.2 – Reduce Coastal Hatchery Coho Smolt Releases.

Description: Specifically this measure calls for reducing smolt releases to 3.4 million in 1997 and 2.3 million in 1998.

Status: Implemented and on going. Met timeline for reducing hatchery coho smolt releases. Coastal hatchery coho smolt releases were 3.0 million in 1997 and 1.7 million in 1998. Planned coastal hatchery coho smolt releases in 2005 (2003 brood year) are less than 1.0 million.

ODFW-II.A.3 – Develop Management Objectives, Including Genetic Guidelines.

Description: This objective calls for written management objectives and operational guidelines for all coastal hatchery coho programs by the end of 1997.

Status: Done, although we did not meet the timeline of end of 1997. The last coastal hatchery coho HGMP was submitted to NOAA Fisheries in 2003. There is an HGMP still under development for a proposed coho program (Table 8). However, this program is not currently being implemented, and can not be implemented prior to completion of the HGMP.

ODFW-II.A.4 – Mark All Hatchery Coho.

Description: Specifically to externally mark all hatchery coho prior to release as smolts, beginning with the 1995 brood (1997 release year).

Status: Implemented and on going. Met timeline for mass marking coastal hatchery coho smolts, beginning with the 1995 brood year (1997 release year). The design of the mass marking program has included some groups of double index fish, which are not externally marked but do have a coded-wire tag. Plans for the 2003 brood year (2005 release year) call for one group of 25,000 double index fish for release in the Rogue River. Results of pre-release mark quality checks showed that for the 1997 through 2002 release years, coastal hatchery coho smolt releases averaged 98.7% marked and 89.3% adipose fin clipped.

ODFW-II.B.1 – Assess the Effectiveness of Using Hatchery Production to Reintroduce or Rebuild Depressed Wild Coho Populations.

Description: This measure does not have any specific numerical or date goals, but calls for assessment and evaluation of this tool.

Status: In progress. There are several ODFW research programs around the state addressing this issue including; aspects of the Lower Snake River Compensation Plan, Hood River Steelhead supplementation research, and the Umpqua River Conservation Hatchery Improvement Program (CHIP) research on Calapooya Creek. The Umpqua River CHIP program is located within the Oregon Coast coho ESU and uses a pedigree analysis to assess supplementation of a naturally spawning coho population with both hatchery and wild broodstock juveniles. North Fork Nehalem life-cycle monitoring site data is also being reviewed as a possible means of examining productivity of hatchery and wild fish in the natural environment. Finally, ODFW is in the process of converting

an old production hatchery into a hatchery research center. The Hatchery Research Center is a cooperative project with Oregon State University and other partners. The remodeling will be completed by summer 2005. Further information is available on the web at: (http://www.dfw.state.or.us/HRC/main.html).

ODFW-IV.B.4 – Use Hatchery Carcasses to Increase Stream Productivity.

Description: The measure has four specific objectives: 1) Develop an expanded carcass placement and monitoring plan for experimental placement of carcasses beginning Fall of 1997; 2) Obtain DEQ approval for placement of surplus carcasses in selected streams and request their commitment to water quality monitoring; 3) Obtain and distribute carcasses in selected reaches of coastal coho streams; and 4) Conduct follow up evaluations, including carcass distribution and retention, and production changes in test and control streams.

Status: Implemented and ongoing. See Section III. 5. above.

2. IMST Report 1998-1

The IMST reviewed the OPSW hatchery related measures in light of the recommendations of three recent independent hatchery review panels and made the following conclusion (IMST 1998). "The IMST concludes that the major issues identified by the three panels are recognized and reflected in the Oregon Plan. However, determining hatchery effectiveness has not been given enough priority and the measures that are proposed to address the other concerns are not entirely inadequate. Of primary concern is the lack of direct monitoring of hatchery and wild interactions either on the spawning grounds or in the juvenile rearing areas and migration routes." In addition the IMST made eight recommendations to the OPSW as it relates to hatchery coho programs along the Oregon coast.

Following are the eight specific IMST recommendations, and comments on ODFW's progress in implementing and/or addressing them. Between 1998 and 2004 considerable progress, both direct and indirect, has been made on these recommendations. However, more work is needed on some and others represent on-going activities and coordination.

Recommendation 1. ODFW give higher priority to measure II.A.3 (development of management objectives for each hatchery program, including genetic guidelines) of the Oregon Plan and complete the development and adoption of objectives and management guidelines for each coastal coho hatchery as quickly as possible.

Status: Done, although we did not meet the timeline of end of 1997. The last coastal hatchery coho HGMP was submitted to NOAA Fisheries in 2003. There is an HGMP still under development for a proposed coho program (Table 8). However, this program is not currently being implemented, and can not be implement prior to completion of the HGMP.

Recommendation 2. ODFW establish and implement a specific program to determine if its coastal coho hatcheries are meeting their objectives, and the process by which management will be adapted if they are not.

Status: Hatchery objectives, and the standards and indicators that will be used to monitor success in implementing those objectives are identified in the HGMP for each specific

hatchery program (HGMP Section 1.7, 1.9 and 1.10). The specific monitoring program for the identified standards and indicators is described in Section 11 of each hatchery program's HGMP. Alternative actions for the hatchery program are discussed in Section 1.16 of each hatchery program's HGMP. In general terms, straying of hatchery fish to natural spawning grounds in this ESU is monitored under an OPSW monitoring program (Jacobs et.al 2002). Post release survival, harvest, and escapement of specific hatchery coho programs in this ESU is monitored through use of CWT marking and a region wide sampling program for CWT fish (Lewis 2004). Total marine harvest and regulations are established and monitored through the Pacific Marine Fisheries Commission (http://www.pcouncil.org/index.html). Freshwater harvests are monitored though use of angler harvest card data, available on the ODFW web page (http://www.dfw.state.or.us/). In-hatchery performance, release, and return information is monitored by the ODFW hatchery staff and is maintained in the HMIS database available from ODFW headquarters staff. Monitoring of the stream enrichment program is described in the MOA that governs that program (See Section III.5. of this report). Pending results and guidance from research into genetic and ecological interactions between hatchery and wild fish, monitoring of such interactions is based on monitoring of surrogate metrics such as; abundance, spatial distribution, temporal distribution, and phenotypic data on both hatchery and wild fish in this ESU. Such information is derived from a variety of sources including but not limited to; HMIS database, Jacobs et.al (2002), Jepsen and Rodgers (2004), Lewis (2004), and Solazzi et.al (2003). Monitoring and adaptive management will be ongoing efforts for these hatchery programs.

Recommendation 3. ODFW develop and implement a program of research that determines the effects of wild-hatchery fish interactions.

Status: ODFW is in the process of converting an old production hatchery into a hatchery research center. The Hatchery Research Center is a cooperative project with Oregon State University and other partners. The remodeling will be completed by summer 2005. Information is available on the web at: (http://www.dfw.state.or.us/HRC/main.html). While the HRC will be an important research tool, other research opportunities, in conjunction with or independent from the HRC, can and should still be pursued.

Recommendation 4. Based on research findings (see Recommendation 3), ODFW develop monitoring measures that can be used to judge the operational effectiveness of hatchery management programs with respect to their adverse impact on wild fish stocks.

Status: See Recommendation 3 status. Monitoring and adaptive management will be ongoing efforts for these hatchery programs.

Recommendation 5. ODFW develop a strategy that will be useful in quantifying the impact of mixed stock fisheries on the recovery of depressed OCN stocks.

Status: See Part 4(C) ODFW (2) Harvest Report.

Recommendation 6. ODFW determine the impact of hatchery release practices on predation of wild fish.

Status: The potential for releases of large numbers of hatchery coho smolts from Fall Creek hatchery to attract and concentrate predators in Alsea Bay was raised as a possible issue in the depressed status of wild coho production in the Alsea Basin. Subsequent

research by Nickelson (2003) found an inverse relationship between number of hatchery coho released in an basin and the productivity of the wild coho population in that basin. Attraction of predators was cited as one possible mechanism for the correlation (Nickelson 2003). To address the issue hatchery coho smolt releases in the Alsea basin were eliminated in 1999. However, no specific research program was established to determine the impacts on predation from this change in management. ODFW has not initiated any research projects in this ESU to address this issue. Aspects of this issue could be a subject for investigation at the HRC (see Recommendation 3 above). These might include laboratory studies or possible work involving the winter steelhead production in the Alsea Basin. Work at larger spatial scales may be possible when the planned watershed scale monitoring infrastructure proposed for the facility is operational.

Recommendation 7. ODFW use hatcheries as important tools in research that supports monitoring programs.

Status: Several changes in hatchery programs have been implemented that should assist in monitoring of the wild coho populations in this ESU. Mass marking of all hatchery coho began with the 1995 brood, adult returns in 1998. This will assist monitoring by providing an external and definitive identification of all hatchery juveniles and adults in natural habitats in this ESU. Reductions in number of hatchery coho smolts released and shifting to almost all releases at the hatchery and relatively low in the watershed, should assist monitoring through reducing the numbers of hatchery coho as well as spatial overlap of hatchery and wild coho in freshwater habitats. The hatchery release database has added fields to capture latitude and longitude of release sites. This information is not yet complete for all releases, and has not yet been added in for historic data. However, it starts the process of geo-referencing of hatchery releases which should assist in monitoring efforts.

The explicit use of hatcheries as tools in research is less common in this ESU. Rock Creek hatchery has been involved in two specific research projects involving wild coho in this ESU. First, is an evaluation of a habitat improvement involving planting of coho eggs collected from wild parents spawned at the hatchery (Umpqua River Basin Coho Program HGMP Appendix 5). Second, is a pedigree study in Calapooya River, involving naturally produced coho, hatchery produced coho from wild parents, and hatchery produced coho from hatchery parents (Umpqua River Basin Coho Program HGMP Appendix 6). The Fall Creek hatchery was closed as a production facility and is being converted into a research facility. The Hatchery Research Center is a cooperative project with Oregon State University and other partners. The remodeling will be completed by summer 2005. Information is available at: (http://www.dfw.state.or.us/HRC/main.html).

Recommendation 8. ODFW establish explicit coordination between hatchery programs and monitoring programs to help them ensure that they accomplish management and research objectives.

Status: This is an area that is in need of further work. Some progress has occurred in coordinating hatchery programs with research and monitoring programs, see the discussions under Recommendations 2, 3, and 7 above. Informal coordination occurs between ODFW Fish Propagation and Conservation and Recovery staff at the headquarters building, and by having one member of the Fish Propagation staff stationed

at the ODFW Corvallis research office. However, no formal mechanisms have yet been established for the explicit coordination called for in this recommendation.

3. IMST Report 2001-1

In 2001 the IMST reviewed the scientific basis of artificial propagation programs and their management under the OPSW (IMST 2001). They identified two broad questions.

1. *What is the scientific basis for the artificial propagation of anadromous salmonids?*
2. *Scientifically, how could Oregon's artificial propagation program be consistent with the recovery of wild salmonids in Oregon?*

In their assessment of these two questions they reviewed five assumptions related to hatchery programs and whether their management can be scientifically consistent with the recovery of wild salmonids. From this work they made three conclusions and 10 Recommendations. The specific assumptions and conclusions are not listed here but are available on the web (http://www.fsl.orst.edu/imst/index.htm). Following are the 10 specific IMST recommendations, and comments on ODFW's progress in implementing and/or addressing them. Again, like the recommendations in the earlier IMST report on hatcheries (IMST 1998) considerable progress, both direct and indirect, has been made on these recommendations. However, more work is needed on some and others represent on-going activities and coordination.

Recommendation 1. ODFW should develop a comprehensive plan/cohesive policy for hatchery management.

Status: In 2002 and 2003 a set of three interconnected policies were adopted by the Oregon Fish and Wildlife Commission that address this recommendation. The three policies are the Native Fish Conservation Policy (OAR 635-007-0502 through 635-007-0535), the Fish Hatchery Management Policy (OAR 635-007-0542 through 635-007-0548), and the Fish Health Management Policy (OAR 635-007-0960 through 635-007-1000). For a discussion of the three policies see Section IV.1. and IV.2. of this report.

Recommendation 2. ODFW should adopt and incorporate the recommendations of the independent science panels into statewide comprehensive policy.

Status: The IMST reviewed the results of the three science panels and proposed a list of eight recommendations for the ODFW hatchery program (IMST 1998). For a discussion of the implementation of those recommendations see Section V.2. of this report.

Recommendation 3. ODFW should tie the operation of hatcheries to explicit, measurable management objectives.

Status: Explicit, measurable management objectives are included as part of the HGMP for each hatchery program. A draft HGMP has been submitted to NOAA Fisheries for each of the hatchery coho programs in this ESU. See Section IV.3. of this report.

Recommendation 4. ODFW should implement the recommendations made in IMST's Workshop on Conservation Hatcheries and Supplementation in the assessment and revision of supplementation programs.

Status: The report developed from this IMST workshop (IMST 2000) did not develop a specific list of recommendations like those in the other IMST hatchery reports (IMST

1998 and IMST 2001). The workshop summary does identify 16 "major points" from the workshop. While many of these points are used in a general way when evaluating supplementation programs, ODFW has not developed any explicit means of implementing them in total, during such evaluations.

Recommendation 5. ODFW should incorporate the landscape perspective into hatchery management.

Status: Hatchery management will be described in an HGMP and/or HPMP that is developed under and/or consistent with the NFCP (see Sections IV.2. and IV.3. of this report). Implementation of the NFCP will be through development of conservation plans for each native fish Species Management Unit (SMU). These conservation plans will provide the landscape perspective for the SMU and its constituent populations, including any hatchery populations (see Section IV.1. of this report). Development of conservation plans is underway. Although there are draft HGMPs for the hatchery programs in this ESU, these plans will need to be reviewed once conservation plans are developed.

Recommendation 6. ODFW should initially give priority for change from the hatchery-specific to the landscape perspective consistent with the direction of this report to coastal and Lower Columbia system hatchery programs.

Status: Implementation of the OPSW has focused attention on coastal hatchery programs. However, development of conservation plans under the NFCP is proceeding on a statewide basis.

Recommendation 7. ODFW should support and participate in collaborative research efforts to determine the consequences of interactions between hatchery and wild fish.

Status: In cooperation with OSU and NOAA Fisheries, as well as others, ODFW is building a Hatchery Research Center in the Alsea Basin. Construction of the facility will be completed by summer 2005. For a further discussion of the HRC see Section V.1. (OPSW measure ODFW-II.B.1), and Section V.2. (Recommendation 3) of this report.

Recommendation 8. The IMST should convene a workshop to clarify the state of knowledge on the differences between hatchery and wild fish and the implications to supplementation programs and the fitness of naturally spawning populations.

Status: The IMST did convene a workshop on Conservation Hatcheries and Supplementation in June 2000 (IMST 2000). As this workshop predates this recommendation, it is clear the IMST is suggesting further work on this subject. Although not directly related to this recommendation, the IMST did convene a workshop in October 2003 to provide a scientifically credible basis for the operation of the research aspects of the HRC. The HRC mission is to develop an understanding of the mechanisms that may create differences between hatchery and wild fish and devise ways to manage the differences so that hatcheries can be used responsibly in the conservation and use of Oregon's native fish. Thus, the workshop did discuss the issues raised in this recommendation, although that was not its primary purpose. Results of the workshop are available at (http://www.dfw.state.or.us/HRC/IMST_report.pdf).

Recommendation 9. ODFW should strengthen the monitoring and evaluation of hatchery programs.

Status: The identification of goals and objectives, and the establishment of performance standards and indicators in an HGMP and/or HPMP for each hatchery program is an important first step in improving monitoring and evaluation of hatchery programs. This process is nearing completion for the hatchery programs in this ESU (see Section IV.43. of this report). Completion of status reviews and development of conservation plans under the NFCP is the next critical step in improving monitoring and evaluation of hatchery programs. This process will establish the context and parameters within which each hatchery program will be managed to co-exist with native fish populations and their habitats. This context and parameters will help to identify the critical metrics to be monitored for each hatchery program and native fish population, to evaluate if the hatchery program is having unacceptable levels of impacts to the long-term health and sustainability of the native fish population(s) and their habitat(s). This process has begun, and draft status reviews have been developed under the NFCP. Ideally, this process would have been done in reverse, i.e. develop conservation plans first and then develop HGMPs and/or HPMPs to implement the guidance in the conservation plans. However, a hatchery program's HGMP and/or HPMP will be reviewed and revised as needed once conservation plans have been developed.

Little has changed in the levels and types of hatchery monitoring, and data accessibility in the 3 years since this IMST recommendation. A variety of factors have contributed to this, including; budget and staffing limitations, focus on development of new policies and management plans, and some scientific uncertainty as to exactly what, where and how much monitoring is needed. Although not complete, work on policies and plans has progressed enough that in the near future ODFW may be able to shift some focus to improvements in monitoring and evaluation of hatchery programs. Review of existing research and results of new research, including work at the new HRC, will help to resolve the scientific uncertainties. Budget and staffing issues will likely continue for the foreseeable future. In November of 2004, ODFW conducted a preliminary meeting to discuss improvements to management of hatchery data and hatchery data accessibility.

Monitoring and evaluation of hatchery programs can be viewed as composed of three general areas; in-hatchery performance, post-release performance, and interactions with wild fish. Currently, in-hatchery monitoring is the most robust of the three, and the IMST did not include any specific recommendation for improving in-hatchery monitoring. There is some post-release monitoring including: mass marking of all coho, steelhead and spring chinook hatchery smolts; representative CWT marking of hatchery coho and chinook releases; extensive monitoring of ocean and Columbia River freshwater harvest; monitoring of other freshwater harvests through angler harvest card data; monitoring of adults on natural spawning grounds; and monitoring of adults at hatcheries and fish traps. However, as the IMST pointed out there is still a lot that could be done to improve post-release monitoring. Documenting interactions and impacts of hatchery fish on native fish populations can be difficult. Status reviews and monitoring of wild fish may help to identify critical areas or life history stages for wild populations. This information along with further research should help to identify monitoring, both direct and indirect, that can be used to evaluate the impacts of hatchery programs on wild populations.

Recommendation 10. ODFW should establish an explicit process for adaptive management that makes effective use of the results from monitoring programs.

Status: To date, ODFW has not yet established an explicit process and timeline for review of the program goals for each hatchery program. Identification of goals and objectives in conservation plans and hatchery management plans is an important step in adaptive management of hatchery programs, see Recommendation 9 above. Adaptive management is acknowledged in the NOAA Fisheries HGMP template in Section 1.16, which calls for identification of alternative management actions to achieve the goals of the hatchery program. Hatchery production plans are reviewed annually by ODFW district biologists, hatchery crews and fish propagation staff. Historically these reviews have been mostly focused on operational and logistical issues, not programmatic issues. To a degree, hatchery programs are also reviewed during the ODFW annual regional stock status review meetings. While the process for adaptive management of hatchery programs might be included in either of these meetings, it also might interfere with the meetings primary purpose. For a variety of reasons, hatchery, district and fish propagation staff have been engaging in more programmatic discussions in recent years. However, there is no explicit structure or timeline for such discussions. More work is needed on establishing an explicit adaptive management process for hatchery programs.

VI. Citations

Angradi, T.R., and J.S. Griffith. 1990. Diel feeding chronology and diet selection of rainbow trout (*Oncorhynchus mykiss*) in the Henry's Fork of the Snake River, Idaho. Canadian Journal of Fisheries and Aquatic Sciences, 47: 199-209.

Berejikian, B.A., E.P. Tezak, L. Park, E. LaHood, S.L. Schroder, and E. Beall. 2001. Male competition and breeding success in captively reared and wild coho salmon. Canadian Journal of Fisheries and Aquatic Sciences, 58: 804-810.

Bilby, R.E., B.R. Fransen and P.A. Bisson. 1996. Incorporation of nitrogen and carbon from spawning coho salmon (*Oncorhynchus kisutch*) into the trophic system of small streams: evidence from stable isotopes. Canadian Journal of Fisheries and Aquatic Sciences, 53: 164-173.

Bilby, R.E., R.R. French, P.A. Bisson, and J.K. Walter. 1998. Response of juvenile coho salmon (*Oncorhynchus kisutch*) and steelhead (*O. mykiss*) to the addition of salmon carcasses to two streams in southwestern Washington, USA. Canadian Journal of Fisheries and Aquatic Sciences, 55: 1908-1918.

Bisson, P.A. 1978. Diel food selection by two sizes of rainbow trout (*Salmo gairdneri*) in an experimental stream. Journal of the Fisheries Research Board of Canada, 35: 971-975.

Borgerson, L.A., and R.K. Bowden. 1999. Scale Analysis. Oregon Department of Fish and Wildlife, Annual Progress Report, Salem, Oregon.

Brodeur, R.D., and W.G. Pearcy. 1990. Trophic relations of juvenile pacific salmon off the Oregon and Washington coast. Fishery Bulletin, 88: 617-636.

Buchanan, D.V. 1992. Fish sampling methods. North-west Fish Hatchery Newsletter 8:1-2.

Buckman, B. 1999. Mid coast estuary sampling program spring 1999. Oregon Department of Fish and Wildlife, District Report. Newport, Oregon.

Chilcote, M.W. 2003. Relationship between natural productivity and the frequency of wild fish in mixed spawning populations of wild and hatchery steelhead. Canadian Journal of Fisheries and Aquatic Sciences, 60: 1057-1067.

Clark, J. and B. McCarl. 1983. An investigation of the relationship between Oregon coho salmon (*Oncorhynchus kisutch*) hatchery releases and adult production utilizing law of the minimum regression. Canadian Journal of Fisheries and Aquatic Sciences, 40: 516-523.

Cornwell, T.J, D.L. Bottom, and K.K. Jones. 2001. Rearing of juvenile salmon in recovering wetlands of the Salmon River estuary. Oregon Department of Fish and Wildlife, Information Reports Number 2001-05, Salem, Oregon.

Efford, I.E., and K. Tsumura. 1973. A comparison of the food of salamanders and fish in Marion Lake, British Columbia. Transactions of the American Fisheries Society, 102: 33-47.

Emlen, J.M., R.R. Reisenbichler, A.M. McGie, and T.E. Nickelson. 1990. Density-dependence at sea for coho salmon (*Oncorhynchus kisutch*). Canadian Journal of Fisheries and Aquatic Sciences, 47: 1765-1772.

Ewing, R.D., T.R. Walters, M.A. Lewis, and J.E. Sheahan. 1994. Evaluation of inventory procedures for hatchery fish. I. Estimating weights of fish in raceways and transportation trucks. The Progressive Fish-Culturist, 56: 153-159.

Ewing, R.D., M.A. Lewis, J.E. Sheahan, and S.K. Ewing. 1998. Evaluation of inventory procedures for hatchery fish. III. Nonrandom distributions of chinook salmon in raceways. The Progressive Fish-Culturist, 60: 159-166.

Federal Register Notice. 1997. Endangered and Threatened Species; Threatened status for Southern Oregon/California Coast Evolutionarily Significant Unit (ESU) of coho salmon. Vol. 62, No. 87, pp 24588-24609.

Federal Register Notice. 1998. Endangered and Threatened Species; Threatened Status for the Oregon Coast Evolutionarily Significant Unit of Coho Salmon. Vol. 63, No 153, pp 42587-42591.

Federal Register Notice. 2003. Policy for evaluation of conservation efforts when making listing decisions. Vol. 68, No 60, pp 15100-15115.

Federal Register Notice. 2004. Endangered and Threatened Species: Proposed listing determinations for 27 ESUs of West Coast salmonids; proposed rule. Vol. 69, No. 113 pp 33102 to 33179.

Fishery, J.P, and W.G. Pearcy. 1988. Growth of juvenile coho salmon (*Oncorhynchus kisutch*) off Oregon and Washington, USA, in years of differing coastal upwelling. Canadian Journal of Fisheries and Aquatic Sciences, 45: 1036-1044.

Fishery, J.P, and W.G. Pearcy. 1989. Distribution and residence times of juvenile fall and spring chinook salmon in Coos Bay, Oregon. Fishery Bulletin, 88: 51-58.

Harvey, B.C., and R.J. Nakamoto. 1996. Effects of steelhead density of growth of coho salmon in a small coastal California stream. Transactions of the American Fisheries Society, 125: 237-243.

Hubert, W.A., R.D. Gipson, R.A. McDowell and A.C. Stewart. 1994. Diet of Eagle Lake rainbow trout in Lake DeSmet, Wyoming. North American Journal of Fisheries Management, 14: 457-459.

Independent Multidisciplinary Science Team (IMST). 1998. Review of the hatchery measures in the Oregon Plan for Salmon and Watersheds. Report 1998-1 to the Oregon Plan for Salmon and Watersheds. Governor's Watershed Enhancement Board. Salem, Oregon.

IMST. 2000. Conservation hatcheries and supplementation strategies for recovery of wild stocks of salmonids: Report of a workshop. Technical Report 2000-1 to the Oregon Plan for Salmon and Watersheds. Oregon Watershed Enhancement Board. Salem, Oregon.

IMST. 2001. The scientific basis for artificial propagation in the recovery of wild anadromous salmonids in Oregon. Technical Report 2001-1 to the Oregon Plan for Salmon and Watersheds. Oregon Watershed Enhancement Board Office. Salem, Oregon.

Independent Scientific Group (ISG). 1996. Return to the River: Restoration of salmonid fishes in the Columbia River. Northwest Power Planning Council. Portland, Oregon.

Jacobs S., J. Firman, G. Susac, D. Stewart and J. Weybright. 2002. Status of Oregon coastal stocks of anadromous salmonids, 2000-2001 and 2001-2002; Monitoring Program Report Number OPSW-ODFW-2002-3, Oregon Department of Fish and Wildlife, Salem, Oregon.

Jepsen, D.B and Rodgers, J.D. 2004. Abundance Monitoring of Juvenile Salmonids in Oregon Coastal Streams, 2002-2003. Monitoring Program Report Number OPSW-ODFW-2003-1, Oregon Department of Fish and Wildlife, Salem, Oregon.

Johnston, N.T., E.A. MacIsaac, P.J. Tschaplinski, and K.J. Hall. 2004. Effects of abundance of spawning sockeye salmon (*Oncorhynchus nerka*) on nutrients and algal biomass in forested streams. Canadian Journal of Fisheries and Aquatic Sciences, 61: 384-403.

Keeley, E.R., and J.W.A. Grant. 2001. Prey size of salmonid fishes in streams, lakes, and oceans. Canadian Journal of Fisheries and Aquatic Sciences, 58: 1122-1132.

Kline, T.C., Jr., J.J. Goering, O.A. Mathisen, P.H. Poe, and P.L. Parker. 1990. Recycling of elements transported upstream by runs of Pacific salmon: I. 15N and 13C evidence in Sashin Creek, southeastern Alaska. Canadian Journal of Fisheries and Aquatic Sciences, 47: 136-144.

Koslow, J.A., A.J. Hobday and G.W. Boehlert. 2002. Climate variability and marine survival of coho salmon (*Oncorhynchus kisutch*) in the Oregon production area. Fisheries Oceanography, 11: 65-77.

Kostow, K.E. 2004. Differences in juvenile phenotypes and survival between hatchery stocks and natural population provide evidence for modified selection due to captive breeding. Canadian Journal of Fisheries and Aquatic Sciences, 61:577-589.

Labelle, M. 1992. Straying patterns of coho salmon (*Oncorhynchus kisutch*) stocks from southeast Vancouver Island, British Columbia. Canadian Journal of Fisheries and Aquatic Sciences, 49: 1843-1855.

Larkin, G.A. and P.A. Slaney. 1997. Implications of trends in marine-derived nutrient influx to south coastal British Columbia salmonid production. Fisheries, 22: 16-24.

Lewis, M.A., T.R. Walters, and R.D. Ewing. 1994. Evaluation of inventory procedures for hatchery fish. II. Variation in specific gravities of pacific salmonids during rearing. The Progressive Fish-Culturist, 56: 160-168.

Lewis, M.A. 2004. Stock assessment of anadromous salmonids, 2003. Monitoring Program Report Number OPSW-ODFW-2004-04, Oregon Department of Fish and Wildlife, Salem, Oregon.

Logerwell, E.A, N Mantua, P.W. Lawson, R.C Francis and V.N. Agostini. 2003. Tracking environmental processes in the coastal zone for understanding and predicting Oregon coho (*Oncorhynchus kisutch*) marine survival. Fisheries Oceanography, 12: 554-568.

McCabe, G.T. Jr., W.D. Muir, R.L. Emmett, and J.T. Durkin. 1983. Interrelationships between juvenile salmonids and nonsalmonid fish in the Columbia River Estuary. Fisher Bulletin, 81: 815-826.

McCarl, B.A., and R.B. Rettig. 1983. Influences of hatchery smolt releases on adult salmon production and its variability. Canadian Journal of Fisheries and Aquatic Sciences, 40: 1880-1886.

McGie, A.M. 1981. Trends in the escapement and production of fall chinook and coho salmon in Oregon. Oregon Department of Fish and Wildlife, Information Reports Number 81-7, Salem, Oregon.

National Fish Hatchery Review Panel (NFHRP). 1994. Report of the National Fish Hatchery Review Panel. The Conservation Fund, Arlington, Virginia.

National Marine Fisheries Service (NMFS). 1995. Status Review of Coho Salmon from Washington, Oregon and California. NOAA Technical Memorandum NMFS-NWFSC-24, September 1995.

NMFS. 2003. Updated status of Federally listed ESUs of West Coast salmon and steelhead. West Coast Salmon Biological Review Team. NOAA Fisheries Northwest and Southwest Fisheries Science Centers. July 31, 2003.

National Research Council (NRC). 1996. Upstream: Salmon and society in the Pacific Northwest. Committee on Protection and Management of Pacific Northwest Anadromous Salmonids, National Academy of Science, Washington, D.C.

Nickelson, T.E. 1986. Influences of upwelling, ocean temperature, and smolt abundance on marine survival of coho salmon (*Oncorhynchus kisutch*) in the Oregon Production Area. Canadian Journal of Fisheries and Aquatic Sciences, 43: 527-535.

Nickelson, T. 2003. The influence of hatchery coho salmon (*Oncorhynchus kisutch*) on the productivity of wild coho salmon populations in Oregon coastal basins. Canadian Journal of Fisheries and Aquatic Sciences, 60: 1050-1056.

ODFW. 1990. Oregon Department of Fish and Wildlife hatchery benefit cost evaluation. Internal report by the Fish Propagation Technical Services Section, Oregon Department of Fish and Wildlife. Salem, Oregon.

ODFW. 1998. Rogue River coho hatchery program background information, alternative management options and risk assessment. Oregon Department of Fish and Wildlife, Salem, Oregon.

ODFW. 1999. Coastal salmonid and Willamette trout hatchery program review. Draft Final Report (March 19, 1999), Oregon Department of Fish and Wildlife. Salem, Oregon.

ODFW. 2001a. Nehalem River coho hatchery program background information, alternative management options and risk assessment. Oregon Department of Fish and Wildlife. Salem, Oregon.

ODFW. 2001b. Research Proposal: Nonpariel Dam adult trap and coho genetic pedigree project. Oregon Department of Fish and Wildlife. Salem, Oregon.

ODFW. 2003. Fish propagation annual report 2003. Oregon Department of Fish and Wildlife. Salem, Oregon.

Orsi, J.A., and A.C. Wertheimer. 1995. Marine vertical distribution of juvenile chinook and coho salmon in Southeast Alaska. Transactions of the American Fisheries Society, 124: 159-169.

Pearcy, W.G. 1992. Ocean Ecology of North Pacific salmonids. Washington Sea Grant Program, University of Washington Press, Seattle Washington, 179 pp.

Peterman, R.M. 1981. Form of random variation in salmon smolt-to-adult relations and its influence on production estimates. Canadian Journal of Fisheries and Aquatic Sciences, 38: 1113-1119.

PFMC 1995. Preseason Report I Stock abundance analysis for 1995 ocean salmon fisheries. Pacific Fishery Management Council. Portland, Oregon.

PFMC 2004. Preseason Report I Stock abundance analysis for 2004 ocean salmon fisheries. Pacific Fishery Management Council. Portland, Oregon.

Radtke, H.D. and S.W. Davis. 1997. The economics of hatchery salmon production in Oregon. Prepared for Oregon Trout with a grant from the Northwest Area Foundation.

Ritchy, J.E., M.A. Perkins, and C.R. Goldman. 1975. Effects of kokanee salmon (*Oncorhynchus nerka*) decomposition on the ecology of a subalpine stream. Journal of the Fisheries Research Board of Canada, 32: 817-820.

Sandercock, F.K. 1991. Life History of coho salmon (*Oncorhynchus kisutch*), pp. 395-445. *In*: C. Groot and L Margolis (ed.). Pacific salmon life histories. UBC Press, Vancouver, B.C.

Scarnecchia, D.L., and B.B. Roper. 2000. Large-scale, differential summer habitat use of three anadromous salmonids in a large river basin in Oregon, USA. Fisheries Management and Ecology, 7: 197-209.

Schabetsberger, R., C.A. Morgan, R.D. Brodeur, C.L. Potts, W.T. Peterson, and R.L. Emmett. 2003. Prey selectivity and diel feeding chronology of juvenile chinook (*Oncorhynchus tshawytscha*) and coho (*O. kisutch*) salmon in the Columbia River plume. Fisheries Oceanography, 12: 523-540.

Schneidervin, R.W., and W.A. Hubert. 1987. Diet overlap among zooplanktophagous fishes in Flaming Gorge Reservoir, Wyoming-Utah. North American Journal of Fisheries Management, 7: 379-385.

Solazzi, M.F., S.L. Johnson, B. Miller, T. Dalton and K.A. Leader. 2003. Salmonid life-cycle monitoring project 2002. Monitoring Program Report Number OPSW-ODFW-2003-2, Oregon Department of Fish and Wildlife, Salem, Oregon.

Stahl, T.P., C.B. Schreck, and D.D. Roby. 2000. Avian predation in Oregon estuaries and juvenile salmonid migration. Annual Report. Oregon Cooperative Fish and Wildlife Research Unit, Department of Fish and Wildlife, Oregon State University, Corvallis, Oregon.

State of Oregon. 2002. Department of Fish and Wildlife: Hatchery cost effectiveness – State Fiscal years 1994-1997. Secretary of State, Audit Report No. 2002-39, Salem, Oregon.

State of Oregon. 2004. Draft Report. Part 1: Viability criteria and status assessment of Oregon coast coho. IMST and Stakeholder Team draft, dated December 20, 2004. Primary authors are M. Chilcote, T. Nickelson and K Moore, Oregon Department of Fish and Wildlife, Salem, Oregon.

Stein, R.A., P.E. Reimers, and J.D. Hall. 1972. Social interaction between juvenile coho (*Oncorhynchus kisutch*) and fall chinook salmon (*O. tshawytscha*) in Sixes River, Oregon. Journal of the Fisheries Research Board of Canada, 29: 1737-1748.

VII. Tables and Figures

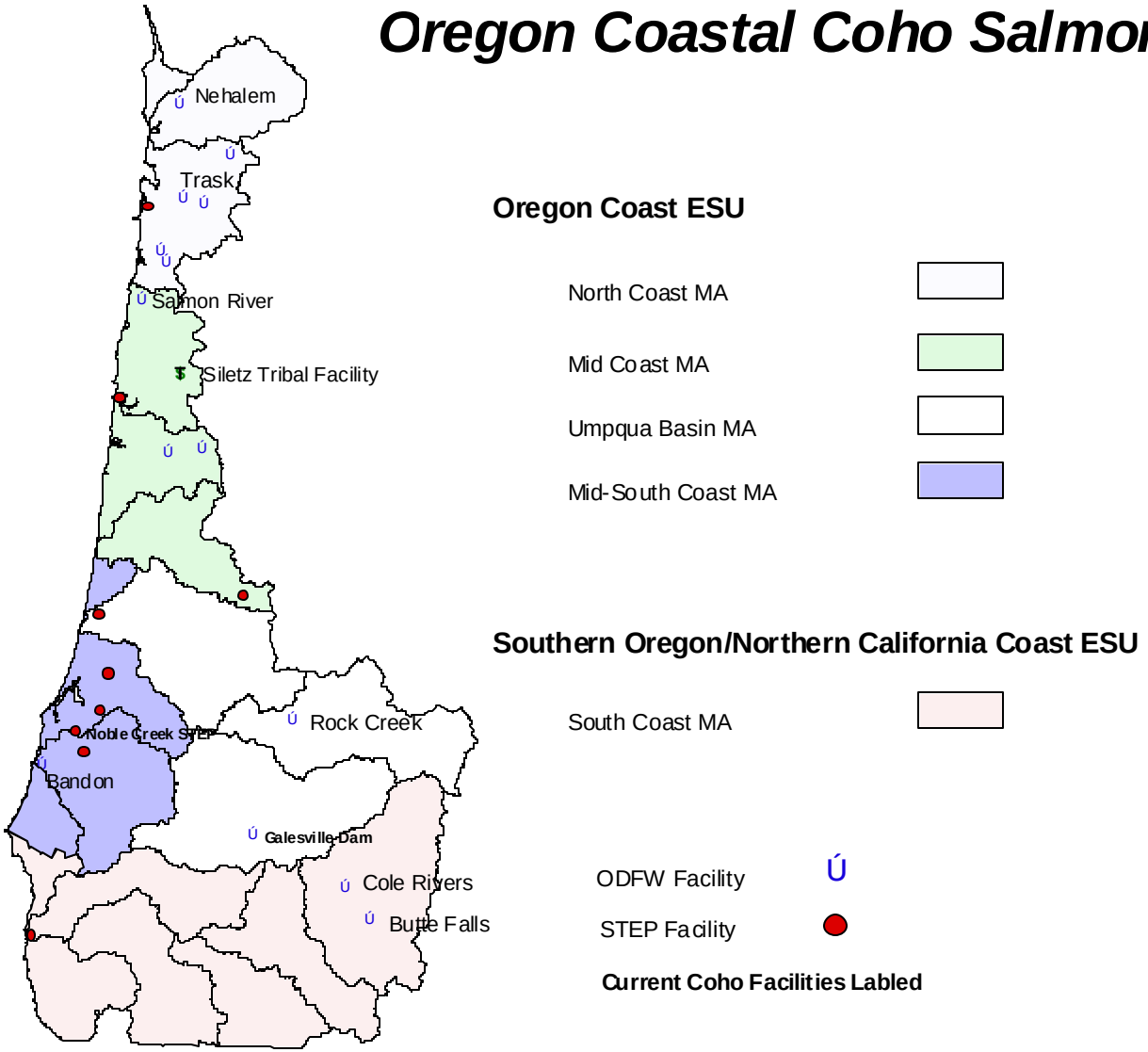

Figure 1. Locations of ODFW and STEP hatcheries and satellites along the Oregon Coast. Coho programs located at named facilities.

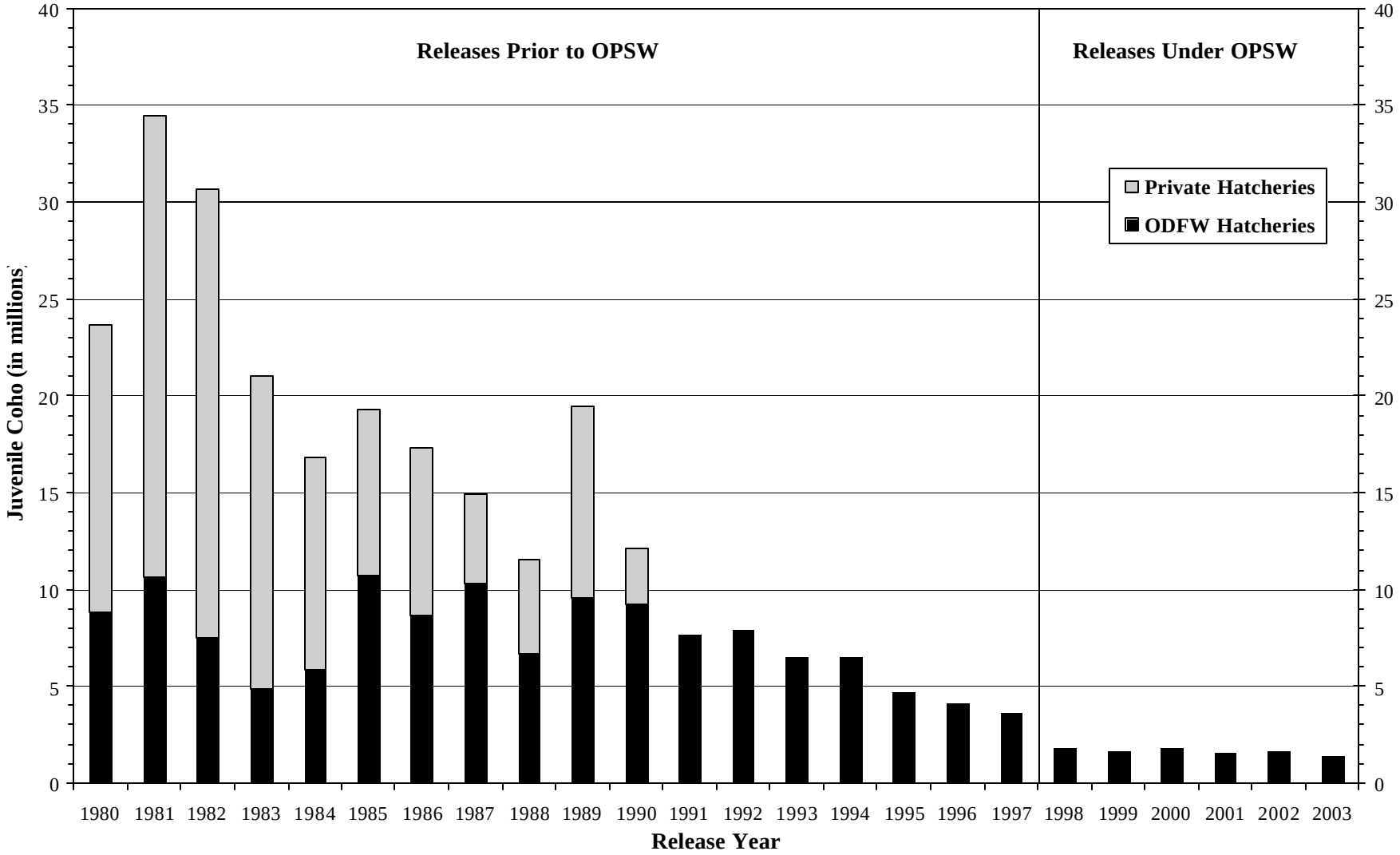

Figure 2. Releases of juvenile hatchery coho (all age classes) in the Oregon Coast ESU, by hatchery type. The 1980 through 1984 release years are missing unfed fry release data.

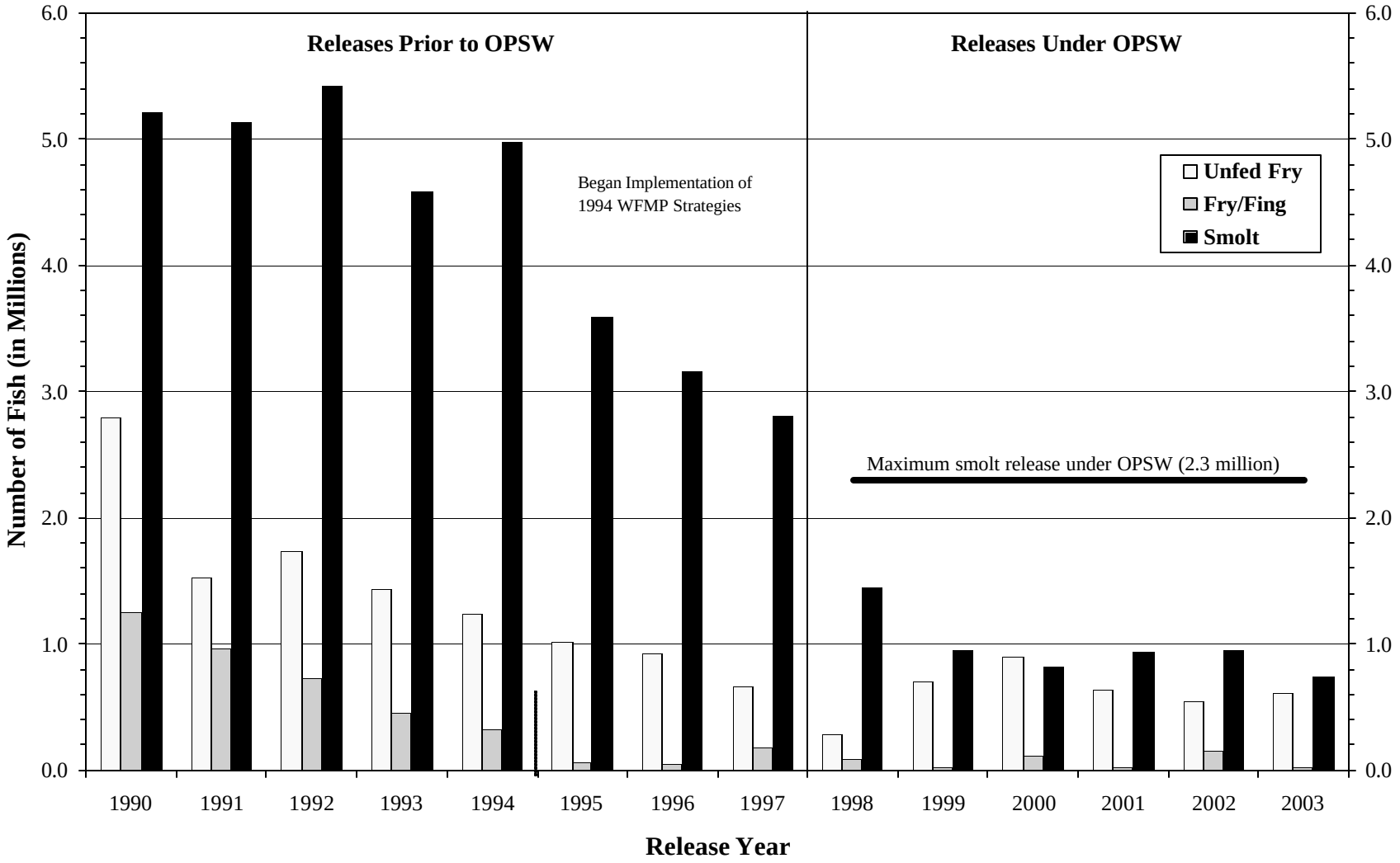

Figure 3. Releases of ODFW juvenile hatchery coho in the Oregon Coast ESU by age class. WFMP = Wild Fish Management Policy, OPSW = Oregon Plan for Salmon and Watersheds.

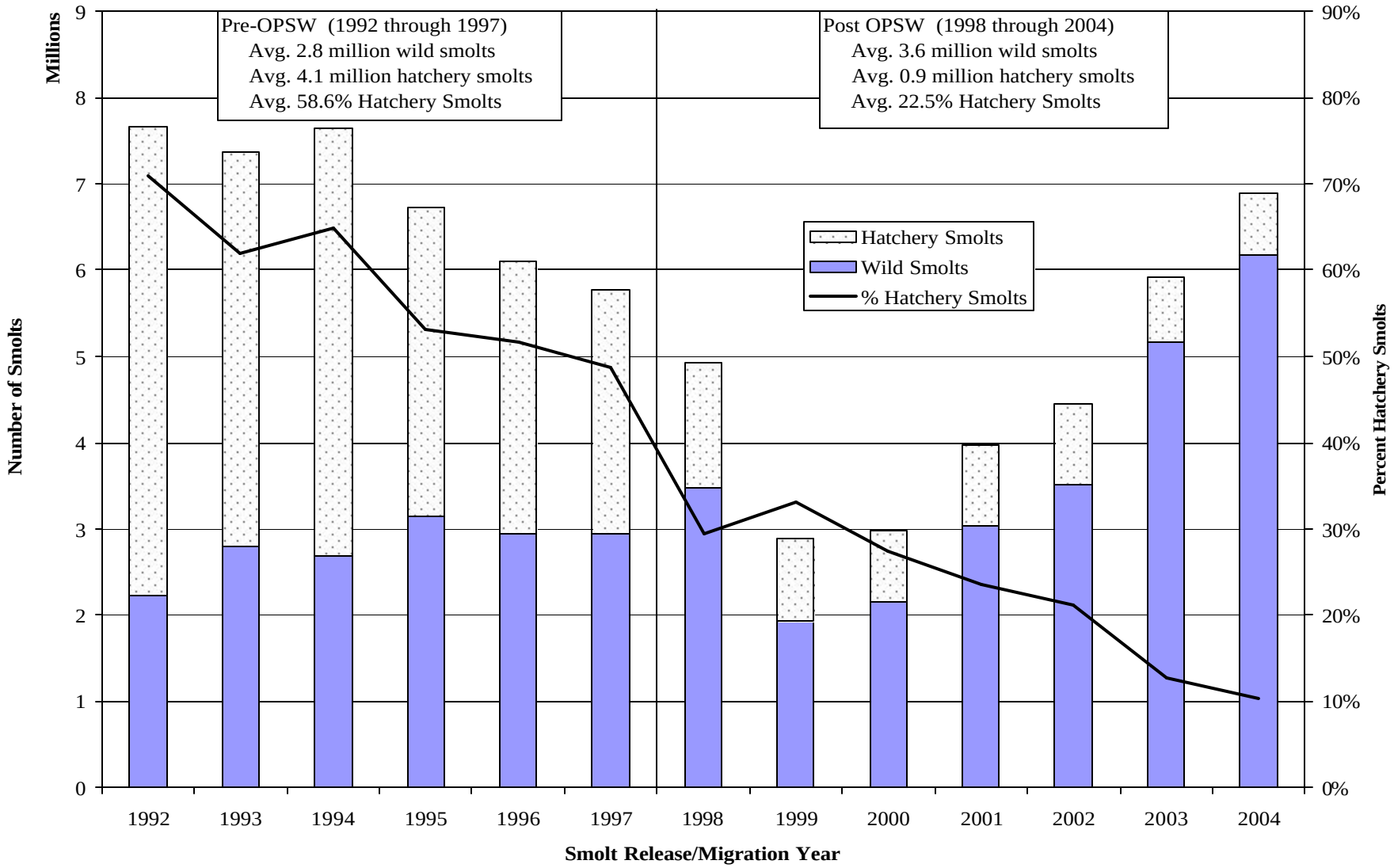

Figure 4. Estimated annual coho salmon smolt production in the Oregon Coast coho ESU by origin, hatchery and wild.

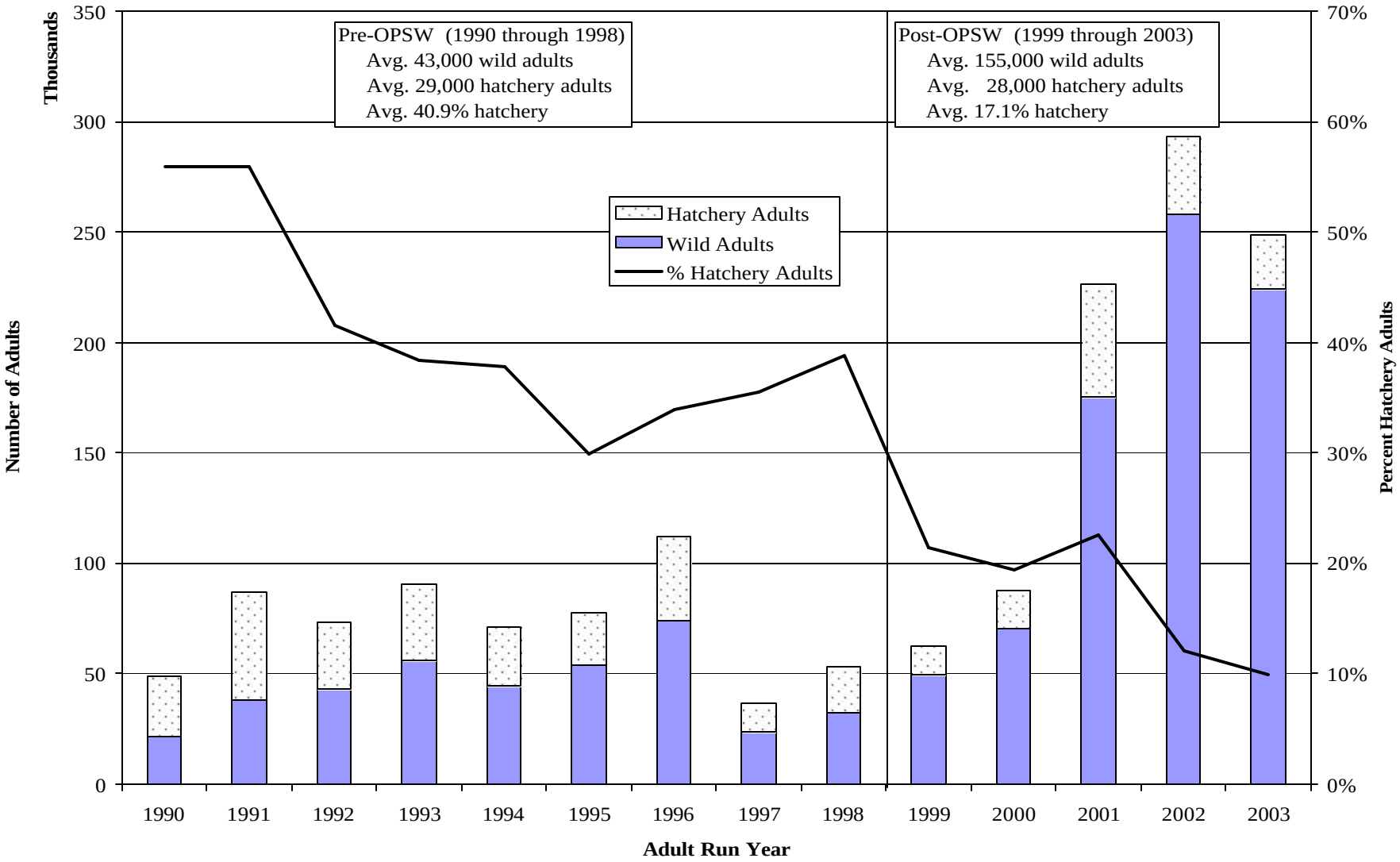

Figure 5. Estimated annual adult coho salmon returns to hatcheries and natural spawning grounds in the Oregon Coast coho ESU.

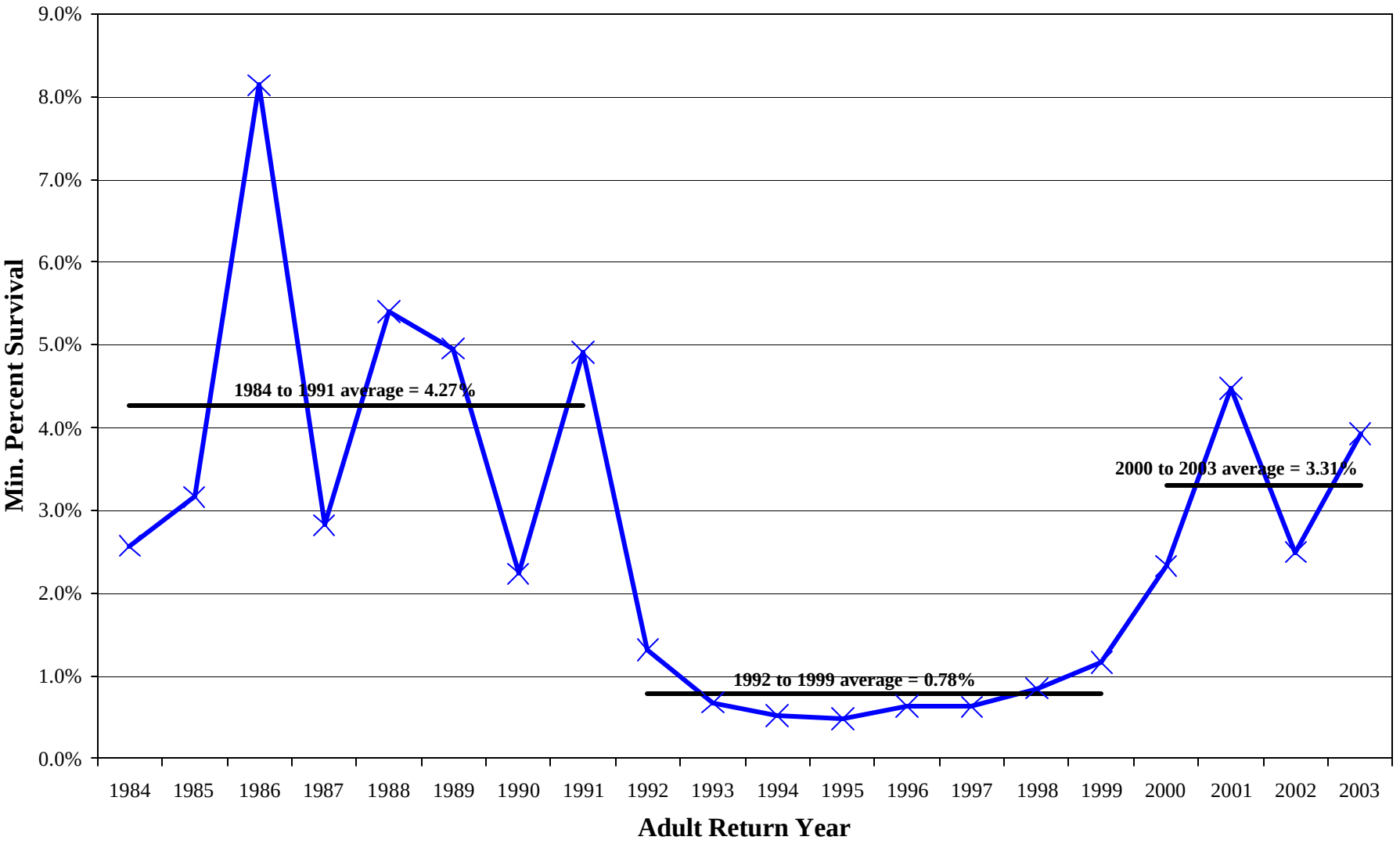

Figure 6. Estimated annual marine survival of hatchery coho in the Oregon Production Index area.

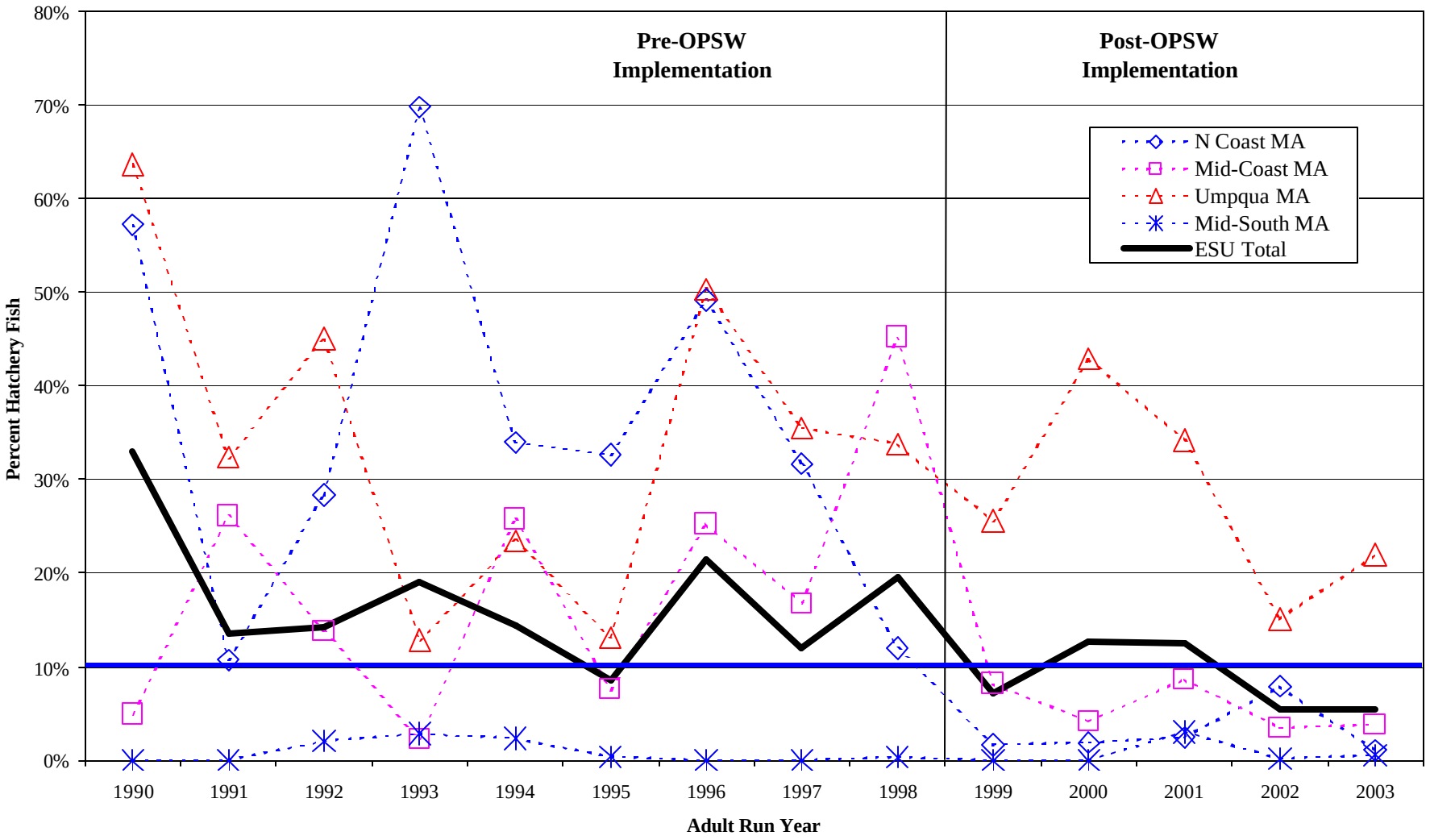

Figure 7. Percent hatchery fish in the naturally spawning coho population, by monitoring area and ESU total in the Oregon Coast Coho salmon ESU.

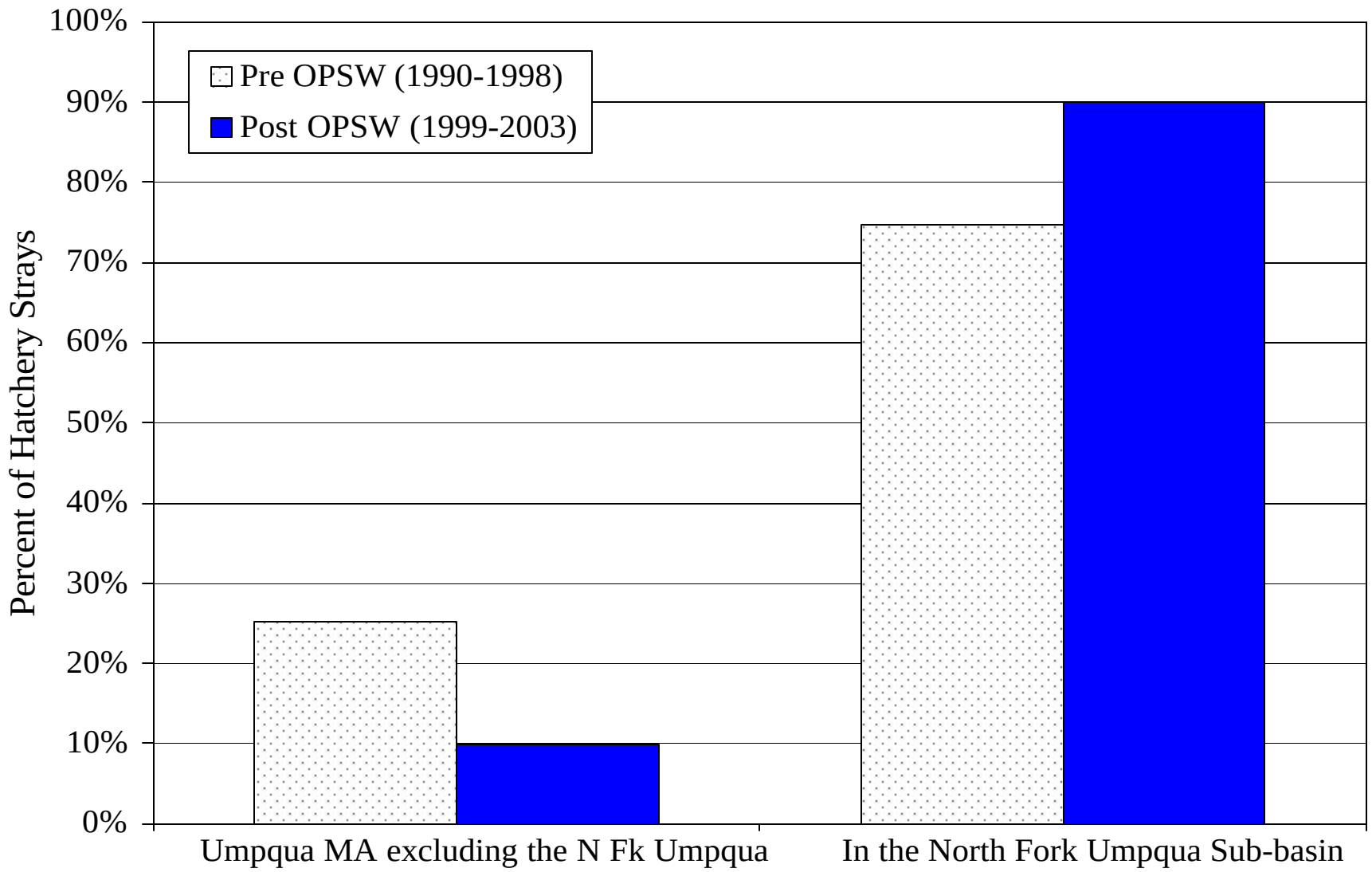

Figure 8. Percent of hatchery coho strays in two sections of the Upper Umpqua wild coho population.

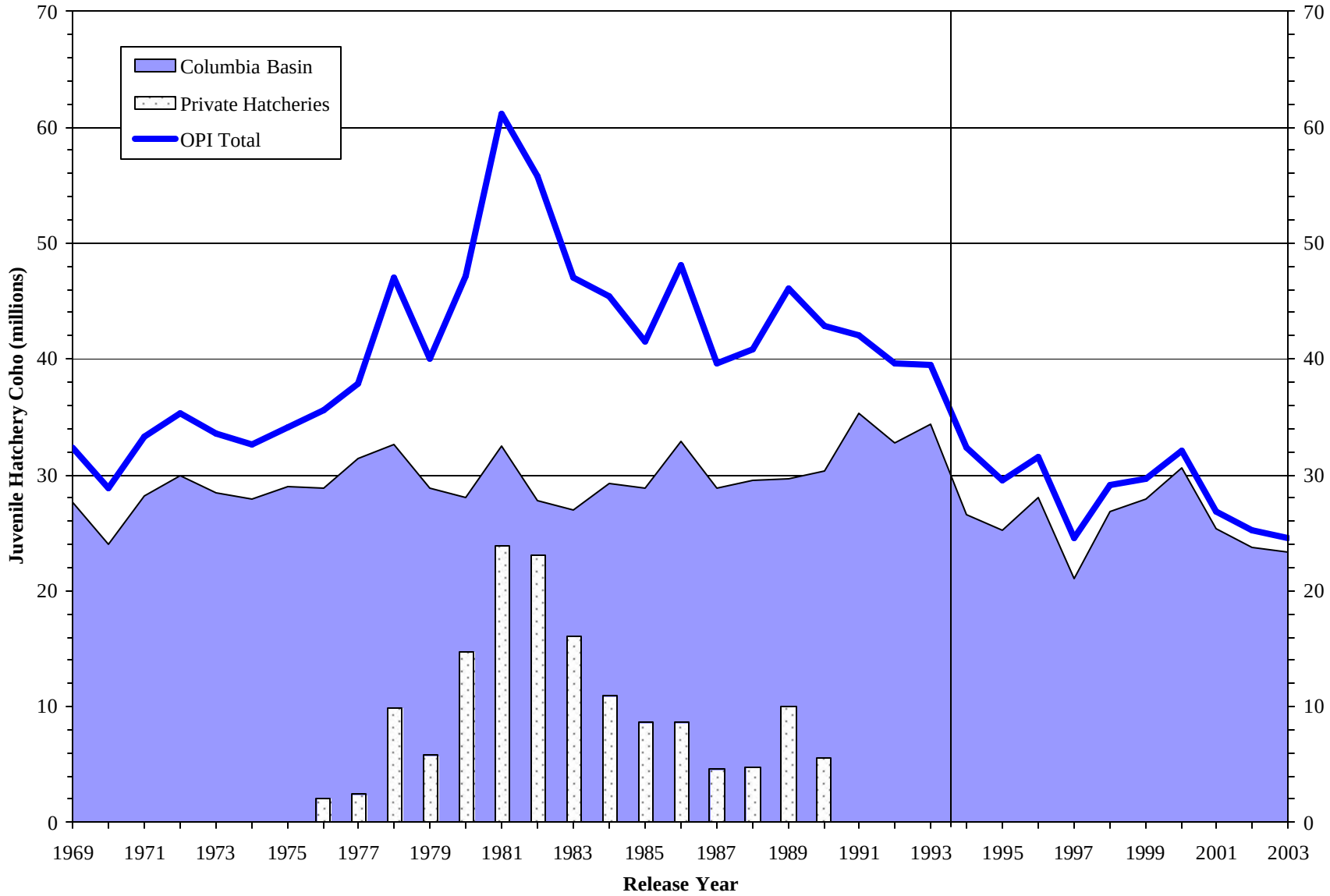

Figure 9. Releases of hatchery coho smolts, both yearling and sub-yearling, in the Oregon Production Index (OPI) area.

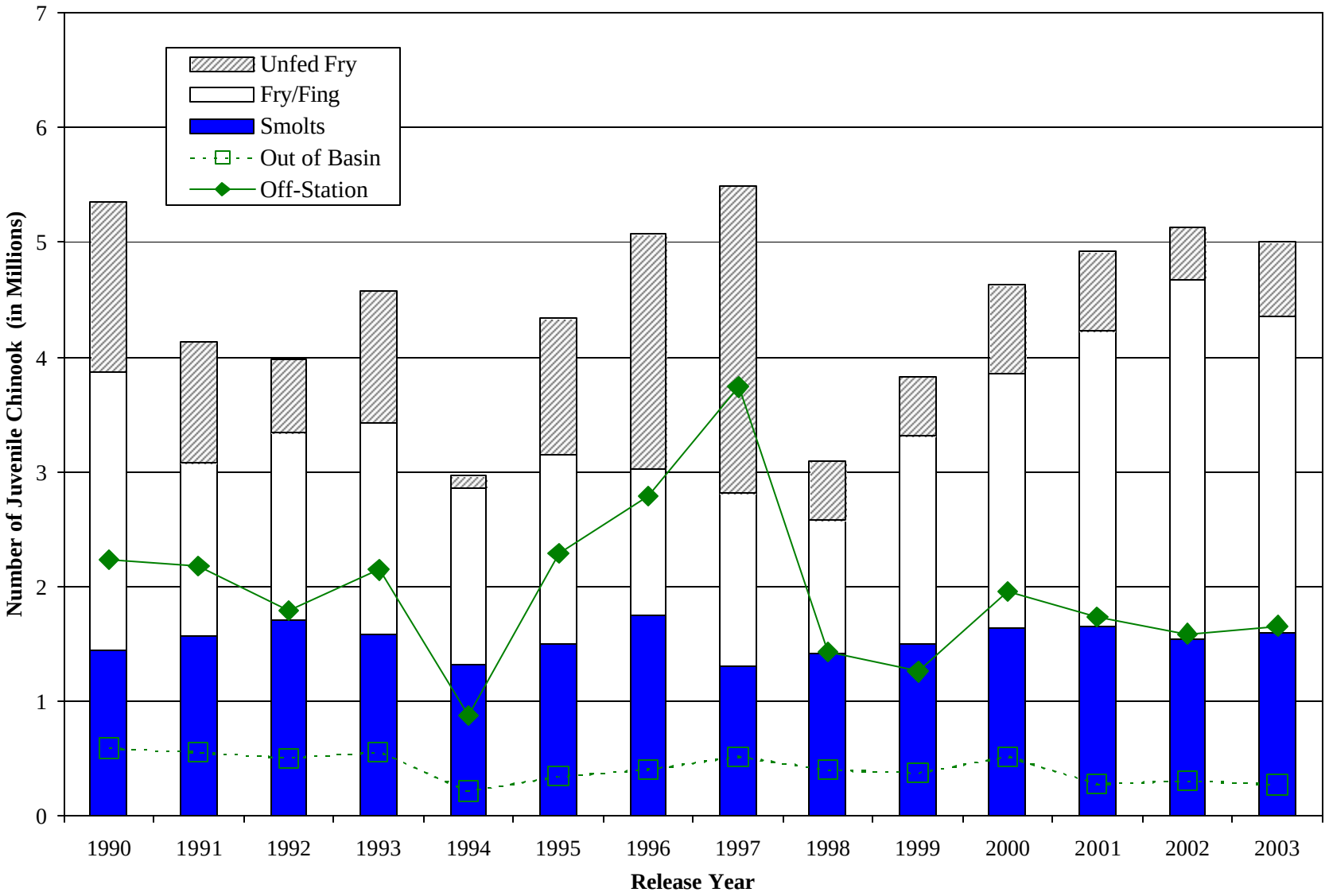

Figure 10. Releases of juvenile hatchery chinook salmon into flowing waters of the Oregon Coast Coho ESU. Releases are from ODFW and STEP facilities, by three fish size classes. Includes number released off-site and out-of-basin (see Section III.7).

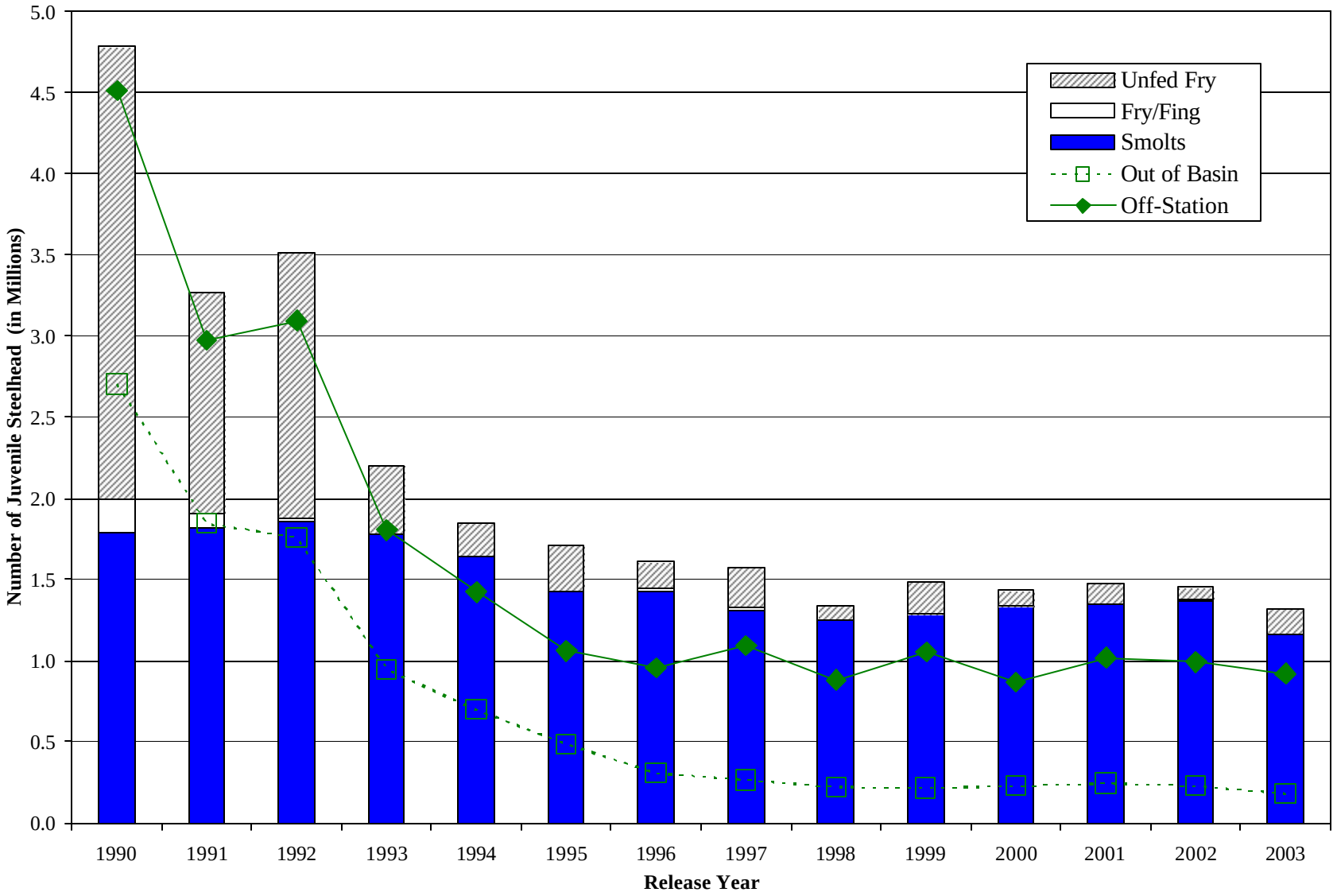

Figure 11. Releases of juvenile hatchery steelhead into flowing waters of the Oregon Coast Coho ESU. Releases are from ODFW and STEP facilities, by three fish size classes. Includes number released off-site and out-of-basin (see Section III.7).

Table 1. Oregon Coastal ESU hatchery facilities and release plans for the 2003 brood year. Organized by wild coho population, species, and stock. Also coho HGMP status. Includes STEP releases, but not facilities. c.a. = Covered above, under main HGMP.

Wild Coho Population	ODFW Hatchery/Satellite	Coho HGMP Status [1]	Production by Species and Stock [2]				
			Coho	Fall Chinook	Spring Chinook	Summer Steelhead	Winter Steelhead
Necanicum	None			034			032
Nehalem	Nehalem	Yes	032, 099				032, 099
Tillamook	Trask / 2 satellites	Yes	034	034	034	047	047, 121
Nestucca	Cedar Cr/Rhoades Pd			047	047	047	047, 047W
Salmon	Salmon River	Yes	033	036			
Siletz	None	Yes	033			033	033
Yaquina	None			146			043
Beaver	None						
Alsea	Alsea/Fall Creek						043, 143
Siuslaw	None						038
L. Umpqua	None			151			
U. Umpqua	Rock Cr/Soda Spring	Yes	018, 055, 509	018	055	055	018
Siltcoos	None						
Tahkenitch	None						
Tenmile	None						088
Coos	None	Yes	037	037			037
Coquille	Bandon	Yes	044	044			044, 144
Floras	None			*035*			
Sixes	None						
Dependent Populations with Hatchery Releases							
Depoe Bay	None	c.a.	033				
Big Creek	None						*043*

1 = Draft HGMP submitted to NOAA Fisheries, Yes or No.

2 = ODFW stock code definitions.

018 = Cow Cr. (S. Umpqua R.)
032 = Nehalem River
033 = Siletz River
034 = Trask River
035 = Elk River
036 = Salmon River
037 = Coos River
038 = Siuslaw River
043 = Alsea River
044 = Coquille River
047 = Nestucca River
047W = Nestucca River Wild
055 = Umpqua River
088 = Tenmile Lakes
099 = Fishhawk Lake (Nehalem R)
121 = Wilson River Wild
143 = Alsea River Wild
144 = Coquille R, South Fork
146 = Yaquina River
151 = Smith River
509 = Calapooya Cr. (Umpqua R)

Table 2. Proposed releases of 2003 brood year hatchery coho in the Oregon Coast Coho ESU.

Wild Coho Population	Stock	ESU Status [1]	Release Site	On-Site [2]	In-Basin [3]	Release Dates		Release Number			Release Pounds	External Mark(s)
						Begin	End	Fry	Fingerling	Smolt		
Necanicum	--	--	--	--	--	--	--	--	--	--	--	--
Nehalem	032	Inc.	Nehalem R., N Fk	yes	yes	03/02/05	03/16/05			50,000	3,333	Ad
			Nehalem R., N Fk	yes	yes	04/02/05	04/16/05			50,000	3,333	Ad
Tillamook	034	Ex	Trask R.	yes	yes	03/02/05	03/16/05			50,000	3,333	AdRM
			Trask R.	yes	yes	04/11/05	05/01/05			50,000	3,571	AdRM
Nestucca	--	--	--	--	--	--	--	--	--	--	--	--
N. Coast Dep. Pops.	--	--	--	--	--	--	--	--	--	--	--	--
Salmon	033	Ex	Salmon R.	yes	No	05/02/05	05/09/05			200,000	18,182	Ad
Siletz	033	Ex	Rock Cr	yes	yes	03/01/05	06/01/05			42,000 [a]	2,625	Ad
	033W	n.a.	Rock Cr	yes	yes	03/01/05	06/01/05			8,000 [a]	229	Ad
Yaquina	--	--	--	--	--	--	--	--	--	--	--	--
Beaver	--	--	--	--	--	--	--	--	--	--	--	--
Alsea	--	--	--	--	--	--	--	--	--	--	--	--
Siuslaw	--	--	--	--	--	--	--	--	--	--	--	--
Mid-Coast Dep. Pops.	033	Ex	Depoe Cr., N Fk	yes	No		04/30/04		20,000		80	Ad
Lower Umpqua	--	--	--	--	--	--	--	--	--	--	--	--
Upper Umpqua	018	Inc.	Galesville Dam	No	yes		03/14/04	50,000			56	--
			Umpqua R., N Fk	yes	yes	04/01/05	04/15/05			45,000	4,500	Ad
			Umpqua R., S Fk	yes	yes		05/01/05			15,000	1,500	Ad
	055	Inc.	Rock Cr., E Fk	No	yes		01/01/04	80,000			Eggs	--
			Calapooya Cr.	No	yes		03/14/04	200,000			222	--
			Calapooya Cr.	No	yes		04/16/05			10,000	1,000	AdLM
			Umpqua R., N Fk	yes	yes	04/01/05	04/15/05			62,500	6,250	Ad
	509	n.a.	Calapooya Cr.	No	yes		03/14/04	200,000			222	--
			Calapooya Cr.	No	yes		04/15/05			10,000	1,000	AdRM
Siltcoos	--	--	--	--	--	--	--	--	--	--	--	--
Tahkenitch	--	--	--	--	--	--	--	--	--	--	--	--
Tenmile	--	--	--	--	--	--	--	--	--	--	--	--
Coos	037	Inc.	Elk Cr. (C)	No	yes		03/31/04	45,000			50	--
			Noble Cr.	yes	yes	03/27/05	03/31/05			120,000	10,000	Ad
Coquille	044	Inc.	4 Coquille Tribs.	No	yes		03/31/04	30,000			33	--
			Ferry Cr.	yes	yes	04/10/05	04/15/05			12,500	1,042	Ad
			Sevenmile Cr.	yes	yes	04/01/05	04/15/05			37,500	3,125	Ad
Floras	--	--	--	--	--	--	--	--	--	--	--	--
Sixes	--	--	--	--	--	--	--	--	--	--	--	--
Mid-South Dep. Pops.	--	--	--	--	--	--	--	--	--	--	--	--
Total								**605,000**	**20,000**	**762,500**	**63,686**	

1 = Proposed status under NOAA Fisheries new hatchery policy. Inc – Included in ESU, Ex – Excluded from ESU, n.a. – Not assessed.

2 = The fish are reared or acclimated (2 weeks or more) at the release site.

3 = Released within the same wild coho salmon population boundary as where the broodstock predominately originated from.

a = These release numbers are based on historic smolt production. Under the new "natural" rearing techniques actual smolt releases are likely less than 10,000.

Table 3. Adult salmon and steelhead passage at ODFW hatchery barriers in the Oregon Coast Coho Salmon ESU. ChF = Fall Chinook, ChS = Spring Chinook, Ct = Cutthroat Trout, StS = Summer Steelhead, StW = Winter Steelhead,

Facility	Water Supply	Barrier [a]	Miles of Fish Habitat Above Barrier	Comments
Nehalem	North Fork Nehalem River	Limited barrier. Concrete footing of old barrier, dam boards (July-Sept.).	30 miles (above intake, Coho, StW, ChF, Ct)	Anadromous fish are restricted only at very low flows, no barrier at normal flows.
Trask	Gold Creek	Complete barrier. 2 barriers: (1) horizontal finger apron rack with concrete foot with ladder to adult pond at side; (2) limited concrete barrier at intake on side of bank.	4 miles (Ct = 4 mi, StW = 3 mi, 1.2 mi above apron rack for Coho and ChF)	No anadromous fish passed above intake dam rack. Cutthroat trout present above barrier. Has two satellite facilities, Trask Pond and Tuffy Creek Pond.
Trask Pond	East Fork Trask River	Limited barrier. Intake Dam has fish ladder and trap.	11.4 miles (for Coho, StW, StS, and Ct; 8.4 miles for ChS & ChF).	Passage problem at certain flows related to attraction water for the ladder. Can be regulated to some degree
Tuffy Creek Pond	South Fork Wilson River	Limited barrier. Concrete barrier with fish ladder for passage.	6.5 surveyed (~ 4 for coho, 1.5 StW unknown for other species).	Fall chinook and cutthroat trout above also. Ladder trap run to remove hatchery coho and steelhead except during high flow events.
Cedar Creek	Cedar Creek	Complete barrier. 4 barriers: 1) Wooden weir near inlet to Three R. 2) Concrete dam near adult pond. 3) Intake dam for old pond 14. 4) Upper intake dam.	3.1 miles (above upper intake dam). Ct = 3.1 mi, StW = 2.5 mi	No anadromous fish pass above the four barriers. StW adults pass above the lower two barriers during high flows (about 1/5 mile up Cedar Creek). Cutthroat trout, maybe winter steelhead (?) habitat, steep and small stream.
	Three Rivers	Selective barrier. Hydraulic weir.	14.8 miles (Coho, ChF, Chum, StW and Ct)	Voluntary fish passage occurs at high flows. The hatchery intentionally passes all unmarked; StW, Coho, Ct, and chum, and beginning in 2004 unmarked ChF (not need for brood). ChS and StS not passed due to IHN virus concern.
Salmon River	Salmon River	Limited barrier. Wood deck of old electric barrier.	About 30 miles	No indication that the deck is slowing or stopping passage of anadromous adults.
Alsea	North Fork Alsea River	Selective barrier. Concrete dam with fish ladder and sorting facility.	17 miles (Mainstream North Fork 7 miles; tributaries 10 miles)	Fish ladder can be operated to allow passage or to collect all fish for sorting. Currently, remove hatchery fish and pass all wild fish, unless need some wild StW for broodstock.
Fall Creek	Fall Creek	Selective barrier. Weir about 300 ft downstream of intake dam. Intake dam has a fish ladder.	16 (8.5 miles of Fall Creek, 7.5 miles of tributaries)	Currently adult weir is only operated from mid-December through April. Currently, remove hatchery fish and pass all wild fish, unless need some wild StW for broodstock. From May through mid-December leave a gap in weir to allow volitional passage of all fish.
Rock Creek	Rock Creek	Limited barrier. Concrete diversion dam, with an older ladder.	25 miles	Low flows restrict passage, but no fish intentionally stopped. Passage checked and maintained on a regular basis.
Soda Springs	North Umpqua	No barrier	n.a.	Satellite of Rock Creek.
Bandon	Ferry Creek & Geiger Creek	Selective barrier. Steel bar rack, just below confluence of Ferry and Geiger creeks. Passable in high water but barriers at Ferry Creek Dam & Geiger Creek Dam (no fish ladder at either dam).	2.5 miles above reservoirs (1.5 Geiger, 1.0 Ferry). Approx. 350 yards of stream between hatchery rack and dams.	Selectively pass some wild coho. Cutthroat trout present, but not blocked by hatchery barrier. Bar spacing allows passage.

[a] = Barrier types: 1) Complete = these barriers are operated or exist to block all fish migration except in a few cases where high water flows may allow some passage. 2) Selective = these barriers are operated to selectively pass specific fish, i.e. wild fish may be passed but hatchery fish are blocked. 3) Limited = these barriers restrict fish only during certain times of the year, generally during low flow periods.

Table 4. Adult passage and coho habitat blocked at ODFW hatchery barriers in the Oregon Coast Coho Salmon ESU.

Coho Population	Hatchery	Barrier Location	Type of Barrier [1]	Coho Habitat Above [2]	Coho Spawning Miles	% of Miles Above Barrier	Comments
Necanicum	None	--	--	--	59.8	--	
Nehalem	Nehalem	Nehalem R, N Fk	Limited	30.0	490.0	6.1%	Restricts passage only at very low flows.
Tillamook	Trask	Gold Creek	Complete	1.2	--	0.5%	No anadromous fish passed above barrier.
	E Fk Pond	Trask R, E Fk	Limited	11.4	--	4.5%	Restricts passage at some flows.
	Tuffy Cr Pond	Wilson R, F Fk	Limited	4.0	--	1.6%	Fish ladder that can be operated as a trap to remove hatchery
				16.6	251.0	6.6%	fish and pass wild fish.
Nestucca	Cedar Creek	Cedar Creek	Complete	0.0	--	--	No anadromous fish passed above barrier.
		Three Rivers	Selective	14.8	--	9.1%	Pass wild Coho, Stw, Ct, Chum, and Chf not used for brood.
				14.8	163.0	9.1%	
Salmon	Salmon River	Salmon River	Limited	30.0	41.2	72.8%	Restricts passage only at very low flows.
Siletz	None	--	--	--	208.0	--	
Yaquina	None	--	--	--	133.0	--	
Beaver	None	--	--	--	22.0	--	
Alsea	Alsea	Alsea R., N Fk	Selective	17.0		7.1%	Pass all wild, except those not needed for brood (Stw).
	Fall Creek	Fall Creek	Selective	16.0		6.7%	Pass all wild, except those not needed for brood (Stw).
				33.0	239.0	13.8%	block passage from mid-December through April.
Siuslaw	None	--	--	--	477.2	--	
Lower Umpqua	None	--	--	--	336.3	--	
Upper Umpqua	Rock Creek	Rock Creek	Limited	25.0	--	2.2%	Restricts passage only at low flows.
	Soda Springs	Umpqua R, N Fk	None	--	--	--	
Siltcoos	None	--	--	--	51.4	--	
Tahkenitch	None	--	--	--	15.2	--	
Tenmile	None	--	--	--	36.1	--	
Coos	None	--	--	--	222.8	--	
Coquille	Bandon	Ferry Cr. & Geiger Cr.	Selective	2.5	277.9	0.9%	Pass wild coho, but complete barrier ~350 ft upstream at dams.
Floras	None	--	--	--	27.7	--	
Sixes	None	--	--	--	28.0	--	
Dependent Pops	None	--	--	--	248.8	--	
			Limited	100.4		2.3%	
			Selective	50.3		1.1%	
			Complete	1.2		0.0%	
			Total	**151.9**	**4,461.3**	**3.4%**	

1 = Limited: These barriers restrict fish only during certain times of the year, generally during low flow periods.
Selective: These barriers are operated to selectively pass specific fish, i.e. wild fish may be passed but hatchery fish are blocked.
Complete: These barriers are operated or exist to block all fish migration except in a few cases where high water flows may allow some passage.

2 = Estimated miles of coho habitat above the barrier.

Table 5. Juvenile hatchery coho releases, by age and monitoring area in the Oregon Coast Coho ESU. Data not available for shaded areas.

	North Coast MA			Mid Coast MA			Umpqua MA			Mid-South Coast MA			ESU Total		
Release Year	Unfed Fry	Fry/Fing	Smolt	Unfed Fry	Fry/Fing	Smolt	Unfed Fry	Fry/Fing	Smolt	Unfed Fry	Fry/Fing	Smolt	Unfed Fry	Fry/Fing	Smolt
1980		2,306,693	1,080,029		3,528,695	9,170,267		0	351,660		0	7,232,430		5,835,388	17,834,386
1981		2,666,868	1,817,864		4,032,634	13,781,142		0	225,769		0	11,927,049		6,699,502	27,751,824
1982		64,649	1,723,028		3,317,069	22,705,100		0	226,727		0	2,593,400		3,381,718	27,248,255
1983		214,196	855,587		1,728,818	16,574,723		0	149,509		80,500	1,405,236		2,023,514	18,985,055
1984		0	1,913,433		1,378,224	10,492,388		0	586,543		16,001	2,386,369		1,394,225	15,378,733
1985	2,015,785	250,946	1,213,148	1,072,162	1,008,752	6,227,974	957,072	0	380,606	993,068	553,491	4,428,113	5,038,087	1,813,189	12,249,841
1986	1,243,852	164,563	1,802,720	274,235	660,461	7,467,497	1,067,268	19,980	588,731	399,277	191,388	3,459,952	2,984,632	1,036,392	13,318,900
1987	1,273,793	97,418	1,753,718	915,370	640,970	6,249,565	1,802,651		555,964	509,897	278,804	775,414	4,501,711	1,017,192	9,334,661
1988	251,367	124,337	1,816,773	156,245	130,112	6,440,683	184,521	17,983	456,263	102,863	254,341	1,395,461	694,996	526,773	10,109,180
1989	985,158	52,962	2,041,527	172,747	93,069	10,261,198	179,724	0	430,795	1,525,590	922,496	2,316,879	2,863,219	1,068,527	15,050,399
1990	595,971	117,264	1,887,650	906,386	620,696	5,365,015	40,194	0	433,235	1,247,731	571,945	309,041	2,790,282	1,309,905	7,994,941
1991	533,202	0	1,847,071	393,680	380,710	2,604,528	40,612	0	426,633	549,359	583,152	261,110	1,516,853	963,862	5,139,342
1992	29,193	53,913	2,156,888	608,694	383,340	2,656,221	359,780	0	318,407	730,395	293,302	315,037	1,728,062	730,555	5,446,553
1993	108,284	0	1,851,612	522,453	178,190	2,150,814	509,246	21,140	298,033	301,692	260,040	271,467	1,441,675	459,370	4,571,926
1994	29,855	0	2,091,227	146,827	265,334	2,312,372	589,380	0	283,908	477,508	50,745	273,231	1,243,570	316,079	4,960,738
1995	29,875	0	1,006,785	24,863	29,062	2,036,120	568,041	18,208	277,561	386,850	16,250	261,402	1,009,629	63,520	3,581,868
1996	28,341	0	837,617	52,788	46,108	1,920,975	521,520	0	287,623	325,977	0	110,493	928,626	46,108	3,156,708
1997	26,729	0	773,540	69,766	150,794	1,659,488	47,048	0	277,757	525,274	32,406	96,839	668,817	183,200	2,807,624
1998	23,529	24,725	405,170	0	66,186	599,262	35,843	0	309,678	70,956	0	136,866	130,328	90,911	1,450,976
1999	28,400	0	403,786	21,904	10,500	151,666	551,139	10,440	219,047	91,668	0	182,421	693,111	20,940	956,920
2000	19,632	0	406,037	8,436	15,750	20,875	657,271	100,800	214,921	166,631	0	176,232	851,970	116,550	818,065
2001	0	0	399,282	10,532	9,000	247,018	719,367	24,960	116,700	50,403	0	172,569	780,302	33,960	935,569
2002	0	138,811	406,283	0	0	235,606	416,755	0	115,178	78,193	0	191,207	494,948	138,811	948,274
2003	0	0	199,059	0	17,467	241,028	491,644	0	146,170	133,622	0	163,031	625,266	17,467	749,288
Pre-OPSW (release years 1980 through 1997)															
Avg.	550,108	339,656	1,581,679	408,940	1,031,835	7,226,448	528,235	4,548	364,207	621,191	228,048	2,212,162	2,108,474	1,603,834	11,384,496
Min	26,729	0	773,540	24,863	29,062	1,659,488	40,194	0	149,509	102,863	0	96,839	668,817	46,108	2,807,624
Max	2,015,785	2,666,868	2,156,888	1,072,162	4,032,634	22,705,100	1,802,651	21,140	588,731	1,525,590	922,496	11,927,049	5,038,087	6,699,502	27,751,824
Post-OPSW (release years 1998 through 2003)															
Avg.	11,927	27,256	369,936	6,812	19,817	249,243	478,670	22,700	186,949	98,579	0	170,388	595,988	69,773	976,515
Min	0	0	199,059	0	0	20,875	35,843	0	115,178	50,403	0	136,866	130,328	17,467	749,288
Max	28,400	138,811	406,283	21,904	66,186	599,262	719,367	100,800	309,678	166,631	0	191,207	851,970	138,811	1,450,976

Table 6. Adult coho collected at hatcheries in the Oregon Coast coho ESU.

	North Coast MA				Mid Coast MA				Umpqua MA				Mid-South Coast MA				ESU Total			
Run Year	Wild	Hatchery	Total	Collect Off-Site	Wild	Hatchery	Total	Collect Off-Site	Wild	Hatchery	Total	Collect Off-Site	Wild	Hatchery	Total	Collect Off-Site	Wild	Hatchery	Total	Collect Off-Site
1990	n.a	n.a	7,427	0	n.a	n.a	6,144	0	n.a	n.a	574	47	n.a	n.a	2,625	130	n.a	n.a	16,770	177
1991	n.a	n.a	20,061	0	n.a	n.a	14,469	27	n.a	n.a	972	176	n.a	n.a	7,211	262	n.a	n.a	42,713	465
1992	n.a	n.a	6,563	0	n.a	n.a	14,064	101	n.a	n.a	1,322	73	n.a	n.a	1,499	298	n.a	n.a	23,448	472
1993	n.a	n.a	8,208	0	n.a	n.a	10,663	0	n.a	n.a	679	160	n.a	n.a	2,163	204	n.a	n.a	21,713	364
1994	n.a	n.a	10,260	0	n.a	n.a	6,487	0	n.a	n.a	1,069	13	n.a	n.a	1,733	43	n.a	n.a	19,549	56
1995	n.a	n.a	11,466	0	n.a	n.a	5,083	0	n.a	n.a	1,210	7	n.a	n.a	438	268	n.a	n.a	18,197	275
1996	n.a	n.a	5,461	0	n.a	n.a	9,587	0	n.a	n.a	1,682	13	n.a	n.a	1,088	144	n.a	n.a	17,818	157
1997	n.a	n.a	3,413	0	n.a	n.a	5,647	0	n.a	n.a	431	0	n.a	n.a	274	110	n.a	n.a	9,765	110
1998	104	3,799	3,903	0	108	8,173	8,281	0	163	640	803	21	23	278	301	66	398	12,890	13,288	87
1999	99	5,004	5,103	0	197	3,425	3,622	0	132	838	970	0	59	414	473	63	487	9,681	10,168	63
2000	316	4,681	4,997	0	60	306	366	0	194	908	1,102	0	20	943	963	99	590	6,838	7,428	99
2001	238	22,339	22,577	0	130	1,401	1,531	0	301	531	832	0	102	1,931	2,033	61	771	26,202	26,973	61
2002	377	14,720	15,097	0	445	3,472	3,917	0	266	226	492	258	42	2,295	2,337	138	1,130	20,713	21,843	396
2003	382	6,156	6,538	0	130	1,860	1,990	0	243	814	1,057	242	49	3,425	3,474	132	804	12,255	13,059	374
Pre-OPSW (release years 1990 through 1998)																				
Avg.	n.a	n.a	8,529	0	n.a	n.a	8,936	14	n.a	n.a	971	57	n.a	n.a	1,926	169	n.a	n.a	20,362	240
Min	n.a	n.a	3,413	0	n.a	n.a	5,083	0	n.a	n.a	431	0	n.a	n.a	274	43	n.a	n.a	9,765	56
Max	n.a	n.a	20,061	0	n.a	n.a	14,469	101	n.a	n.a	1,682	176	n.a	n.a	7,211	298	n.a	n.a	42,713	472
Post -OPSW (release years 1999 through 2003)																				
Avg.	282	10,580	10,862	0	192	2,093	2,285	0	227	663	891	100	54	1,802	1,856	99	756	15,138	15,894	199
Min	99	4,681	4,997	0	60	306	366	0	132	226	492	0	20	414	473	61	487	6,838	7,428	61
Max	382	22,339	22,577	0	445	3,472	3,917	0	301	908	1,102	258	102	3,425	3,474	138	1,130	26,202	26,973	396

Table 7. Percent hatchery fish in the naturally spawning coho population, by wild coho population, monitoring area, and ESU total in the Oregon Coast Coho salmon ESU. Data are from the file "Coho estimates & occupancy (final summary).xls" located on the Oregon Plan Review Data Site web page (https://nrimp.dfw.state.or.us/metadatawarehouse/default.aspx). The pre-OPSW period is run years 1990 through 1998, the post-OPSW period is run years 1999 through 2003. n.a. = estimates of hatchery strays are not available for this coho population.

Wild Coho Population	Adult Run Year														Pre-OPSW	Post-OPSW
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003		
Necanicum	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.4%	3.6%	0.0%	0.0%	1.4%
Nehalem	65.4%	21.9%	43.0%	80.6%	42.8%	49.0%	74.3%	45.1%	22.7%	9.3%	0.8%	7.6%	14.4%	0.6%	49.4%	6.5%
Tillamook	0.0%	0.0%	0.0%	52.8%	29.4%	62.0%	13.9%	7.8%	0.0%	5.6%	11.4%	12.7%	2.5%	2.2%	18.4%	6.9%
Nestucca	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.9%	3.2%	0.0%	1.4%	0.0%	1.3%
Salmon	11.3%	0.0%	80.4%	0.0%	93.1%	84.0%	90.0%	43.2%	98.6%	16.7%	100.0%	75.9%	45.5%	88.9%	55.6%	65.4%
Siletz	0.0%	70.8%	26.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	30.0%	3.1%	0.0%	10.8%	6.6%
Yaquina	37.8%	0.0%	0.0%	0.0%	0.0%	0.0%	16.0%	27.4%	37.5%	0.0%	0.0%	4.8%	0.0%	0.2%	13.2%	1.0%
Beaver	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Alsea	0.7%	0.0%	17.2%	0.0%	0.0%	0.0%	0.0%	26.7%	87.5%	0.0%	0.0%	15.1%	1.0%	0.0%	14.7%	3.2%
Siuslaw	0.0%	0.0%	0.0%	3.8%	37.9%	0.0%	26.2%	0.0%	11.2%	6.6%	0.0%	0.0%	0.3%	0.0%	8.8%	1.4%
L. Umpqua	23.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	5.1%	3.1%	1.3%	3.9%	12.9%	2.6%	0.1%	3.6%	4.2%
U. Umpqua	23.9%	34.3%	58.1%	22.2%	33.4%	23.6%	64.9%	43.7%	55.4%	34.8%	56.0%	45.1%	29.3%	39.7%	39.9%	41.0%
Siltcoos	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Tahkenitch	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Tenmile	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Coos	0.0%	0.0%	2.6%	4.9%	3.4%	0.9%	0.0%	0.0%	1.9%	0.0%	0.0%	1.8%	0.3%	1.0%	1.5%	0.6%
Coquille	0.0%	0.0%	0.0%	2.2%	1.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	10.5%	1.8%	0.3%	0.4%	2.5%
Floras	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Sixes	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
N Coast MA	57.2%	10.7%	28.3%	69.7%	33.9%	32.6%	49.1%	31.7%	12.0%	1.7%	1.9%	2.4%	7.9%	1.1%	36.1%	3.0%
Mid-Coast MA	4.9%	26.1%	13.8%	2.2%	25.8%	7.6%	25.2%	16.8%	45.2%	8.2%	4.1%	8.7%	3.4%	3.8%	18.6%	5.6%
Umpqua MA	63.6%	32.3%	45.0%	12.8%	23.5%	13.1%	50.3%	35.5%	33.8%	25.6%	43.2%	34.6%	17.7%	24.2%	34.4%	29.1%
Mid-South MA	0.0%	0.0%	2.1%	2.8%	2.3%	0.4%	0.0%	0.0%	0.4%	0.0%	0.0%	3.0%	0.2%	0.6%	0.9%	0.8%
ESU Total	32.9%	13.5%	14.2%	19.1%	14.4%	8.5%	21.5%	11.9%	19.6%	7.2%	12.8%	12.7%	5.9%	5.8%	17.3%	8.9%

Table 8. Listing and status of Hatchery and Genetic Management Plans (HGMP) for salmon and steelhead hatchery programs in the Oregon Coast Coho salmon ESU. Status is as of September 2004.

Hatchery Program	ODFW Stock Code(s)	HGMP Status
Nehalem R. Coho	032, 099	Submitted to NOAA Fisheries
Trask R. Coho	034	Submitted to NOAA Fisheries
Salmon R. Coho	033	Submitted to NOAA Fisheries
Siletz R. Coho	033, 033W	Submitted to NOAA Fisheries
Umpqua R. Coho	018, 055, 509	Submitted to NOAA Fisheries
Coos R. Coho	037	Submitted to NOAA Fisheries
Coquille R. Coho	044	Submitted to NOAA Fisheries
Trask R. Fall Chinook	034	Draft prepared (Old)
Nestucca R. Fall Chinook	047	Submitted to NOAA Fisheries
Salmon R. Fall Chinook	036	Draft in review (Region)
Yaquina R. Fall Chinook	146	Draft in review (Region)
Umpqua R. Fall Chinook	151	Draft in review (Public)
Umpqua R. Fall Chinook	018, 151	Draft in review (Public)
Coos R. Fall Chinook	037	Draft in review (Public)
Coquille R. Fall Chinook	044	Draft in review (Public)
Trask R. Spring Chinook	034	Draft prepared (Old)
Whiskey Cr. Spring Chinook	034	Draft prepared (Old)
Nestucca R. Spring Chinook	047	Draft prepared (Old)
Umpqua R. Spring Chinook	055	Draft in review (Public)
Nestucca R. Summer Steelhead	047	Draft in review (Region)
Siletz R. Summer Steelhead	033	Draft Reviewed
Umpqua R. Summer Steelhead	055	Draft in review (Public)
Nehalem R. Winter Steelhead	032	Draft Prepared (Old)
Fishhawk Lake Winter Steelhead	099	Draft Prepared (Old)
Wilson R. Winter Steelhead	121	Submitted to NOAA Fisheries
Trask R. Winter Steelhead	047	Draft Prepared (Old)
Nestucca R. Winter Steelhead	047, 047W	Submitted to NOAA Fisheries
Siletz R. Winter Steelhead	033W	Submitted to NOAA Fisheries
Alsea R. Winter Steelhead	043, 143	Submitted to NOAA Fisheries
Siuslaw R. Winter Steelhead	038	Draft in review (Region)
Umpqua R. Winter Steelhead	018	Draft in review (Public)
Tenmile Lake Winter Steelhead	088	Draft in review (Public)
Coos R. Winter Steelhead	037	Draft in review (Public)
Coquille R. Winter Steelhead	144	Draft in review (Public)

* = Status is defined as:

Submitted to NOAA Fisheries = Final Draft HGMP has been through ODFW review and been submitted to NOAA Fisheries for their review.

Draft Reviewed = "New" draft HGMP has been through ODFW and external review. Draft will be edited in response to review, and then will be submitted to NOAA Fisheries for their review.

Draft in review (Public) = "New" draft HGMP is completed and is posted for external review.

Draft in review (Region) = "New" draft HGMP is completed and is in the process of ODFW internal review, prior to being submitted for external review.

Draft prepared (Old) = Draft HGMP exists, but needs to be updated for revised HGMP format.

Table 9. Planned hatchery coho smolt releases in 2005 (2003 brood year) in the Oregon Coast coho ESU, and the percent of population wide coho rearing habitat downstream of hatchery coho release site.

Wild Population	Release Site	Planned Smolt Release	Coho Habitat Downstream % of Population / MA Total
Necanicum	None	0	0%
Nehalem	Nehalem Hatchery	100,000	1.1%
Tillamook	Trask Hatchery	100,000	4.9%
Nestucca	None	0	0%
North Coast Monitoring Area Total		**200,000**	**1.8%**
Salmon	Salmon River Hatchery	200,000	10.5%
Siletz	Rock Creek	50,000 [a]	17.8%
Yaquina	None	0	0%
Beaver	None	0	0%
Alsea	None	0	0%
Siuslaw	None	0	0%
Mid-Coast Monitoring Area Total		**250,000**	**3.1%**
U. & L. Umpqua	Rock Creek Hatchery	107,500	6.6%
U. & L. Umpqua	Galesville Dam	15,000	10.2%
Umpqua Monitoring Area Total		**122,500**	**11.6%**
Siltcoos	None	0	0%
Tahkenitch	None	0	0%
Tenmile	None	0	0%
Coos	Noble Creek	120,000	2.9%
Coquille	Bandon Hatchery	12,500	0.4%
	Sevenmile Creek	37,500	1.2%
Floras	None	0	0%
Sixes	None	0	0%
Mid-South Coast Monitoring Area Total		**170,000**	**1.5%**
ESU Total		**742,500**	**5.2%**

a = These release numbers are based on historic smolt production. Under the new "natural" rearing techniques actual smolt releases are likely less than 10,000.

Table 10. Results for the OPSW stream enrichment program in the Oregon Coast coho ESU. Number and pounds of hatchery carcasses used, and number of stream miles treated. Pounds of carcasses for 1997-98 through 2000-01 were estimated based on number of carcasses used and average fish sizes (2001-02 through 2003-04) for each species in each monitoring area.

Year	Number of Carcasses	Pounds of Carcasses	Stream Miles	Lbs/Mile
North Coast Monitoring Area				
1997-98	1,539	*14,635*	25.3	578.5
1998-99	2,280	*21,444*	29.1	736.9
1999-00	3,037	*29,698*	118.0	251.7
2000-01	6,369	*62,751*	86.5	725.4
2001-02	4,578	44,565	48.5	918.9
2002-03	6,476	71,706	104.0	689.5
2003-04	5,365	52,841	91.5	577.5
Avg.	4,235	42,520	71.8	639.8
Mid-Coast Monitoring Area				
1997-98	0	*0*	0.0	0.0
1998-99	492	*4,340*	16.0	271.3
1999-00	3,631	*32,671*	140.4	232.7
2000-01	1,235	*13,623*	40.4	337.2
2001-02	4,920	55,851	80.0	698.1
2002-03	4,783	43,700	85.0	514.1
2003-04	2,353	19,338	63.3	305.7
Avg.	2,488	24,218	60.7	337.0
Mid-South Coast Monitoring Area				
1997-98	877	*9,050*	26.2	345.4
1998-99	2,188	*25,639*	65.2	393.2
1999-00	3,286	*38,260*	124.0	308.5
2000-01	4,597	*48,931*	168.0	291.3
2001-02	8,430	113,647	130.6	870.2
2002-03	8,801	107,416	90.0	1,193.5
2003-04	13,529	127,215	73.6	1,728.5
Avg.	5,958	67,166	96.8	732.9
Umpqua Monitoring Area				
1997-98	657	*6,986*	17.0	410.9
1998-99	843	*8,481*	28.5	297.6
1999-00	1,440	*17,000*	36.0	472.2
2000-01	1,348	*16,628*	36.0	461.9
2001-02	1,444	18,274	21.0	870.2
2002-03	1,442	18,178	25.0	727.1
2003-04	720	8,598	23.0	373.8
Avg.	1,128	13,449	26.6	516.3
ESU Total				
1997-98	3,073	*30,671*	68.5	447.8
1998-99	5,803	*59,904*	138.8	431.6
1999-00	11,394	*117,629*	418.4	281.1
2000-01	13,549	*141,933*	330.9	428.9
2001-02	19,372	232,337	280.1	829.5
2002-03	21,502	241,000	304.0	792.8
2003-04	21,967	207,992	251.4	827.5
Avg.	13,809	147,352	256.0	577.0

Table 11. Releases of juvenile hatchery chinook and steelhead in the Oregon Coast Coho ESU. Releases are from ODFW and STEP facilities, by three fish size classes. Off station releases are characterized by lack of rearing, acclimation, or adult re-capture at the release site. Fish released in a basin, other than that stocks basin of origin, are reported as out of basin releases. Fish released in a closed water body, one from which they are assumed not to migrate to the ocean, are not reported.

Release Year	Chinook			Steelhead		
	Unfed Fry	Fry/Fing.	Smolts	Unfed Fry	Fry/Fing.	Smolts
Total Releases						
1990	1,483,602	2,426,332	1,443,560	2,786,524	207,604	1,787,249
1991	1,059,682	1,500,052	1,575,376	1,365,602	88,868	1,817,036
1992	642,330	1,625,302	1,709,448	1,640,869	15,832	1,861,280
1993	1,145,848	1,846,604	1,585,085	417,915	8,020	1,774,994
1994	104,398	1,542,107	1,316,885	199,998	10,602	1,636,409
1995	1,185,012	1,642,476	1,503,322	281,521	0	1,429,555
1996	2,048,214	1,275,814	1,746,585	160,595	17,627	1,429,511
1997	2,678,867	1,499,632	1,312,440	246,789	16,717	1,311,273
1998	517,843	1,167,723	1,410,141	83,701	0	1,252,913
1999	516,673	1,812,358	1,496,827	202,209	0	1,284,760
2000	770,866	2,211,460	1,642,577	100,180	0	1,334,173
2001	695,787	2,578,798	1,645,164	125,589	0	1,351,966
2002	459,513	3,134,274	1,537,199	69,650	15,461	1,366,568
2003	646,290	2,760,093	1,594,567	158,174	177	1,165,429
Off Station Releases						
1990	1,358,532	402,143	468,770	2,770,142	199,884	1,539,681
1991	1,035,963	608,771	530,771	1,333,075	88,868	1,551,915
1992	642,330	670,030	481,193	1,584,975	15,832	1,494,115
1993	1,089,488	525,778	530,325	417,915	0	1,386,050
1994	104,398	261,453	512,039	189,392	0	1,232,957
1995	1,185,012	679,121	426,267	169,665	0	891,103
1996	2,048,214	275,311	461,910	50,121	17,627	890,167
1997	2,678,867	517,199	541,250	246,789	12,667	836,910
1998	517,843	428,484	481,565	83,701	0	798,906
1999	516,673	273,082	467,490	202,209	0	850,356
2000	770,866	581,665	600,037	100,028	0	768,177
2001	695,787	468,732	565,807	120,114	0	899,945
2002	459,513	613,709	511,935	69,650	15,461	904,423
2003	646,290	470,093	538,896	158,174	177	761,336
Out of Basin Releases						
1990	384,450	0	204,418	1,745,623	61,441	897,115
1991	328,924	32,213	189,456	939,047	59,168	846,652
1992	257,653	43,704	203,564	965,449	15,832	778,832
1993	324,811	13,251	219,305	209,572	0	737,480
1994	33,458	0	182,716	13,896	0	683,367
1995	62,052	15,369	266,592	15,954	0	470,324
1996	145,020	37,170	220,105	5,834	0	301,417
1997	370,480	13,726	132,274	4,555	0	259,647
1998	243,384	11,566	144,787	4,537	0	215,689
1999	212,708	0	163,256	5,220	0	211,433
2000	363,461	25,725	127,863	5,170	0	221,950
2001	118,853	16,228	139,457	5,916	0	238,537
2002	158,550	16,978	131,477	4,600	0	223,895
2003	128,500	0	142,377	1,900	0	178,364